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01. General Principles of Design and Drawing

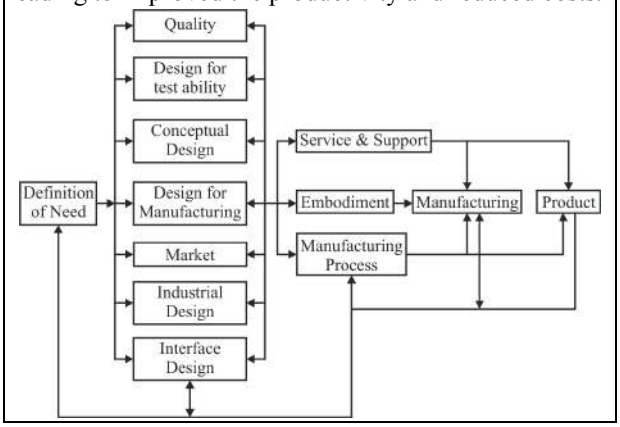
1.1 Engineering Design Process

1. Concurrent engineering is implemented by involving a cross-functional team for design, production, testing and operational work

(a) During the project execution
(b) Long before the project execution
(c) Towards the end of the project execution
(d) After completion of the project execution

ESE (Pre) 2017

Ans. (b) : Concurrent Engineering– It is also known as simultaneous engineering, is a method of designing and developing products, in which the different stage run simultaneous, rather than consecutively. It decreases product development time and also the time to market, leading to improved the productivity and reduced costs.



2. Among the effects of design specifications on costs, which one of the following is the most significant that influences the producibility of end product?

(a) Standard size (b) Large tolerance
(c) Breakeven point (d) Cost estimate

ESE (Pre) 2020

Ans. (b)

Large Tolerances– Among the effects of design specifications on costs, tolerances and perhaps significant. Tolerances, manufacturing processes, and surface finish are interrelated and influence the producibility of the end product in many ways. Tolerances cover dimensional variation and surface-roughness range and also the variation in mechanical properties resulting from heat treatment and other processing operations.

Standard Sizes– The use of standard for stock sizes is first principle of cost reduction. To ensure that standard of preffered sizes are specified, designers must have access to stock lists of the materials they employ.

Breakeven Points– Sometimes it happens that, when two or more design approaches as are compared for cost, the choice between the two depends on a set of conditions such as the quantity of production, the speed of the assembly lines, or some other condition. There than others and point corresponding to equal cost, which is called break even point.

Cost Estimates– There are many ways of obtaining relative cost figure so that two or more designs can be roughly compared Cost estimators can be used, depending upon the application, such as area, volume, horsepower, torque, speed and various performance ratio.

3. Which one of the following is not the best approach for the prevention of product liability?

(a) Analysis and design
(b) Quality control
(c) Comprehensive testing
(d) Cost

ESE (Pre) 2020

Ans. (d) : Product Liability– The strict liability concept of product liability generally prevails in the United States.

This concept states that the manufacturer of an article is liable for any damage or harm that results because of a defect.

⇒ The best approaches to the prevention of product liability are–

- Good engineering in analysis and design.
- Quality Control.
- Comprehensive testing procedure.

'Cost' is not the approach to prevent product liability.

EXAM POINTS

- The product whose production involves the least amount of cost– **Product design**
- That form of design which deals with improving the appeal of a product to the human senses – **Industrial design**
- ..... step in engineering design process involves decision making– **Evaluation**
- That phase of the design which includes modelling and simulation– **Configuration design**
- The method for generating mechanism for a machine to get a desired output for a given input is known as– **Synthesis**
- In a design process that process which should be followed after the selection for material– **Determining mode of failure**
- The simplicity to operate and easy to understand a product is concerned with its following aspect– **Functional aspect**

- ..... is useful contributor to a strategy of mass customization– **Modular design**
- One of the disadvantage of standardization is– **Early freezing of product design**
- That name which is most closely associated with robust design– **Taguchi**
- The term 'voice of Customer' is associated with– **Quality function deployment**
- Service design often differs from product design for which one of these consideration– **Customer interference**
- The ability of a product, part or service to perform its intended function under an appropriate set of condition is– **Robustness**
- Production, design and manufacturing personal being together early in the design process is called– **Concurrent engineering**
- Steps involved in reverse engineering process are– **Prediction, observation, disassemble, analyze, test, documentation**
- The preliminary stage of production planning is– **Product development and design**
- Nomography stands for– **Graphical representation of mathematical laws**
- Product design specification is done at the stage of– **Problem definition**
- Type of design in which a known solution is applied to satisfy a different need is called– **Adaptive design**

1.2 Problem Definition and Information Gathering

4. It is important to carefully identify the needs and expectations of the customer prior to beginning the design of mechanical device. One of the step in formulating usually quantitative statements of expected performance levels, environmental conditions in which the device must operate, limitations on space or weight, or available materials and components that may be used. These are part of which one of the following elements of design?

(a) Functions
(b) Evaluation criterias
(c) Design requirements
(d) Drawings

ESE (PRE) 2024

Ans. (c) : Design requirements is important to carefully-identify the needs and expectation of the customer prior to beginning the design of mechanical device. One of the step in formulating usually quantitative statements of expected performance level, environmental conditions in which the device must operate, limitation on space or weight, or available materials and components.

EXAM POINTS

- The source of developing a new product is– **Customer feedback, Research and development**
- A serviceability aspect of a product is– **Ease with which a product can be maintained**
- Comparison of identical practices same or outside industry is known as– **Functional benchmarking**
- Generic benchmarking is– **Unrelated business process or functions that can be practiced in the same way regardless of industry**
- That method of benchmarking which is most cost efficient– **Internal benchmarking**
- Reverse engineering would be used in ..... part of the design process– **Concept generation**
- The House of Quality is best described as– **A set of matrices used in conjugation with quality function deployment**
- Design of manufacture and assembly is an example of– **Concurrent engineering**
- The quality function deployment process begins with– **Customer wants and needs**
- That aspect of product which is concerned with the ease and efficiency of the product performance– **Functional aspect**
- That method which is associated with parallel design– **Concurrent engineering**
- According to Kano's categorization of customer requirements, which of the following will not make customer unhappy if missing in product – **Exciters**

1.3 Generate Multiple Solutions

5. Which of the following factors are included in product realization process ?

1. Marketing functions to assess customer requirements
2. Documentation of the design
3. Legal requirements

Select the correct answer using the code given below:

(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

ESE (Pre) 2022

Ans. (d) : The product realization process (PRP) is the collection of steps involved in a product's life cycle, from concept to completion.

The PRP involves many factors.

- Market requirement
- Technological capabilities
- Resources
- Customer input
- Design and development
- Purchasing
- Production and manufacturing
- Service and support
- Control of measuring equipment

EXAM POINTS

- The correct order of 4 steps involved in creative thinking process is–
  Preparation, incubation, inspiration, verification
- Insufficient knowledge, incorrect information and memory blocks are belonging to which type of barrier to creative thinking– **Intellectual block**
- During the concept generation, associating his or her body with device of the process under consideration is called– **Personal analogy**
- The correct sequence of design is–
  Identification of problem, generate feasible solution, detailing of solution, revision of solution
- Optimised solution of a problem is the–
  Solution which satisfy all constraints

1.4 Analysis and Select a Solution

6. Which one of the following is not the way of estimating the statistical parameters and is integral part of analysis or synthesis tasks when probability of failure is involved?
(a) Propagation of error
(b) Propagation of uncertainly
(c) Propagation of weight
(d) Propagation of dispersion

ESE (Pre) 2020

Ans. (c) : There are ways of estimating the statistical parameters describing weight or inertia from those describing size and density. These methods are variously called propagation of error; propagation of uncertainty, or propagation of dispersion. These methods are integral parts of analysis or synthesis tasks when probability of failure is involved.

It is important that good statistical data and estimates are essential to perform an acceptable reliability analysis.

EXAM POINTS

- In decision making model probability of outcomes are unknown– **Decision under risk**
- The 1st stage of Pugh model is–
  Choose the criteria for concept evaluation
- Concept generation is a _____ process– **Divergent**
- A method of solving multi-criteria decision problem is– **Analytical hierarchy**
- The essential components of decision making–
  Objective, Constraints

1.5 Embodiments Design and Details Design

7. Consider the following non-reliability performance measures of automobile industry related objects?
1. Fuel efficiency (km/ℓ)
2. Economic efficiency (cost/km/kg)
3. Quality of ride
4. Emissions (ppm)
(a) 1, 3 and 4 only (b) 1, 2 and 3 only
(c) 3 and 4 only (d) 2, 3 and 4 only

ESE (PRE) 2023

Ans. (d) : Fuel efficiency, economic efficiency, quality of ride and emissions are all performance measures of automobiles.
Fuel efficiency: The ratio of distance travel to fuel consumed, usually measured in (Km/litre)
Economic efficiency:- A measure of how efficiently a company uses resources such as inventory waiting times and transportation.
Improving economic efficiency can help companies reduce lead times, improve quality and increase productivity.
Quality of rides: A measure of how comfortable a vehicle is for passengers, including factors like acceleration, vibrations, noise and frequency of oscillation.
Emissions: The amount of green house gases (GHGs) a vehicle emits. In 2019, the transportation Industry was the second largest contribution to global GHG emissions.

8. The manufacturing cost of the components will decrease as a result of using the probabilistic relationship because
(a) Manufacturing cost deceases as the tolerance on the quality characteristic decreases
(b) Manufacturing cost decreases as the tolerance on the quality characteristic increases
(c) Manufacturing cost remains constant as the tolerance on the quality characteristic increases
(d) Manufacturing cost increases as the tolerance on the quality characteristic increases

ESE (PRE) 2024

Ans. (b) : The manufacturing cost of the components will decrease as a result of using the probabilistic relationship because manufacturing cost decrease as the tolerance on the quality characteristic increases.

9. Which of the following statements are correct for portable step-ladders?
1. Used on working platforms to gain height above the protected edge.
2. Used in the fully opened position.
3. Should be of a length that ensures a person's feet are not positioned any higher than the second top rung.
Select the correct answer using the codes given below:
(a) 2 and 3 only (b) 1 and 3 only
(c) 1 and 2 only (d) 1, 2 and 3

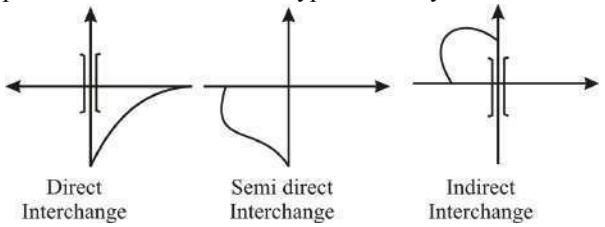
ESE (Pre) 2019

Ans. (a) : Step ladders are used in fully opened position. Used in such way that person feet is not on top rung of ladder. Also they are avoided being placed on working platforms like scaffolding etc.

10. The design of highway interchanges involves the application of the geometry of?
(a) circle arcs (b) Semi ellipse
(c) hyperbola (d) semi-circle

ESE (PRE) 2021

Ans. (a) : The design of highway interchanges involves the application of the geometry of circle arcs. Interchanges ramps at grade separations can be provided in three different types and they are



from the above images we can say the design of highway interchanges involves the application of the geometry of circle arcs.

11. The creative design routes are practised by adopting following steps?
1. Concentration
2. Illumination
3. Preparation
4. Verification
5. Incubation
Arrange the above stops in correct sequence:
(a) 3, 1, 5, 2, 4 (b) 3, 5, 2, 1, 4
(c) 3, 2, 1, 5, 4 (d) 3, 1, 2, 5, 4

ESE (PRE) 2021

Ans. (a) : The creative design routes are practised by adopting steps-
1. Preparation
2. Concentration
3. Incubation
4. Illumination
5. Verification

EXAM POINTS

- In a design process of a product, the exact dimensions and tolerances could be established during– **Parametric design phase**
- That type of modularity which exists when a family of dissimilar products uses the same assembly or component– **Component sharing modularity**
- The design which is concerned with the visual appearance of the product is called–**Industrial design**
- That type of prototyping method, there is no need to make the model look like the product in size– **Proof of concept prototype**
- That method which produces prototypes directly from CAD model– **Rapid-prototype**
- That rapid prototyping process which is most suitable for making Prototype of large components– **Laminated object modelling**
- The lowest level in the hierarchy of design process is– **Concept generation**
- What does "X" stands for in DFX– **Performance measure**
- That forms which is a limitation in the engineering design process– **Aesthetics, Safety, Reliability**
- In a parametric modelling system, relation between sketch entities is defined with– **Constraints**
- Allows the designer to conceptualize objects more easily without making costly model prototype– **CAD**
- Allows the performance of structure to be analyzed and tested efficiently, accurately and quickly– **Computer Aided Engineering**
- The basis series of preferred numbers are– **R5,R10, R20, R40 and R80**
- Step by step approach for identifying all possible features in design is called– **FMEA**
- Arrangement of the physical elements of a product to carry out its required function is called– **Product architecture**

1.6 Design of Machine Elements

12. A piece of copper originally 305 mm long is pulled in tension with a stress of 276 MPa. If the deformation is entirely elastic what is the resultant entirely elastic, what is the resultant elongation approximately?
(a) 3.3 mm (b) 0.33 mm
(c) 0.77 mm (d) 7.7 mm

ESE (PRE) 2023

Ans. (c) : From Hook's law

$\sigma = \varepsilon E$

$$\sigma = \frac{\Delta l}{l} E$$

$$\Delta l = \frac{\sigma l}{E}$$

$$\Delta l = \frac{276 \times 305}{110 \times 10^3}$$

$$\Delta l = 0.756 \cong 0.77 \text{mm}$$

13. What is the approximate value of ductility (%EL) of a cylindrical copper rod if it is cold worked such that the diameter is reduced from 15.2 mm to 12.2 mm? (Take the tensile strength from the curve for copper is as 340 MPa)
(a) 7% (b) 3.56%
(c) 70% (d) 35.6%

ESE (PRE) 2023

Ans. (a) : Percentage of cold working

$$= \frac{A_o - A_f}{A_o} \times 100$$

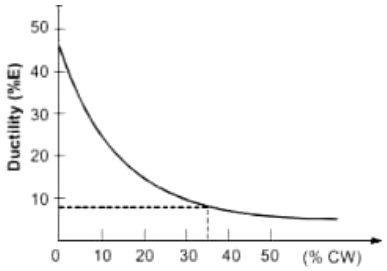
$$= \frac{\pi\left(\frac{15.2}{2}\right)^2 - \pi\left(\frac{12.2}{2}\right)^2}{\pi\left(\frac{15.2}{2}\right)^2} \times 100$$

$$= \frac{20.55}{(7.6)^2} \times 100$$

$$= \frac{20.55}{57.76} \times 100 = 0.3557$$

$= 35.6\%$

For copper ductility (%EL) versus % CW curve is given by



Note:- official answer is given (a).

14. For a vehicle travelling at 24 km/hr having a wheel radius of 0.305 m with overall gear ratio G = 19.915, and when torque transmitted is 203.6 N.m. the engine speed and power are, nearly

(a) 4155 rpm and 88.6 kW
(b) 4500 rpm and 88.6 kW
(c) 4155 rpm and 95.4 kW
(d) 4500 rpm and 95.4 kW

ESE (Pre) 2018

Ans. (a) : $R_{wheel} = 0.305$ m

$$V_{vehicle} = 24 \text{ km/hr} = \frac{24\times1000}{60\times60} \text{m/sec.}$$

G = 19.915

Torque 'T' = 203.6 Nm.

Now, $V = \frac{\pi dN}{60}$

$$6.67 = \frac{\pi\times2\times0.305\times N}{60}$$

$$N = \frac{60\times6.67}{0.61\times\pi}$$

[N = 208.78 rpm]

Engine Rotational velocity = Overall gear ratio × Wheel rotational velocity (rpm).

Engine Rotational velocity = 19.915 × 208.78

Engine Rotational velocity = 4156.26 rpm.

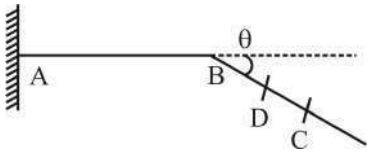
Now, engine power = Torque × Angular displacement

$$\text{Engine power} = \frac{2\pi NT}{60} = \frac{2\times\pi\times4156.26\times203.6}{60}$$

Engine power 'p' = 88609.83 watt

Engine power = 88.6 kw

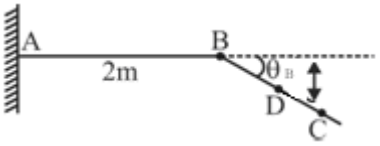
15. A cantilever beam ABC is shown to a highly exaggerated vertical scale. Horizontally, AB is 2m long and BC is 0.6m long. Loads act only in the region AB, and there are no loads in the region BC. Under this load system, the deflection at B is 0.24 cm and the slope of the beam at B is θ, where sin θ = 0.038. What is the deflection at D, which is midway between B and C?



(a) 0.2406 cm (b) 0.2514 cm
(c) 0.2530 cm (d) 0.2452 cm

ESE (Pre) 2018

Ans. (b) :



■ For getting the answer correct the deflection at B should be in 'm'.

i.e. [$\delta_1 = 0.24$m]

So, Deflection at D = Deflection at B + $\theta_B \times$ (BD)

$$\text{Deflection at D} = 0.24 \text{ m} + 0.038\times\frac{0.6}{2}$$

Deflection at 'D' = 0.24 + 0.0114

Deflection at 'D' = 0.2514 m

16. A clutch has to transmit 200 Nm of torque. Assuming uniform pressure theory and the ratio of outer to inner radii is 2.5, what are the radii for a uniform pressure of 2MPa with the co-efficient of friction of the liner material being 0.4?

(a) 35mm and 50mm (b) 20mm and 50mm
(c) 35mm and 80mm (d) 20mm and 80mm

ESE (Pre) 2017

Ans. (b) : (T) Transmitted torque $= \frac{2}{3}\mu W\left(\frac{R_o^3 - R_1^3}{R_o^2 - R_i^3}\right)$

$$P = \frac{W}{\pi\left(R_o^2 - R_1^2\right)}$$

So, $T = 2\mu\pi P\left(\frac{R_o^3 - R_1^3}{3}\right)$

Here according to question option (b) satisfy–

$$\frac{r_o}{r_i} = \frac{50}{20} = 2.5$$

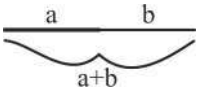
17. Consider the following statements regarding Golden Ratio for positive integers

1. It is the ratio of difference of two numbers and the smaller number
2. It is the ratio of sum of two numbers and the smaller number
3. It is the ratio of the sum of two numbers and the larger number

Which of the above statements is/are correct?

(a) 1, 2 and 3 (b) 3 only
(c) 2 only (d) 1 only

Ans. (b) : The golden ratio is a mathematical ratio. It is commonly found in nature, and when used in design. It is the ratio of smaller number and the differene of two numbers and it is also ratio of sum of two number and the larger number.



a + b is to a as is to b

$$\frac{\text{Sum of No}}{\text{Larger No}} = \frac{a+b}{a} = \frac{a}{b} = 1.618$$

$$\boxed{\phi = 1.618}$$

ϕ = Called golden ratio

18. A weight of 240 N is dropped on to a close-coiled helical spring made up of 18 mm spring steel wire. The spring consists of 22 coils wound to a diameter of 180 mm. If the instantaneous compression is 120 mm, what is the height of drop of the weight, given G = 88 × 10^3 N/mm^2?

(a) 450 mm (b) 300 mm
(c) 250 mm (d) 150 mm

ESE (Pre) 2018

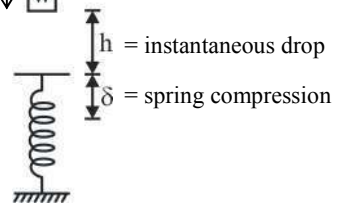
Ans. (d) : Weight 'w' = 200 N
Diameter of spring wire 'd' = 18 mm
Number of turns/coils, N = 22

Mean coil radius 'R' $= \frac{D}{2} = 90$ mm

Instantaneous compression 'δ' = 120 mm

$G = 88 \times 10^3$ N/mm^2

240 N↓ [w]



Work done = Strain energy stored by a spring

$$\left[mgh + mg\delta = \frac{1}{2}w_1\delta\right] \quad .....(i)$$

But deflection of spring, $\left[\delta = \frac{8w_1D^3n}{Gd^4}\right]$

$$120 = \frac{8 \times w_1 \times 180^3 \times 22}{88 \times 10^3 \times 18^4} = \frac{10 \times 8 \times w_1}{4 \times 10^3}$$

$$\frac{w_1}{9} = 120$$

$[w_1 = 1080$ N] Put in equation (i)

$$240(h + 120) = \frac{1}{2} \times 1080 \times 120$$

$$2h + 240 = \frac{1080}{2}$$

$4h + (240) \times 2 = 1080$
$4h = 1080 - 480$
$4h = 600$

$$\boxed{h = 150\,mm}$$

19. Consider the following statements regarding V-belt drive:

1. The groove angle of the sleeve is less than the belt section angle
2. The efficiency of a V-belt drive is higher than that of a flat belt drive
3. The groove angle is so made that the belt gets wedged in the groove

Which of the above statements are correct?

(a) 1, 2 and 3 (b) 1 and 2 only
(c) 1 and 3 only (d) 2 and 3 only

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Ans. (c) :

	Flat Belt		V-Belt
1.	They do not require precise alignment of shaft and pulley	1.	They required
2.	It can be use industry and abrasive atmosphere	2.	It can not be used
3.	Design is simple and inexpensive	3.	Design is difficult and expansive
4.	It can used upto 15m long	4.	It is used for short distance
5.	$\eta_B \uparrow$	5.	$\eta_v \downarrow$
6.	$P_{capacity} \downarrow$	6.	$P_{capacity} \uparrow$
7.	VR ↓	7.	VR ↑

20. A rod of length L, cross-section area A_1 and modulus of elasticity E_1, has been placed inside a tube of length L, of cross-section area A_2 and modulus of elasticity E_2, and the two are firmly held by end plates. The portion of the load P applied on the end plates shared by rod and tube, respectively, are

(a) $\frac{PA_1E_1}{A_1E_1 + A_2E_2}$ and $\frac{PA_2E_2}{A_1E_1 + A_2E_2}$

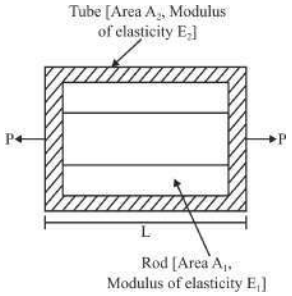
(b) $\frac{PA_2E_2}{A_1E_1 + A_2E_2}$ and $\frac{PA_1E_1}{A_1E_1 + A_2E_2}$

(c) $\frac{PA_1E_1}{A_1E_1 + A_2E_1}$ and $\frac{PA_2E_2}{A_1E_2 + A_2E_2}$

(d) $\frac{PA_1E_1}{A_1 + A_2}$ and $\frac{PA_2E_2}{A_1 + A_2}$

ESE (Pre) 2018

Ans. (a) :



Equilibrium equation,

$P_1 + P_2 = P$ .....(i)

Compatibility equation

Change in length is the same for both tube and rod.

$$\delta\ell_1 = \delta\ell_2 \qquad \left[\therefore \delta\ell = \frac{PL}{AE}\right]$$

$$\frac{P_1(L)}{A_1E_1} = \frac{P_2(L)}{A_2E_2}$$

$$\left[P_1 = \frac{A_1E_1}{A_2E_2}P_2\right]$$

Substituting in equation (i),

$$\frac{A_1E_1}{A_2E_2}(P_2) + P_2 = P$$

$$P_2\left[\frac{A_1E_1}{A_2E_2} + 1\right] = P$$

$$P_2\left[\frac{A_1E_1 + A_2E_2}{A_2E_2}\right] = P$$

$$\left[P_2 = \frac{PA_2E_2}{A_1E_1 + A_2E_2}\right]$$

Similarly $\left[P_1 = \frac{PA_1E_1}{A_1E_1 + A_2E_2}\right]$

21. Which one of the following makes the design, assembly and operation of complex systems feasible and practical?

(a) System Architecture (b) Modularization
(c) Standardization (d) Composition

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Ans. (b) : Modularization is a design approach that subdivides a system in to parts called modules that can be independently created and then used in different systems. A modular system can be characterised by functional partitioning into discrete scalable, reusable modules, rigorous use of well defined modular interfaces; and making use of industry standards for interfaces.

System Architecture or Product Architecture– It is arrangement of physical element of the product to perform it's functions. There are two entirely opposite styles of product architecture, modular and integral.

22. What are the functions of axles?

(a) Support the weight of the mower. Permit easy, rolling movement. Provide for mounting on an axle. Ensure safe operation on flat or sloped lawn surfaces
(b) Support, safely enclose, and protect operating components, including the blade and motor. Accommodate the attachment of two axles and a handle. Permit cut grass to exit the cutting area
(c) Cut blades of grass and weeds while rotating at high speed. Facilitate connection to motor shaft. Operate safely when foreign objects are encountered, such as stones, sticks, or metal pieces
(d) Transfer the weight of mower from the housing of the wheels. Allow rotation of the wheels. Maintain location of the wheels relative to the housing

ESE (PRE) 2024

Ans. (d) : Axles perform multiple functions, including–

- Supporting weight–Axles support the weight of the vehicle or mower, as well as any cargo or passengers.
- Permitting rolling movement–Axles allow wheels to rotate and roll easily.
- Connecting wheels to suspension.
- Facilitating Steering.
- Absorbing shocks.

23. Factors which govern the operating cost of equipment are:

1. Purchase price of the equipment
2. Depreciation due to regular use
3. Cost of operation, maintenance and repairs

Which of the above statements are correct?

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

ESE (Pre) 2017

Ans. (d) : Operating cost incurred when the equipment is operated. The operating cost of equipment is influenced by various parameter namely no. of operating hours, location of job site, operating condition, category of equipment etc.

Factors which govern the operating cost of equipment are–

(a) Purchase price of the equipment.
(b) Depreciation due to regular use.
(c) Cost of operation, maintenance and repairs.

24. Statement (I) : Lifts and external staircases are provided with access from the lobby area of each floor in multi-storey blocks. The external staircase must be accessible through self-closing, 180^0-swing unlocked doors (with provision for locking at appropriate conditions).

Statement (II) : Such staircases should not be inadvertently subjected to spreading of smoke, but must yet provide unhindered exit from the lobby of each floor.

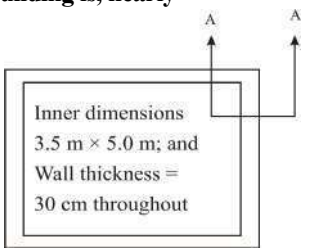
(a) Both statement-I and statement-II are individually true, and statement-II is the correct explanation of statement-I.
(b) Both statement-I and statement-II are individually true, but statement-II is not the correct explanation of statement-I.
(c) Statement-I is true; but statement-II is false.
(d) Statement-I is false; but statement-II is true.

ESE (Pre) 2018

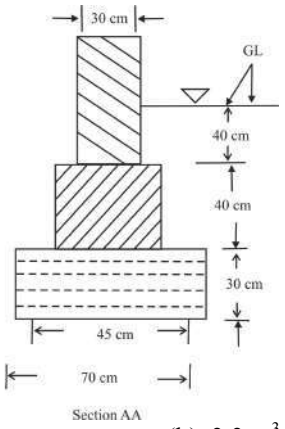
Ans. (a) : Any building having more than four floors including basement or sunken floors, shall have at least two stair case, one of which may be an external stairway.

An external strain is one which is connected to public area and/or common areas on all floors and leads directly to ground, has at least two sides abutting external wall. The staircase and exits should be designed for uninterrupted excavation of people from the multi-storey building and such staircases should not be spreading smoke.

25. The plan view at just below window-sill level, but not showing door openings – is shown – of an outpost building of, say, the Forest Department. Section AA extending just a little above ground level GL and fully below ground level is shown. The wall and first footing are of random-rubble masonry in cement mortar; and the lowest part of the foundation is of mass rubble in cement mortar. The total volume of the 40 cm deep footing for the whole building is, nearly



(Not to Scale)



(a) 3.8^{3} (b) $3.3\ m^3$
(c) $2.8\ m^3$ (d) $2.3\ m^3$

ESE (Pre) 2018

Ans. (b) : Total volume of footing = $\ell \times b \times h$

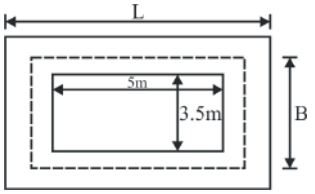
ℓ = Total length of the footing

b = Width of the footing = 0.45 m

h = Depth of the footing = 0.4 m

L = 5 + 0.3 = 5.3 m

B = 3.5 + 0.3 = 3.8 m



$\therefore \quad \ell = 2[L + B]$

$= 2[5.3 + 3.8]$

$[\ell = 18.2m]$

$\therefore$ So, volume = $\ell \times b \times h$

Volume = $18.2 \times 0.45 \times 0.4$

Volume = $3.276m^3 \cong 3.3\ m^3$

EXAM POINTS

- When dimension are specified from a common origin and spaced parallel to one another, it is called– **Progressive dimensioning**
- The length to width ratio of standard size of drawing sheet is– **$\sqrt{2}$: 1**
- ..... is used to make measurement in one unit system from a drawing in another unit system measurement– **Comparative scale**
- Replacement of protractorcan be used as a– **Scale of chord**
- The edge of drawing board on which T-square in made to slide is called its– **Working edge**
- For drawing thin lines of uniform thickness, the pencil should be sharpened in the form of– **Chiesel edge**
- That line which is used to show the outline of part– **Continuous thick line**
- If the radius of generating circle is 20% of the radius of directing circle. Then the number of epicycloids formed for a complete revolution of generating circle will be– **5**
- That curve which represents the Boyle's Law– **Rectangular hyperbola**
- Primary unit of measurement for engineering drawing and design in the mechanical industries is– **Millimeter**
- ..... set of lead grades has a grade out of sequence– **7B,H, F, 3H**
- Trammel method is used to draw– **Ellipse**
- In the context of logarithmic spiral, consecutive radius are in– **Geometric progression**
- The type of line which is part of dimensioning– **Extension line**
- When the diameter of directing circle is twice the diameter of generating circle then the hypocycloid will be– **Circle with infinite radius**
- In the context of the spiral curve the distance from any point on the curve to the pole is– **radius vector**
- In unidirectional method dimensions are placed in– **Only horizontal direction**
- A circle passes through three given points its centre lies at the intersection of– **Perpendicular bisection of the lines that connect the points**
- Part of circle bounded by two radii meeting at centre and enclosed by arc is called– **Sector**
- Section lines are continuous ____ lines and drawn at an angle of _____ to the main out line of the section– **thick, 45°**
- Locus traced by a point around the surface of right circular cylinder in such a way that its axial distance is uniform with its movement around the surface– **Helix**
- The surface area of basic AO size drawing sheet is nearly– **1 m^2**
- That compass which is used to draw large size circles– **Lengthening bar**
- The two parts of T-square are called– **Head and blade**

- The scale of chord is used to measure– **Angle**
- Cabinet projection is a part of– **Oblique**
- A room of 1728 m^3 volume is represented by a cube on drawing with representative factor is 0.5. The volume of cube is– **216 m^3**
- When measurement is required in three units _____ scale is used– **Diagonal**
- If the diameter of directing circle is equal to diameter of generating circle then epicycloids will be– **Logarithmic**
- Curve generated by point on the circumference of tyre of bicycle is– **Cycloidal**
- That instrument which is free from Abbe error– **Screw gauge**
- That drive which reduces shock and vibration transfer during power transmission– **Belt drive**
- Ergonomics in related to human– **Comfort, Safety**
- That belt drive which is used with shafts arranged parallel and rotating in opposite direction– **Crossed belt drive**
- When the driving shaft is running at constant speed, then for changing the speed of driven shaft, which pulley should be used– **Stepped or cone pulley**
- Intermittent power transmission should be used for– **Fast and loose pulley drive**
- That type of belt should be used for very large power transmission over a long distance– **Circular belt**
- That belt which is widely used in variable speed drive– **V-belt**
- Coefficient of friction between belt and pulley depends upon– **Material of belt, Material of pulley, The slip of belt, Speed of belt**
- That clutch which is known as wet clutch– **Multi plate clutch**
- That clutch which is a positive clutch– **Spiral jaw clutch**
- Crowning of pulley is done to– **Avoid slipping of belt**
- Included angle between two adjacent flank of acme thread is– **29^0**

1.7 Basics of engineering drawing

26. In a plain scale, if 1.5 inches = 1 foot and it can measure upto 4 feet, what is the representative factors of the scale?

(a) $\frac{1}{8}$ (b) $\frac{1}{4}$

(c) $\frac{1}{1.5}$ (d) $\frac{2}{1.5}$

ESE (PRE) 2023

Ans. (a) : That 1.5 Inches = 1 foot

$$\text{Representative factor} = \frac{1.5 \text{ Inches}}{1 \text{feet}}$$

$$= \frac{3.81 \text{cm}}{30.48 \text{cm}}$$

$$= \frac{3.81}{30.48} = 0.125$$

$$= \frac{1}{8}$$

27. Which one of the following is used when components of same shape but different dimensions are to be manufactured?

(a) Drawing for installation
(b) Tabular drawing
(c) Schematic assembly drawing
(d) Patent drawing

ESE (PRE) 2023

Ans. (b) : A tabulated drawing is a drawing that has symbols or variables in place of dimension. This type of drawing is mostly used when components of same shape but different dimensions.

28. Which one of the following lines is used to represent the outlines of adjacent parts or alternative and extreme positions of movable parts?

(a) Continuous thick line
(b) Continuous thin line
(c) Chain thin double-dashed line
(d) Dashed thin line

ESE (PRE) 2023

Ans. (c) : The thin chain double dashed line is used to show adjacent components. This is especially useful when the component has a reference to the existing components. It is also used to show alternative or extreme positions.

29. Which one of the following is/are used for drawing curves which cannot be drawn with a compass?

(a) Scale (b) Protractor
(c) French curves (d) Set square

ESE (PRE) 2024

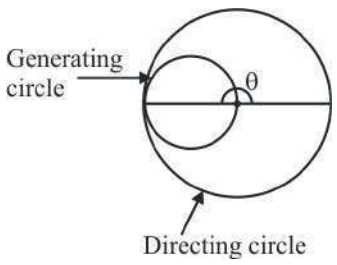
Ans. (c) : French curves is the best tool for drawing complex curves that cannot be made with a compass. It offers flexibility and accuracy in creating various shapes.

30. If the radius of a generating circle which is moving inside the directing circle is half of the radius of the directing circle, the curve generated by a point on the circumference of the generating circle is

(a) A circle (b) An ellipse
(c) A straight line (d) A spiral

ESE (Pre) 2017

Ans. (c) :



■ A cycloid is generated by a point on the circumference of a circle rolling along a straight line without slipping.
The rolling circle is called the generating circle the straight line is called the directing line or base line.
A straight line–

$$\theta = \frac{r}{R} \times 360° = \frac{d}{D} \times 360°$$

$$d = \frac{D}{2} \text{ or } r = \frac{R}{2}$$

Since R = 2r then [θ = 180°]

31. The insert command is used in 'Auto CAD' to insert
(a) Objects in the current file
(b) Objects in any file
(c) Blocks in any drawing file
(d) Blocks and blocks in the current drawing

ESE (Pre) 2019

Ans. (d) : Auto CAD–In Auto CAD insert command is use to insert blocks and BLOCK in current drawing.
Use the BLOCK command to export these objects as a drawing, which can be inserted into other drawing as a block.

32. Statement (I) : The drawings and machining processes can be automated using CAD/CAM change the primary function of these drawings and processes.
Statement (II) : The primary function is to provide information about the product to the designer and production people.
(a) Both statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of statement (I)
(b) Both Statements (I) and Statement (II) are individually true but statement (II) is NOT the correct explanation of Statement (I)
(c) Statement (I) is true but statement (II) is false
(d) Statement (I) is false but statement (II) is true

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Ans. (d) : In automated machining processing CAD/CAM the primary function cannot be changed.
The primary function at automated CAD/CAM is to design and manufacture complex parts with high precision and durability.
CAD:- Computer-Aided Design (CAD) is used to create digital models of parts or systems. CAD allows designers to create and modify model, and to test them in simulated real-world condition.
CAM:- Computer-Aided Manufacturing (CAM) uses the geometrical data from CAD to control machines that produce parts. CAM systems can automate manufacturing processes like milling, turning, laser cutting and 3D printings.

33. In general, which one of the following is NOT included in the list of parts of the bill of materials in an engineering drawing sheet?
(a) Part number (b) Material name
(c) Cost (d) Quantity

ESE (Pre) 2022

Ans. (c) : The bill of material in an engineering drawing sheet, typically includes-
1. The part number
2. Name
3. Description
4. Quality
5. Unit of measure
The bill of materials does not include
1. Labor costs
2. The materials or the manufactures of the item.

34. Continuous thin (narrow) with zigzags (straight lines are generally used to represent
(a) Long-break line (b) Hidden outline
(c) Visible outline (d) Reference line

ESE (Pre) 2022

Ans. (a) : Continuous thin (Narrow) with zigzags (straight) Lines are generally used to represent long-break line.

- Hidden line are represented by dashed wide line in general.

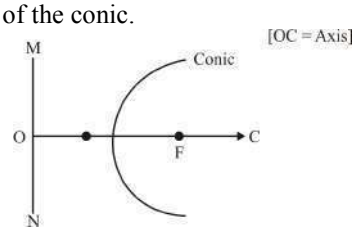
- Visible outline is generally represented by continuous

- Reference line is generally represented by continuous narrow line.

35. The line passing through the focus and perpendicular to the directrix is called
(a) axis (b) vertex
(c) eccentricity (d) conic

ESE (Pre) 2020

Ans. (a)
- **Axis of the conic–** The straight line passing through the focus and perpendicular to the directrix is called the axis of the conic.



- **Directrix–The** fixed line (MN) is called the directric.

36. Dimensions in a series may be placed in any one of the following ways, except.
(a) progressive dimensioning
(b) proportional dimensioning
(c) continuous dimensioning
(d) chain dimensioning

ESE (Pre) 2020

Ans. (b) : Dimensions in series, adopt any one of the following ways–
- **Chain Dimensioning (Continuous Dimensioning)–** All the dimensions are aligned in such a way that an arrowhead of one dimension touches tip-to-tip the arrowhead of the adjacent dimension. The overall

dimension is placed outside the other smaller dimension.

- **Progressive Dimensioning (Parallel Dimensioning)–** All the dimensions are shown from a common reference line. Obviously, all these dimensions share a common extension line.

37. In a rectangular hyperbola, if a curve is traced out by a point moving in such a way that the product of its distances from two fixed lines at right angles to each other is a constant, then those fixed lines are called

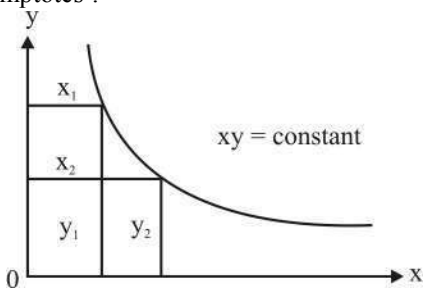
(a) asymptotes (b) intercepts
(c) holes (d) limits

ESE (Pre) 2020

Ans. (a)

- **Rectangular Hyperbola**

It is a curve traced out by a point moving in such a way that the product of its distances from two fixed lines is constant. The fixed lines are called 'asymptotes'.



$x \rightarrow$ is the distance from one asymptotes (0y)
$y \rightarrow$ is the distance from another asymptotes (0x)

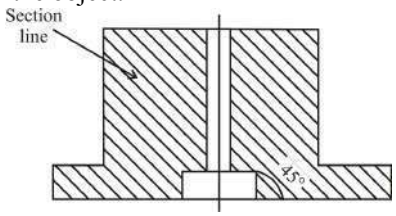
38. On a view showing assembled parts, section lines on adjacent pieces are drawn is.

(a) same directions usually at an angle of 90°
(b) opposite direction usually at an angle of 45°
(c) Opposite directions usually at an angle of 30°
(d) same directions usually at an angle of 60°

ESE (PRE) 2021

Ans. (b) : Section line or hatching line- It is can thin continuous line and is used for the purpose of sectioning an object.

These lines are drawn to make the section evident. It is drawn at an angle of 45° to the horizontal. lines are spaced uniformly from 2 to 4 mm apart depending upon the size of the object.



Here opposite means anti-clockwise directions.

39. Points to be remembered while dimensioning:

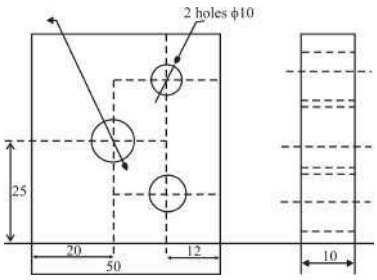
1. Dimensions are to be placed on the which clearly express the relevant feature.
2. Once dimension is marked in one view, it should not be repeated in another view.
3. Dimensions are to be drawn from hidden lines.
4. Dimension should be given

Which of the above statements are correct?

(a) 1, 2, and 3 only (b) 1, 2, and 4 only
(c) 1, 3, and 4 only (d) 2, 3 and 4 only

ESE (PRE) 2021

Ans. (b) :



In the front view length and breadth have been mentioned whereas the depth is mentioned in side-view which gives the relevant information of the drawing.

The height for the Individual part has been given in the front view so it has not been mentioned in the side view as it will create confusion.

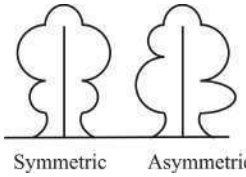
Every dimension lines are a thick line as compared to centerlines or extended line, in the side view. The hole's lines are hidden and the dimension for it has been avoided as it already mentioned in the front view from the diagram shown, one can easily predict that holes are dimensioned from baseline or either centerline.

40. An asymmetric object is usually described by:

(a) 6 views (b) 3 views
(c) 4 views (d) 2 views

(UPRVUNL JE 2014)

Ans : (b) In asymmetric object is usually described by 3 views.



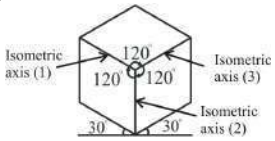
41. Isometric projections are commonly drawn with.....

(a) One (b) Four
(c) Two (d) Three

(RRB JE (Shift-III), 30.08.2015)

Ans : (d) Isometric projection is a method for visually representing three dimensional objects, in two dimensions in technical and engineering drawings.

- It is an axonometric projection in which the three coordinate axes appear equally for foreshortened and the angle between any two of them is 120° .
- Isometric projection are commonly drawn with three equispaced axis.

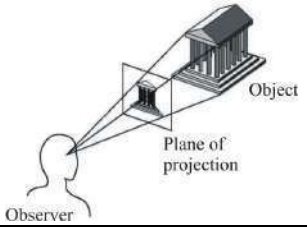


42. In which projection a plane may be at any angle with horizontal.

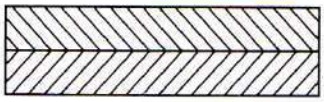
(a) Isometric projection
(b) orthographic projection
(c) Oblique projection
(d) Reference projection

RRB Bangalore Material Superintendent, 21.11.2004

Ans. (d) : In reference projection, a plane may be at any angle with horizontal.

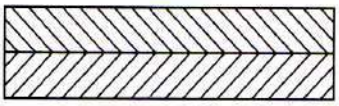


43. In the Fig. below the hatching lines are inclined to each other. This indicates that



(a) Two parts are adjacent to each other
(b) Hatching line are wrongly shown
(c) One part is sectioned and other is not sectioned
(d) None of these

Ans. (a) : In the fig. below the hatching lines are inclined to each other. This indicates that two parts are adjacent to each other.



44. Match the following:

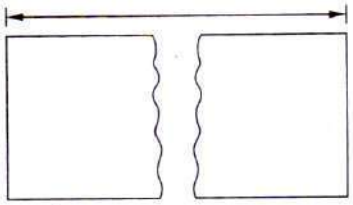
	Object		Convection
1.	Long breaks line	i.	
2.	Interrupted view	ii.	
3.	Section through thin walled metals	iii.	
4.	Centre line, line of symmetry	iv.	

(a) 1 – (i), 2 – (ii), 3 – (iii), 4 – (iv)
(b) 1 – (i), 2 – (iii), 3 – (ii), 4 – (iv)
(c) 1 – (ii), 2 – (iv), 3 – (iii), 4 – (i)
(d) 1 – (ii), 2 – (i), 3 – (iii), 4 – (iv)

Ans. (a) : Representation of line according to standard–

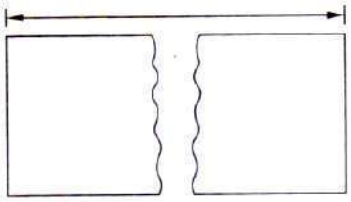
Object	Convection
Long breaks line	
Interrupted view	
Section through thin walled metals	
Centre line, line of symmetry	
Short break line	
Hidden line	
Cutting plane line	
Dimension and extension line	

45. A long feature in the Fig. shown below is shown as broken by using _____ lines



(a) Long break
(b) Short break
(c) Thin continuous irregular
(d) Geometrical curves

Ans. (c) : A long feature in the fig. shown below is shown as broken by using thin continuous irregular.



46. Centre line is drawn as_____.

(i) Continuous narrow line
(ii) Dashed narrow line
(iii) Long dashed chain line
(iv) Long dashed double dotted line

(a) (ii) (b) (iv)
(c) (iv) (d) (i)

Ans. (c) : Centre line is drawn as long dashed chain line.

- Centre line is thin represented
- These are thin long, chain lines composed of alternatively long and short dashes spaced at an approx 1 mm distance.

47. Visible lines are shown by_____.

(a) Dashed line
(b) Centre lines
(c) Continuous thick lines
(d) None of these

Ans. (c) : Visible lines are shown by continuous thick line.

Lines		Description	General application
A	Thick	Continuous thick	A1 visible outline A2 visible edge
B	Thin	Continuous thin	B1 imaginary lines of intersection B2 dimension lines B3 Projection line or extension line B4 leader line B5 hatching B6 Outline of

			revolved section in place B7 short centre lines B8 thread line B9 diagonal line.

48. The imaginary line which is joining the center of the base to the apex point, is called ?

RRB Bhopal & Mumbai Apprentice Section Eng. 23.03.2003

(a) Parallel line (b) Perpendicular line
(c) Horizontal line (d) Axis line

Ans : (d) On moving forward the center of its base in the list column, if all the corners of the list column meet on it, then that point is called Apex point and this center line is called the 'axis line' of that list column.

49. 0.2, mm thick lines are used for_____.

(a) Dotted lines (b) Outlines
(c) Cutting planes (d) All of these

Ans. (d) : 0.2 mm thick lines are used for dotted lines, outlines, cutting planes.

Out lines:-

- Lines drawn to represent visible edges and surface boundaries of objects
- Also known as object lines or principal lines.
- Represented by continuous thick lines

Cutting Plane lines:-

- These are long, thin chain line with thick ends.
- Use to show the location of cutting plane.

Dotted line:-

- Closely and evenly spaced dashed lines of equal lengths.
- They are medium thick and are used to show the invisible or hidden parts of the object on the drawing.

50. 0.1 mm thick lines used for_____.

(a) Centerlines (b) Dotted lines
(c) Dimension lines (d) (a) and (b)

Ans. (d) : 0.1 mm thick lines used for centerlines, dotted lines.

Type of lines according to thickness–

Thick line $\Rightarrow t \approx 1$ mm

Medium line $\Rightarrow t \approx 0.5$ mm

Thin line $\Rightarrow t \approx 0.3$ mm

Dotted line– Closely and evenly spaced dashes lines of equal lengths.

- They are medium thick and are used to show the invisible or hidden parts of the object on the drawing.

Centre lines– These are thin, long, chain lines composed of alternatively long and short dashes spaced at an approx 1 mm distance.

51. Leader lines should be _____lines.

(a) Thin (b) Medium
(c) Very thin (d) None of these

Ans. (a) :

Leader lines Thin Line	• Leader line should be thin line. • Continuous thin lines are drawn to connect a note with the specific feature in the drawing. • The leader lines generally drawn at angles, not less than 30^o, usually 30^o, 45^o, 60^o.

52. Construction lines are generally _____ mm thick.

(a) 0.2 (b) 1
(c) 0.1 (d) 0.5

Ans. (c) : Construction lines are generally 0.1 mm.

- Thin continuous lines used for construction of object.
- They are continuous thin light lines.

Thin

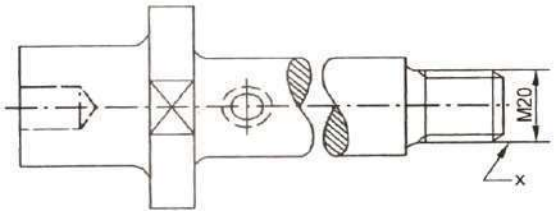
53. Line in Fig. is line used to indicate.

(a) Short break line (b) Long break line
(c) Both (a) and (b) (d) None of these

Ans. (b) : Line in fig is line used to indicate long break line.

Long break line Thin	Thin ruled lines provided with short zig-zag at suitable intervals. • Drawn to show long breaks.
Short break line thin Thin	Continuous, thin and wavy free hand lines draw to show the break of an object for a short length. • Also used to show irregular boundaries.

54. Name the '*x*' line shown in the figure ?



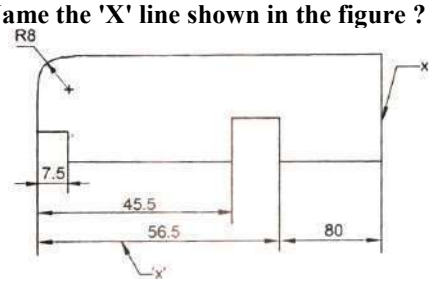
(a) Thread line (b) Dimension line
(c) Extension line (d) Hatching line

Indian Ordnance Factory Fitter 2014

Ans : (c) The extension line is shown by 'X' in given figure.

- Extension lines are used to represent dimensions.
- In engineering drawing, these lines are used while representing the measurement of each part of the drawings after making them.
- It should not cut the dimension line. It extended by about 3 mm beyond the dimension lines.

55. Name the 'X' line shown in the figure ?

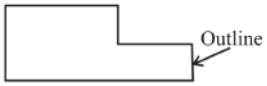


(a) Leader line (b) Out line
(c) Extension line (d) Hatching line

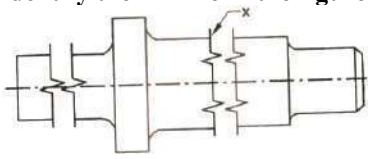
Indian Ordnance Factory Fitter 2013

Ans : (b) The outline is shown by 'X' in the given figure.

- Outline is the main line in drawing of any object.
- These lines are drawn to represent visible edges and surface boundaries of objects.
- They are also called object line or principal lines.



56. To indentify the 'X' line in the figure?



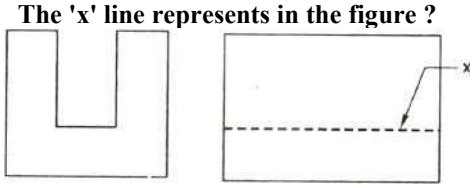
(a) Dashed line (b) Hatching line
(c) Centre line (d) Short break line

HAL Electrician 2015

Ans : (d) Line X indicates short break line.

- This line is used to represent the section of a part.
- Using this line saves space and time in drawing.
- This lines are continuous thin and wavy.
- They are drawn free hand and are used to show a short break or irregular boundaries.

57. The 'x' line represents in the figure ?



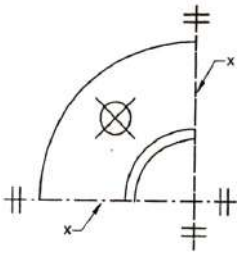
(a) Centre line (b) Locus line
(c) Hatching line (d) Dashed line

MES Electrician Tradesman 2015

Ans : (d) The line '*x*' is represented the dash line.

- This line is used to show invisible lines.

58. Identify the 'X' line in the figure ?



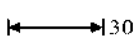
(a) Centre line (b) Lines of Symmetry
(c) Either a & b (d) Both a & b

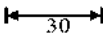
Vizag Steel Electrician 2015

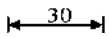
Ans : (b) '*x*' represents the line of symmetry this line is similar to the centre line.

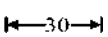
- A line of symmetry is a line that cuts a shape exactly in half.
- This means that if you were to fold the shape along the line, both halves would match exactly.

59. Which of the following represents the correct process of dimension line ?

(a) 

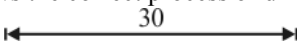
(b) 

(c) 

(d) 

RRB Jammu Section Eng. (Mech, Elec/Elect./Telecom), 2013

Ans : (c) In drawing all the parts of each object are shown with full dimensions information only by planning. It shows the correct process of dimension line.



- It is terminated at its outer end with an arrow head touching the outline, extension line or centre line.

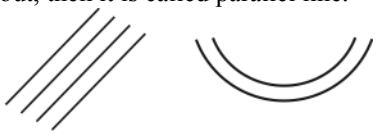
60. A line passing through a point which keeps on changing its direction is-

(a) Straight (b) Curved line
(c) Oblique line (d) Parallel line

IOF 2014

Ans : (b) If a line passing through a point has changing its direction, it is called a curved line.

- When distance between any two lines constant throughout, then it is called parallel line.



61. The ratio of the shorter side of an A4 sheet to the longer side of an A3 sheet is _____ .

(a) 1 : 1 (b) $1:\sqrt{2}$
(c) 1 : 4 (d) 1 : 2

RRB ALP & Tech. 21.01.2019 Shift-II

Ans. (d) : The ratio of the shorter side of A4 sheet to longer side of an A3 sheet is 1 : 2.
The shorter side of an A4 sheet (S_4) = 210mm
and, the longer side of an A3 sheet (L_3) = 420mm
Then,
The ratio of shorter size of A_4 sheet to the longer size of A_3 sheet is -

$$\frac{S_4}{L_3} = \frac{210}{420} = \frac{1}{2}$$

$S_4:L_3 = 1:2$

62. If the width of a standard engineering drawing sheet is 841 mm, then its length will be ___mm.

(a) 1189 (b) 1216
(c) 1000 (d) 1250

RRB ALP & Tech. 23.01.2019 Shift-III

Ans : (a) If the width of a standard engineering drawing sheet is 841 mm, then its length will be 1189 mm.
- It is the size of A0 sheet size being 841×1189 mm
- A0 is the largest sheet size.

63. What is the full form of the abbreviation AC in an engineering drawing?
(a) Aerial Cut (b) Across Corners
(c) Attached Circle (d) Air Conditioning

RRB ALP & Tech. 23.01.2019 Shift-III

Ans : (b) The full form of the abbreviation AC in an engineering drawing is across corners.
- Followings are the various terms and their respective abbreviations in engineering drawings.

AC	Across Corners
AF	Across Flats
AR	As Required
ASA	American Standard Association

64. In an engineering drawing, the letter LH stands for which of the following?
(a) Left Hand (b) Limit of Height
(c) Level Hide (d) Low Heat

RRB ALP & Tech. 23.01.2019 Shift-III

Ans : (a) In engineering drawing, the various terms and their respective abbreviations are followings-

LH	Left-Hand
LMC	Least material condition
MFD	Manufactured
OD	Outer diameter
OPP	Opposite

65. 594 mm × 841 mm are the dimensions of _____ size paper.
(a) A3 (b) A1
(c) A0 (d) A2

RRB ALP & Tech. 08.02.2019 Shift-I

Ans. (b) : 594 mm × 841 mm are the dimensions of A1 sheet size.
- The other sheet sizes are given below-
  A0 = 1189 × 841 mm
  A3 = 420 × 297 mm
  A4 = 297 × 210 mm
  A5 = 210 × 148 mm

66. The area of A0 size sheet is _____.
(a) $1cm^2$ (b) $1000cm^2$
(c) $10000cm^2$ (d) $100cm^2$

RRB ALP & Tech 23.01.2019 Shift-II

Ans : (c) The area of A0 size sheet is 10000 cm^2.
- The area of A0 size sheet = 84.1 cm ×118.9 cm
  = 9999.49 cm^2
  ≈ 10000 cm^2

67. The feature provided on the drawing sheet to show the detail, modification and position of the drawing on the drawing sheet of all sizes is called-
(a) Metric reference (b) Grid reference
(c) Title block (d) Frame

RRB Bhopal Section Engineer, 24.11.2002

Ans : (b) The feature provided on the drawing sheet to show the details, modifications and position of drawing on the drawing sheet of all sizes is called grid reference.

Grid reference system: The provision of the grid reference system (joining is recommended for all sizes) in order to permit easy location on the drawing of details, addition, modifications etc.

68. For binding and filing a drawing sheet, the area left on the left side of the sheet is given by which line ?
(a) Margin line (b) Border line
(c) Frame (d) Orientation sign

RRB Kolkata Chemical & Metallurgical Er., 01.12.2002

Ans : (b) The area left on the left side of a drawing sheet for binding and filing is given by the border line.
- Border lines are very thick continuous lines used to show the boundary of the drawing or to separate different objects drawn on same sheet.

69. The print of the margin line in the drawing sheet is of _____
(a) Raw size (b) Accurate size
(c) Both (d) None of these

RRB Bhopal & Mumbai Apprentice Section Eng. 23.03.2003

Ans : (b) The print of the margin line in the drawing sheet is of accurate size.
- The drawing of center marks on all the four sides of the drawing sheet is called 'Origin line'.

70. Which one of the following represents the reducing R.F scale in this?
(a) 1 : 1 (b) 1 : 20
(c) 50 : 1 (d) 8 : 6

(NCVT-2012, Carpenter, Plumber, Welder, Sheet Metal)

Ans : (b)
R.F.– 1:20 is a reducing scale or reduction scale.
R.F.– 50:1, 8:6 → Enlarging scale
R.F.= 1 : 1 → Full scale.

71. What type of paper is generally used for technical drawings ?
(a) Cartridge paper (b) Tracing paper
(c) Both of the above (d) None of these

RRB Kolkata Jr. Engineer-II Electrical DRG & Design 11.06.2006

Ans : (c) Technical drawings are generally drawn on the following types of paper.
1. **Cartridge Paper:** This is the best quality paper for pencil drawings. Its weight is usually 90 GSM. It is made from esparto grass.
2. **Tracing Paper:** Natural tracing paper is a high quality tracing material that can be purchases in 25 meter rolls. Generally its weight ranges from 38 GSM to 63 GSM and its often used for tracing technical drawings.

These are usually measured on the basis of their weight, which are known as grams per square meter (GSM).

72. What are the importance and benefits of free hand drawing ?

(a) It is very quick to design and explains the size
(b) The practice of free hand drawing gives to anyone an excellent idea about measurements
(c) It is very useful in generating ideas
(d) All of the above

RRB Secunderabad Section Engineer (Civil) 29.06.2008

Ans : (d) The following are the importance and benefits of free hand drawings-

1. It gives very quick explaination about, the design and shape of the devices.
2. It is very useful in generating ideas.
3. The practice of free hand drawing gives to anyone an excellent idea about measurements.

73. What are the medium adopted by the engineer/ draftsman to convey his ideas to the artisans ?

(a) Orally
(b) By writing
(c) In the form of sign or indication or figure
(d) All of the above

RRB Thiruvananthapuram Section Eng (Mechanical) 04.01.2009

Ans : (d) Engineer/ draughtsman adopts oral form, written form, sign, or indication or figure form to convey his idea to artisans.

74. In an engineering drawing, a list of item gives which of the following informations?

(a) Company name, drawing title, scale and angle of projection
(b) Item, description, quantity and substance
(c) Distinctive signs, abbreviations, and units of measurements
(d) None of the above

RRB Bangalore Section Engineer (Civil) 01.02.2009

Ans : (b) In an engineering drawing, a list of item gives Item, description, quantity and substance.

75. What do you understand by B.I.S.?

(a) Bureau of Indian standards
(b) Bureau of Indian system
(c) Bureau of Indian instrument
(d) None of these

RRB Chandigarh Section Engineer (Electrical), 15.03.2009

Ans : (a) The full form of B.I.S. is Bureau of Indian standards.

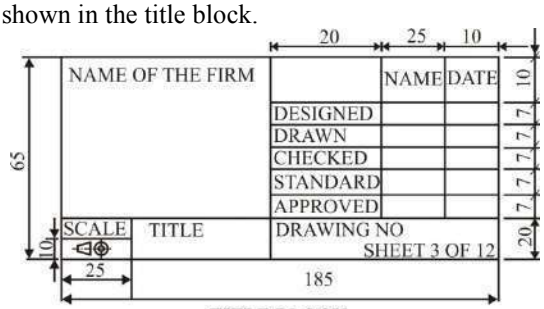
- BIS is the national standard body of India.
- It is a code of practice for general engineering drawing.

76. ..... shown in the title block ?

(a) Name of the company
(b) Title of the drawing
(c) Scale of drawing
(d) All of the above

RRB Chennai Section Engineer, 12.02.2012

Ans : (d) Name of the company, title of drawing, scale of drawing, type of projection and number of drawing are shown in the title block.



TITLE BLOCK

77. An engineering drawing gives different types of information. What is the most important information it gives ?

(a) Length (b) Width
(c) Height (d) Shape

DMRC Electronics Engineering, 21.09.2014

Ans : (d)

- The most important information if the shape of the object which is given by the engineering drawing.
- It helps to make more numbers of same object with another object.

78. In what form does engineering drawings originate as an activity ?

(a) Records (b) Type
(c) Product (d) None of these

RRB Bhopal & Mumbai Apprentice Section Eng. 23.03.2003

Ans : (a) Engineering drawing is prevalent everywhere, hence this drawing is called universal language.

- Engineering drawings originate as 'record' as an activity.

79. In Engineering drawing ideas can be expressed in which form ?

(a) Oral (b) Written
(c) Symbolic (d) All of these

RRB Kolkata Jr. Engineer-II Electrical DRG & Design 11.06.2006

Ans : (d) Expression of ideas in engineering drawing can be taken in the following form-

(i) Oral (ii) Written (iii) Symbolic

- According to Mechanical point of view, engineering drawing is divided into following parts -

1. Geometrical drawing
2. Mechanical or Machine drawing
3. Electrical drawing
4. Civil drawing
5. Electronics drawing

80. Qualitative drawing sheet is used on which of the following should be kept in the mind ?

(a) Neat & clean drawing
(b) The nature of the ink of pencil
(c) Both a and b
(d) None of these

RRB Chandigarh Section Engineer (Civil), 26.02.2012

Ans : (c) Some thing should be kept in mind before using a quality drawing sheet.
Ex.- Neat & clean drawing and the nature of ink of the pencil should be good.

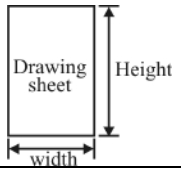
81. The ratio between two adjacent side of a drawing sheet is

(a) $1:\sqrt{2}$ (b) $1:\sqrt{3}$
(c) 1:0.5 (d) 1:1

ISRO - (VSSC) Draughtsman (Mech.), 21-02-2015

Ans : (a) The ratio between two adjacent side of a drawing sheet is $1:\sqrt{2}$

$$\frac{\text{Width}}{\text{Height}} = \frac{1}{\sqrt{2}}$$



82. Area of an A_0 size drawing sheet is as closed to.

(a) 0.25 m^2 (b) 0.5 m^2
(c) 0.75 m^2 (d) 1.0 m^2

ISRO - (VSSC) Draughtsman (Mech.), 21-02-2015

Ans : (d) Area of an A_0 size drawing sheet is as close to as 1.0 m^2.

83. Which one is not the size of a standard trimmed drawing sheet?

(a) 841 × 1189 (b) 420 × 596
(c) 210 × 297 (d) 297 × 420

ISRO - (VSSC) Draughtsman (Mech.), 25-09-2016

Ans : (b) The above are the standard sizes of drawing sheets. So 420×596 is not a standard size of drawing sheet.

- **Standard size and measurement of BIS based drawing sheet-**

Designation	Size in mm
A_0	841 × 1189
A_1	594 × 841
A_2	420 × 594
A_3	297 × 420
A_4	210 × 297
A_5	148 ×210
A_6	105×148

- Mostly A_2 drawing sheet is used by engineering drawing students.

84. Clinograph is used for

(a) measuring and setting the angles
(b) ink work on drawings
(c) drawing horizontal lines
(d) drawing parallel lines at inclination

ISRO - (VSSC) Draughtsman (Mech.), 25-09-2016

Ans : (d) Clinograph is an adjustable set-square and is used to drawn parallel lines at any angle.

- The two sides of Clinograph are fixed at 90° and the third side can be adjusted at any desired angle.
- It is adjustable set square made of wood or plastic. It contains one adjustable wing or strip which can be adjusted to required angle.

Clinograph

85. What is the dimension of B_2 drawing board ?

(a) 1500×1000×25 mm (b) 700×500×15 mm
(c) 1000×700×25 mm (d) 500×350×15 mm

RRB RRB Patna/Allahabad ESM-II, 30.01.2011
RRB Chandigarh Section Engineer (Mech.), 26.02.2012

Ans : (b) The dimension of B_2 drawing board is 700×500×15 mm. B_2 size drawing board is called imperial size drawing board.

86. What is the dimension of A_2 drawing sheet ?

(a) 420 × 594 mm (b) 594 × 841 mm
(c) 210 × 297 mm (d) 297 × 420 mm

RRB Jammu Section Eng. (Mech, Elec/ Elect./Telecom), 2013

Ans : (a) The dimension of A_2 drawing sheet (trimming) is 420 × 594 mm.

- Without trimming the dimension of A_2 is 450 × 625 mm.

Standard sizes of drawing sheets

Specified size	Size (After Trimming	Size (without trimming
A_0	841 × 1189 mm	880 × 1230 mm
A_1	594 × 841 mm	625 × 880 mm
A_2	420 × 594 mm	450 × 625 mm
A_3	297 × 420 mm	330 × 450 mm
A_4	210 × 297 mm	240 × 330 mm
A_5	148 × 210 mm	165 × 240 mm

87. What is the ratio of the length and width of the drawing sheet ?

(a) 1:2 (b) 2:3
(c) $1:\sqrt{2}$ (d) 3:4

RRB ALP & Tech. 22.01.2019 Shift-I
RRB Kolkata Jr. Engineer-II Electrical/ DRG & Design 11.06.2006
DRDO Turner 2016

Ans : (c) The ratio of the length and width of the drawing sheet is $1:\sqrt{2}$.

Ex.: $A0 \rightarrow 841 : 1189 = 1 : \sqrt{2}$
$A1 \rightarrow 594 : 841 = 1 : \sqrt{2}$

88. Match the various instruments used in drawing correctly.

A	**Large compass**	**(i)**	**To ink the lines**
B	**Large divider**	**(ii)**	**For holding pencil lead**
C	**Ruling pen**	**(iii)**	**To draw a big circle**
D	**Lead case**	**(iv)**	**To divide the line**

(a) A-(i); B-(ii); C-(iii); D-(iv)
(b) A-(iii); B-(iv); C-(i); D-(ii)
(c) A-(ii); B-(iii); C-(iv); D-(i)
(d) A-(iv); B-(i); C-(ii); D-(iii)

RRB Thiruvananthpuram Section Eng (Mechanical) 04.01.2009

Ans : (b)

SN.	Instrument	Uses
1.	Large Compass	To draw a big circle and marking
2.	Large divider	To divide the line
3.	Ruling pen	To ink the line
4.	Lead case	For holding Pencil lead

89. Name of the device which is used for marking and dividing small distances.
(a) Small compass (b) Large compass
(c) Protractor (d) Inking pen

RRB Kolkata Jr. Engineer-II Electrical/DRG & Design 11.06.2006

Ans : (a) A small compass is used for marking and dividing small distances.
- Protractor is used to measure angles.
- Large compass is used to draw large circles.

90. For drawing the component of a wrist watch, the scale used is–
(a) Full size scale (b) Enlarged scale
(c) Reduced scale (d) None of these

RRB Bhubaneswar App. Electrical, 19.08.2001

Ans : (b) For drawing the component of a wrist watch enlarged scale is used.
- The components of wrist watch are very small. For giving complete information about the element, you have to print it on paper in large form.
  So, the major or enlarge scale is used for this.
- For this R.F is kept greater than one.

91. To draw smooth curves of any nature, the drafting instrument used is a/an–
(a) Template (b) Eraser shield
(c) French curve (d) Mini drafter

RRB Ranchi Signal Maintainer Group-III, 20.11.2005

Ans : (c) To draw smooth curves of any nature, the drafting instrument used is a French curve.
- They are generally made of wood, plastic or celluloids.
- They are made in various shapes.
- They are used to draw curve which cannot be drawn with compass or for irregular curves.

92. Parallel lines can be drawn with the help of–
(a) T-square/ (b) Mini drafter
(c) Pair of set-square (d) All of these

RRB Allahabad Signal Maintainer-II, 22.01.2006

Ans : (d) Parallel lines can be drawn with the help of T-square, mini drafter and pair of set-squares.
- The set squares are used for draw all straight lines except the horizontal lines which are usually drawn with T-square.
- The set-squares can also be used for drawing parallel and perpendicular lines to any given line.

93. What do you understand by scale 1 : 2 ?
(a) Full size (b) Enlarging size
(c) Reducing size (d) None of these

RRB Kolkata Supervisor (P.Way), 20.02.2000

Ans : (c) 1 : 2 is a reducing size scale because its representative fraction is less than one.
- When a drawing of a very large object is to be made, then this type of scale is used.
- In this, a drawing is made of a smaller size than the actual size of the object.
  Ex.: Drawing of building, roads etc.

94. Which objects can be drawn using 1 : 1 scale ?
(a) Objects of larger size
(b) Objects of medium size
(c) Object of smaller size
(d) both 'a' and 'b'

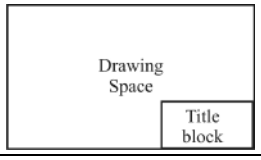
RRB Bangalore Material Superintendent, 21.11.2004

Ans : (b) Drawing of objects of medium size is made from scale 1 : 1.
- The drawings of objects of medium size are made equal to their actual sizes.

95. Where is the Title block made on the drawing sheet ?
(a) Lower left corner (b) Upper left corner
(c) Upper right corner (d) Lower right corner

DMRC Station Controller, 09.09.2007

Ans : (d) The title block is normally located in the lower right corner of the drawing sheet.
- Name of the institute, drawing number, name of the maker of the drawing; type of projection, title of the drawing etc. are presented on the title block of size 185 mm × 65 mm.



96. Which size of drawing board you work on ?
(a) B_o (b) B_1
(c) B_2 (d) B_4

RRB Bangalore Material Superintendent, 21.11.2004

Ans : (c) Drawing boards are available in different sizes, but in engineering drawing only B_2 imperial size is mostly used.

97. Which of the following statement is false:
(a) For 'A' size sheets, mentioning about the length and width of the sheet is a normal thing.
(b) Mentioning GSM value for 'A' size sheets is a normal thing
(c) For 'A' size sheets, it is common to refer to the area of the sheet.
(d) All of the above

Ans : (d) All statements are incorrect.
a. Often A_0, A_1, A_2, A_3 etc. are mentioned.
b. GSM tells about the quality of the paper. It has nothing to do 'A' size sheet.
c. it is often referred to A_0, A_1, A_2, A_3 etc.

98. Which of the following statement is correct ?

(a) The length of A_4 size sheet is the width of A_3 size sheet.

(b) If the length of 'A_1' size sheet is P, then its width will be $\sqrt{2}$ P

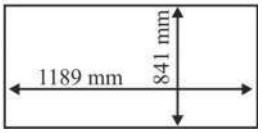
(c) The area of $2A_0$ size sheet is $2m^2$

(d) All of these

RRB Ranchi Signal Maintainer Group-III, 20.11.2005

Ans : (d) The length of A_4 size sheet is equal to the width of an 'A_3' size sheet.

- If the length of 'A_1' size sheet is P, then its width will be $\sqrt{2}$ P.
- The area of $2A_0$ size sheet is $2m^2$, because area of 'A_0' size sheet is '$1m^2$'. So area of $2A_0 = 2\times1 = 2m^2$



Designation	Trimmed size
A0	841 × 1189
A1	594 × 841
A2	420 × 594
A3	297 × 420
A4	210 × 297
A5	148 × 210

- Area of A0 drawing sheet is $1m^2$

99. According to SP 46 : 2003, what types of marks are given on drawing sheet to protect the prints of all sizes of drawing sheets ?

(a) Orientation mark (b) Folding mark

(c) Margin Mark (d) Border Mark

RRB Allahabad Junior Engineer-II

Ans : (b) According to SP 46 : 2003, folding marks are given on drawing sheets to protect the prints of all sizes of the drawing sheets.

100. Trimmed size of a drawing sheet is given by which line ?

(a) Border (b) Border line

(c) Margin line (d) Frame

RRB Kolkata Jr. Engineer-II Electrical/ DRG & Design, 11.06.2006

Ans : (c) Trimmed size of a drawing sheet is given by margin line.

- A border line drawn around the inside edge of the paper.

101. Name the following scale on the principles of similar triangles-

(a) Extended Scale (b) Plain Scale

(c) Reduced Scale (d) Diagonal Scale

RRB Kolkata Chemical & Metallurgical Er., 01.12.2002

Ans : (d) The diagonal scale is based on the principles of similar triangles.

- In the diagonal scale, three ranges of distance are displayed simultaneously.

102. Drawing boards are come in many sizes. Choose the size of the designated drawing board D_0-

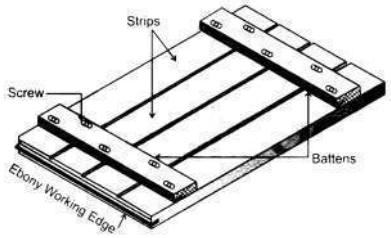
(a) 1000×700×25 mm. (b) 500×300×15 mm.

(c) 700×500×15 mm. (d) 1500×1000×25 mm.

RRB Kolkata Technical-III, 20.08.2006

Ans : (d) The size of the D_0 drawing board is equal to 1500×1000×25 mm.

- D_0 is the largest size of the board.



103. French curve is used for draw the-

(a) Curved radius (b) Irregular curves

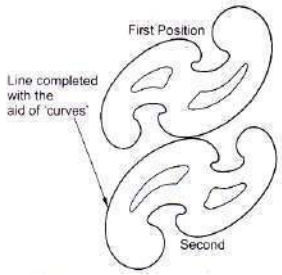
(c) Ellipse (d) Curved path

(COAL India Fitter 2013)

RRB Bangalore Section Eng. (Civil), 01.02.2009

Ans : (b) To draw smooth curves of any size

- French curves are mostly use to draw irregular curve.
- They are made of wood, plastic or celluloid.
- They are made in various shapes.
- It is used to draw curve which cannot be drawn with compass or for irregular curves.



104. According to I.S. specification six different types of trimmed drawing pages are available. What is the measurement of A4 sheet ?

(a) 330 mm. × 450 mm

(b) 297 mm. × 420 mm.

(c) 240 mm. × 330 mm.

(d) 210 mm.× 297 mm.

(NCVT -2013 Fitter, Turner, machinist)

Ans : (d) A4 trimmed sheet size is 210×297 mm.

Designation	Trimmed size (in mm)
A0	841 × 1189
A1	594 × 841
A2	420 × 594
A3	297 × 420
A4	210 × 297

105. Which drawing sheet has a surface area of one square meter ?

(a) A_0 (b) A_2

(c) A_3 (d) A_4

RRB Secunderabad Technical (Eng.), 20.05.2007

Ans : (a)

A_0 drawing sheet area = 841×1189 mm^2

$= 999949 \times 10^{-6}$ m^2

$= 0.999949$ m$^2 \approx 1$ m^2

- So, the surface area of the drawing sheet 'A_0' is 1m^2.

106. What type of scale is the scale 2 : 1 ?

(a) Full scale (b) Reducing scale

(c) Enlarge scale (d) None of these

DMRC Secunderabad Section Eng. (Civil), 29.06.2008

Ans : (c) 2:1 scale is an enlarging scale because its representative factor is >1.

$$\text{Representative factor} = \frac{\text{Length of the object in the drawing}}{\text{Actual length of object}}$$

For full scale - R.F. = 1:1

For reducing scale - R.F= 1:2, 1:5, 1:20, 1:50 etc.

For enlarging scale-R.F.= 2:1, 5:1, 20:1, 50:1, 10:1 etc.

107. 2H pencil is used.....

(a) To draw dark lines

(b) To draw thick lines

(c) To draw less visible lines

(d) None of these

RRB Patna Technical Eng., 27.07.2008

Ans : (c) 2H pencil is used to draw less visible lines. This pencil comes under medium grade pencil.

Lines	Used of Pencil
Initial work and construction lines	H,HB
Outlines, dotted lines, section plane lines, dimension lines arrow heads	2H
Centre lines, section lines	2H or 3H or 4 H

108. Sketch book is used for.....

(a) Tracing (b) Rough drawing

(c) Graph (d) All of these

RRB Chennai Section Eng., 12.02.2012

Ans : (a) Sketch book is used by artists for tracing, drawing or painting as a part of their creative process.

109. On which of the following paper the drawing made is called blue print ?

(a) Tracing paper (b) Sand paper

(c) Ammonia paper (d) None of these

SAIL Bokaro Steel Plant 2016

Ans : (c) A drawing made on ammonia paper is called a 'blue print' because by placing tracing paper over the already made drawing, that drawing is copied by ink pen.

110. What type of pencil lead is shown in figure.

(a) Conical lead (b) Chisel lead

(c) Drafting lead (d) Fine lead

Vizag Steel Fitter 2015

Ans : (a) The conical lead type pencil is shown in the figure.

- It is used in sketch work and for lettering.

111. Soft grade pencil is used for which of the following ?

(a) To draw thin lines

(b) To draw thick lines

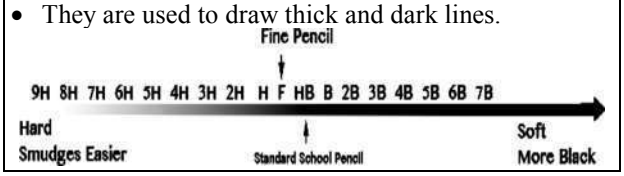
(c) To draw section lines

(d) To draw structural lines

(Vizag Steel Fitter-2015)

Ans : (b) Soft grade pencils are used for make thick lines.

- 2B, 3B, 4B, 5B, 6B, 7B pencils are soft grade pencil.
- They are used to draw thick and dark lines.



112. What are the main components in the tip of a pencil ?

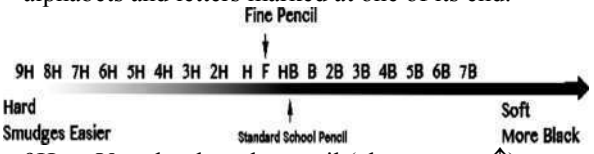
(a) Graphite and clay (b) Lead and graphite

(c) Clay and lead (d) None of these

Vizag Steel Fitter 2015

Ans : (a) Graphite and clay are used as the main components in the tip of the pencil.

- The lead of the pencil is made of graphite or kaolin or clay.
- The grade of a pencil lead is usually shown by alphabets and letters marked at one of its end.



- 9H $\rightarrow$ Very hard grade pencil (clay content $\uparrow$)
- 9B $\rightarrow$ Very soft grade pencil (Graphite content $\uparrow$)
- When clay content $\uparrow$ = Pencil lead becomes light and hardness $\uparrow$)
- When graphite content $\uparrow$ = Pencil lead becomes dark and softness $\uparrow$)

113. With the help of which of the following instruments parallel lines can be drawn?

(a) Mini drafter (b) T-square

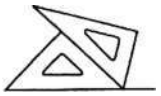
(c) Pair of set square (d) All of these

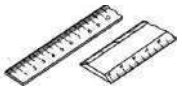
BHEL Hyderabad Fitter 2014

Ans : (d) Parallel lines can be drawn with the help of mini drafter, T-square and pair of set-square.

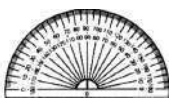
- Mini drafter is used to draw horizontal, vertical and inclined parallel lines on the sheet with saving time.
- Set-square is used for drawing all straight lines except the horizontal lines which are usually drawn with the T-square.
- T square is used to draw horizontal lines.

114. Which of the following figure shows a french curve?

(a) 

(b) 

(c) 

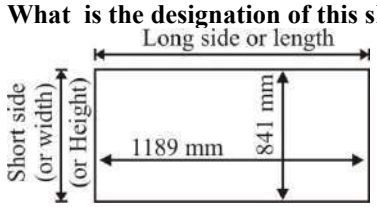
(d) 

MES Fitter Tradesman 2015

Ans : (c) French curves are used for drawing irregular curves.

- A continuous smooth curves required through a set of points that do not lie on a straight line or on a circle can be drawn with the help of French curves.

115. Figure shows one of a series drawing sheets. What is the designation of this sheet?



(a) A1 (b) A4
(c) A0 (d) A2

Ans. (c) : The given figure is the designation of A0 Sheet because its size is 841 mm × 1189 mm.

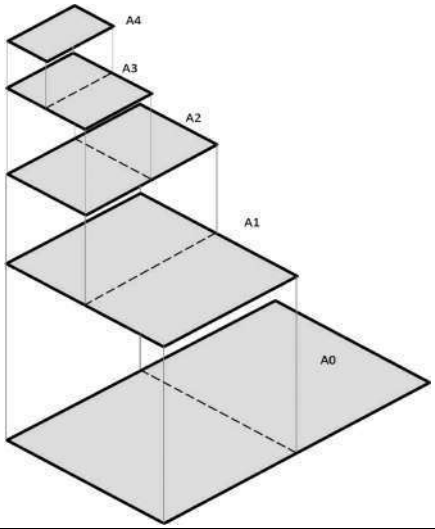
Designation	Trimmed size
A0	841 × 1189
A1	594 × 841
A2	420 × 594
A3	297 × 420
A4	210 × 297
A5	148 × 210
Area of A0 drawing sheet is $1m^2$	

116. The SP 46 : 2003 does not specify the_____ sheet(s)

(a) A_4 (b) A_5
(c) A_0 (d) b and c both

Ans. (d) : The SP 46 - 2003 does not specify the A5 and A0 sheets.

- Drawing sheet is a white paper on which an object is drawn which is available in various sizes.



117. The smallest size drawing sheet as per ISO-A series has a designation of_____.

(a) A_0 (b) A_3
(c) A_2 (d) A_4

Ans. (d) : The smallest size drawing sheet as per ISO-A series has a designation of A_4.

- The preferred sizes of the trimmed sheets as selected from the main ISO-A series are given in table–

Designation	Trimmed size (in mm)
A_0	841 × 1189
A_1	594 × 841
A_2	420 × 594
A_3	297 × 420
A_4	210 × 297

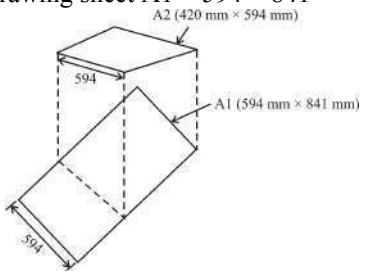
118. If width (shorter side) of A1 drawing paper is 594 mm, what is the longer side if A2 paper?

(a) 297 mm (b) 594 mm
(c) 841 mm (d) 210 mm

Ans. (b) : According to question, width (shorter side) of A1 drawing paper is 594 mm.

and we know,

Size of drawing sheet A1 = 594 × 841



So, from the above graphic representation longer side of A2 paper is 594 mm.

119. The number of A2 size sheet that can be trimmed from one A0 size sheet is:

(a) 2 (b) 4
(c) 6 (d) 8

Ans. (b) : A0, A1, A2 ..... sheet nomenclature are practical examples of ratio.

- From the above figure–

We can get 2 A1 sheets from one A0 sheet, likewise,

We can get 2 A2 sheet from one A1 sheet.

Therefore, from A0 sheet we can get 4 A2 sheets.

120. Why always a ratio of $1:\sqrt{2}$ is kept between the sides of A series sheets?

(a) For ease of printing
(b) For weight reduction
(c) For microfilming
(d) For ease of handling

Ans. (c) : For microfilming always a ratio of $1:\sqrt{2}$ is kept between the sides of a series sheets.

- The area of the successive sizes are in the ratio of 1:2.

121. The ISO size of A4 sheet is 210 × 297 mm. The size of A4×3 sheet will be = ?

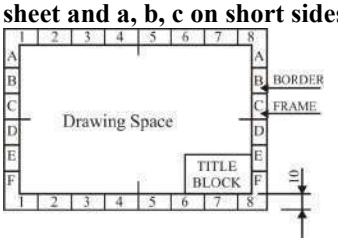
(a) 297 × 630 mm (b) 630 × 891 mm
(c) 210 × 891 mm (d) Not defined

Ans. (a) : Special elongated series increasing its widths, double, triple etc. are designated as follows A3 × 3, A3 × 4 .....
The ISO size of A4 sheet is 210 × 297 mm.
The size of A4 × 3 sheet will be–
297 × (3 × 210) = 297 × 630 mm.
The ISO size of A4 sheet is 210 × 297 mm, the size of A4 × 3 sheet 297 × (3 × 210) = 297 × 630 mm

Special elongated series–

Designation	Size
A3 × 3	420 × 891
A3 × 4	420 × 1189
A4 × 3	297 × 630
A4 × 4	297 × 841
A4 × 5	297 × 1051

122. Figure given below shows a simple drawing sheet and a, b, c on short sides are for_____



(a) Folding (b) Grid reference
(c) Orientation (d) Direction

Ans. (b) : Give drawing sheet A, B, C on short sides shows a grid reference system.

Grid reference system (zones system)–

- The grid reference system is drawn on the sheet to permit easy location on the drawing such as detains, alterations or additions.
- The rectangle of grid along the length should be referred by numerals 1, 2, 3 etc. & along the width by the capital letters A, B, C, D etc.

123. A title block contains all of the following information except_____.

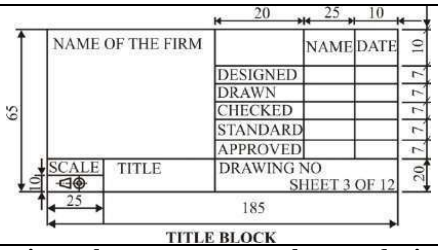
(a) Name and address of the company
(b) Parts list
(c) Drawing sheet size letter designation
(d) Drawing number

Ans. (b) : A title block contain all of the following information–

- Name and address of the company.
- Drawing sheet size
- Drawing number
- Scale

Title block–

- The position of this block should be within the drawing space such that the portion of the title block containing the identification or information of the drawing is situated in the bottom right hand corner of the drawing space.
- It contains the details of drawing, here we include the name of the persons who have designed and drawn.



124. A0 size sheets are mostly used in_____ engineering

(a) Chemical (b) Civil
(c) Mechanical (d) All of (a), (b) and (c)

Ans. (d) : The standard for drawing sheet size is the A series.

- The basic size in this series is the A0 size (841 mm × 1189 mm).
- Surface area of are mostly used in engineering (Civil, mechanical, chemical).

125. Zoning areas on the drawing sheet are

(a) Squares (b) Rectangles
(c) Rhombus (d) Either of these

Ans. (b) : Zoning areas on the drawing sheet are rectangles.

- The zone along the length *l* are designated by numerals, while along the width w are designated by letters.

126. The thickness of the drawing board generally varies from _____ mm.

(a) 15 to 25 (b) 25 to 40
(c) 40 to 50 (d) 5 to 10

Ans. (a) : The thickness of the drawing board generally various from 15-25 mm.

Size of drawing board–

Designation	Length × width × thickness
B0	1500 × 1000 × 25
B1	1000 × 700 × 25
B2	700 × 500 × 15
B3	500 × 350 × 15

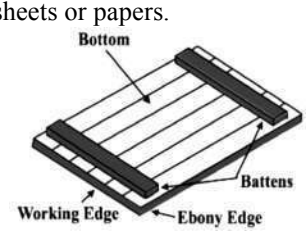
127. Battens are provided on the drawing board for _____of the board.

(a) Strengthening (b) Preventing bending
(c) Ease of handling (d) All of (a), (b) and (c)

Ans. (d) : Batten are provided on the drawing board for–

(a) Strengthening
(b) Prevent bending
(c) Ease of handling.

- Drawing boards are used to provides support to the drawing sheets or papers.



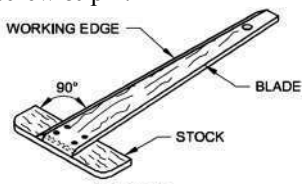
Drawing Board (Bottom)

128. The angle between the stock and working edge of T-square should be_____90°.

(a) Exactly (b) Approximately
(c) More than (d) None of these

Ans. (a) : The angle between the stock and working edge of T-square should be exactly 90^o.

- Joined together at right angles to each other by means of screw & pin.



T-SQUARE

129. The scale shown in Fig is .

(a) Triangular scale
(b) Isometric scale
(c) Linear reducing scale
(d) (a) and (c)

Ans. (a) : The scale shown in fig. is triangular scale.

- Scale may be flat or of triangular cross-section.
- Made of wood, steel, celluloid or plastic.
- Edges of the scale are marked with division of centimeters which are sub-divided into millimeters.
- Rustless steel scales are more durable.
- 15 cm long and 2 cm wide or 30 cm long and 3 cm wide flat scales are in common use.
- Both the longer edges of the scales are marked with divisions of centimeters, which are sub-divided into millimeters.
- Scales are used to transfer the true or relative dimensions of an object to the drawing.

130. Any angle can approximately be divided into any number of equal parts with the help of_____.

(a) Divider (b) Compass
(c) Protractor (d) Diagonal scale

Ans. (c) : Any angle can approximately be divided into any number of equal parts with the help of protractor.

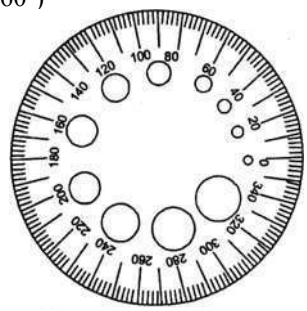
- They are graduated in degree measurable with a least count of upto 0.50.

131. Protractor can be used to draw any angle upto_____.

(a) 90° (b) 180°
(c) 270° (d) 360°

Ans. (d) : Protractor can be used to draw any angle upto 360^o.

- A circle can be divided into any number of equal parts by means of the protractor.
- The diameter of semi-circular protractor is generally 100 mm and its circumferential edge is graduated to 1^0 division. (Angle $\Rightarrow 0^0$ to 180^0).
- Circular protractor is called as circle master. (Angle $\Rightarrow 0^0$ to 360^0)

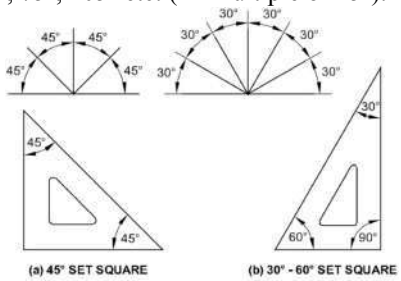


132. For engineering drawing the number of set square used is_____.

(a) 1 (b) 2
(c) 3 (d) 4

Ans. (b) : For engineering drawing the number of set square used is 2.

- Two forms of set-squares are in general use.
- They are used to draw parallel inclined and perpendicular lines, often in conjunction with T square.
- The two set squares are used simultaneously along with the T-square will produce lines making angles of 15^0, 75^0, 105^0 etc. (✍ Multiple of 15^0).



133. The set square are usually made of_____.

(a) Plastic
(b) Transparent celluloid
(c) Both (a) and (b)
(d) Polished wood

Ans. (c) : A set square are usually made of wood, transparent celluloid, tin or plastic.

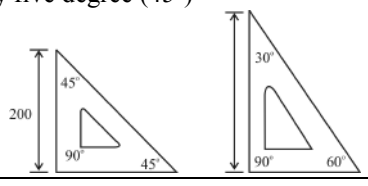
- Those made of transparent celluloid (or) plastic are commonly used as they retain their shape and accuracy for a longer time.

134. Two set squares are known as 45°/45° and 60°/30°

(a) True (b) False
(c) Sometimes (d) None of these

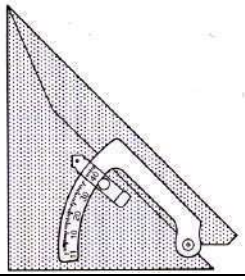
Ans. (a) : They are two types of set square–

1. Thirty-sixty ($30\text{-}60^o$)
2. Forty five degree (45^o)



135. Figure shows a type of set square. This is known as _____ set square.

(a) Rotable (b) Fixed
(c) Adjustable (d) All of these



Ans. (c) : Figure shows a adjustable set square.

- Adjustable set squares allow a range of angles to be drawn accurately.
- They can be adjusted to a variety of angles which means only one set-square is required.

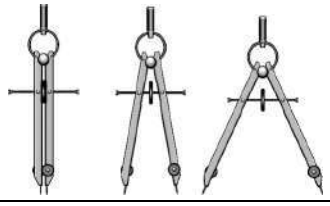
136. Which of the following purpose is not served by a divider?

(a) Divide lines or curves into a number of equal parts
(b) Transfer measurements from one part of the drawing to another part
(c) Make full size, reduced size of enlarged size drawing
(d) Set off a series of equal distances on the drawing

Ans. (c) : The following purpose is not served by a divider make full size, reduced size of enlarged size drawing.

Purpose of dividers are–

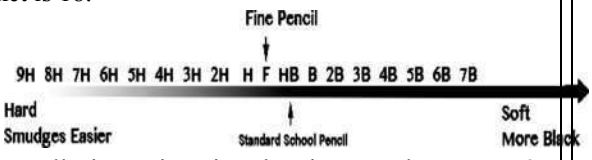
1. To divide curved or straight lines into desired number of equal parts.
2. To transfer dimensions from one part of the drawing to another part.
3. To set-off given distances from the scale to the drawing.



137. Total number of grades of pencils available in the market is_____.

(a) 9 (b) 6
(c) 15 (d) 18

Ans. (d) : Total number of pencils available in the market is 18.



- Generally in engineering drawing mostly HB, H, 2H and 4H pencils are used.

138. Apart from H and B grades, two other grades of pencils are_____.

(a) 1H, 1B (b) 2H, 2B
(c) HB, F (d) FB, HB

Ans. (c) : Apart from H and B grades two other grades of pencils are HB & F.

HB — Medium soft

F — Grade H ⇒ Harden than F, HB etc.

Grade B ⇒ Soft than HB.

Grade	Uses
Hard Grade (9H, 8H, 7H, 6H, 5H, 4H)	Uses to draw light and fine lines
Medium Grade 3H, 2H, H, HB, B	Used for lettering and dimensioning

139. Centre lines, section lines are drawn using _____ pencil.

(a) H (b) 2H
(c) 3H or 4H (d) HB

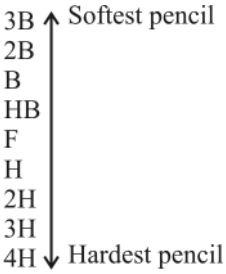
Ans. (c) : Centre lines, section lines are drawn using 3H or 4H pencil

Lines	Pencil
Initial work and construction lines	H
Outlines, dotted lines, section plane lines, dimension line arrowheads	2H
Centre line, section lines	2H or 3H or 4H

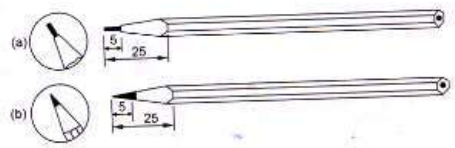
140. Which set of lead grades has a grade out of sequence?

(a) H, HB, B, 3B (b) 7B, H, F, 3H
(c) 6B, B, H, 4H (d) 9H, HB, B, 2B

Ans. (b) : 7B, H, F, 3H set of lead grades has a grade out of sequence.



141. The pencil shown in Fig. (a) is sharpened as_____.

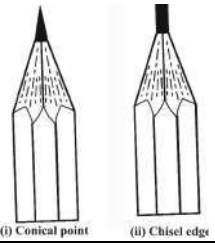


(a) Conical pound (b) elliptical edge
(c) Chisel edge (d) Round

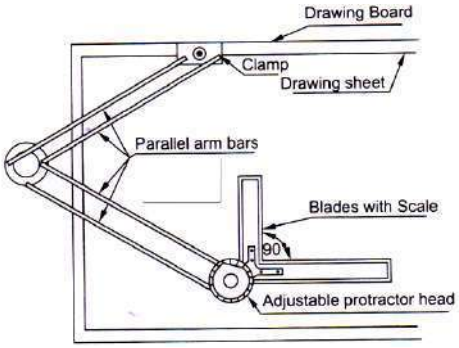
Ans. (c) : The pencil shown in fig. is sharpened as chisel edge.

Chisel edge– Used for drawing long thin lines of uniform thickness.

- This edge is prepared by rubbing the lead on a sand paper block.



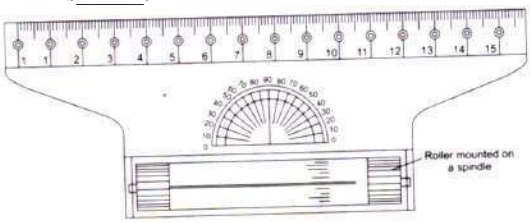
142. The mini drafter shown in Fig. eliminates the need of.



(a) Scale and set squares (b) T-square
(c) protractor (d) All of these

Ans. (d) : The mini-drafter shown in the figure eliminates the need of following–
(a) Scale & set-squares
(b) T-square
(c) Protractor.

143. The drawing instrument shown in Fig below is_____.



(a) Mini drafter (b) Drafting machine
(c) Roll-n-draw (d) None of these

Ans. (c) : The drawing instrument shown in figure is a roll-n-draw.

- It consists of graduated roller, scale of 16 diameter and protractor.
- It is ideal for drawing vertical lines, horizontal lines, angles and circle.

144. To fix the drawing sheet on the drawing board, present practice is to use_____.

(a) Cello tape (b) Clips
(c) Gum (d) Both (a) and (b)

Ans. (d) : To fix the drawing sheet on the drawing board, present practice is to use cello tape and clips.

- They are used to fix the drawing sheet firmly in position to the drawing board.
- Care should be taken while removing the clips or tapes otherwise the sheet may tore.

145. BIS specifies D-series of drawing boards and T-series of T-squares. The drawing board and T-squares are specified in _____ sizes respectively.

(a) 5, 5 (b) 4, 4
(c) 5, 4 (d) 4, 5

Ans. (c) : The sizes of drawing board recommended by the bureau of Indian standard (IS : 1444 - 1989) are–

Sl. No.	Designation	Size (mm)
1.	D0	1500 × 1000 × 25
2.	D1	1000 × 700 × 25
3.	D2	700 × 500 × 15
4.	D3	500 × 350 × 15

The standard 'T' square are designated as follows with–

Sl. No.	Designation	Blade length
1.	T0	1500
2.	T1	1000
3.	T2	700
4.	T3	500

146. If the unit has one or more moving parts, the extreme positions of the moving parts are indicated in :

(a) Continuous thin line
(b) Continuous thick line
(c) Long dashed double dotted narrow line
(d) Continuous wavy line

RRB ALP & Tech. 21.01.2019 Shift-I

Ans. (c) : If the unit has one or more moving parts, the extreme positions of the moving parts are indicated in long dashed double dotted narrow line.

147. ..... are those dimensions that should not necessarily appear on the drawing.

(a) Object dimensions
(b) Auxiliary dimensions
(c) Non-functional dimensions
(d) Functional dimensions

RRB ALP & Tech. 21.01.2019 Shift-I

Ans. (b) : Auxiliary dimensions are those dimensions that should not necessarily appear on the drawing. They are only used for given the objective of information.

• These dimensions which are used for production purpose but which do not directly affect the function of product are called non-functional dimension.

148. Which of the following describes the theoretical fixed plane, axis or point space that G.D. and T are also refers to dimensional support?

(a) Section (b) Datum
(c) Frame (d) Flange

RRB ALP & Tech. 23.01.2019 Shift-III

Ans : (b) Datum lines describes the theoretical fixed plane, axis or point space that G.D. and T or also refers to dimensional support.

It give a reference from which measurements are calculated.

149. In an engineering drawing, which letters written on the dimension indicates that it is an extra information and NOT really required?

(a) NR (b) PER
(c) REF (d) EXT

RRB ALP & Tech 23.01.2019 Shift-II

Ans : (c) In an engineering drawing, REF letters written on the dimension indicates that it is an extra information and NOT really required.

150. An arrowhead at the end of a dimension line is approximately——— long and 1 mm wide.

(a) 1.5mm (b) 5mm
(c) 3mm (d) 1mm

RRB ALP & Tech. 23.01.2019 Shift-I

Ans : (c) An arrowhead at the end of a dimension line is approximately 3 mm long and 1 mm wide.

• Dimension line is used for showing the dimension of an object.

• A dimension line are thin, continuous and straight.

151. Which of the following statements are technically incorrect

(a) When two or more lines of different types are identical the visual outline is a complete circle of the other type of line
(b) A dashed thin line is drawn to display invisible details rather than the center line
(c) Enlarged scale is used for details
(d) Standard abbreviations, symbols or units are specifies in lowercase.

RRB Bhopal Section Engineer, 24.11.2002

Ans. (c) Enlarged scale is not using for details. It is used in drawing to draw the bigger dimension in comparison to the actual dimension of the object.

• Whereas a dashed thin line is drawn to display invisible details rather than the center line.

152. According to SP 46 : 2003, the minimum distance kept between two lines

(a) 0.7 mm (b) 0.5 mm
(c) 0.9 mm (d) 0.1 mm

RRB Kolkata Jr. Engineer-II Electrical/DRG & Design 11.06.2006

Ans : (a) SP 46 : 2003 publications made by bureau of Indian Standard includes standard technique for line conventions in detail.

• According to SP 46 : 2003, the minimum distance kept between two lines is 0.7 mm.

153. This line is used for to give details of an object-

(a) Leader line
(b) Dimension line
(c) Extension line
(d) Any one of the above

RRB Thiruvananthapuram Section Eng. (Mechanical) 04.01.2009

Ans : (a) Leader lines are continuous thin lines which drawn to connect a note with the specific feature in the drawing.

• The leader line generally drawn at angles not less than 30º (usually 30º, 45º, 60º).

154. According to SP 46 : 2003, the layout line to be drawn in the drawing is-

(a) Continuous thick line (b) Dotted thin line
(c) Continuous thin line (d) Dotted thick line

RRB Bangalore Section Engineer (Civil) 01.02.2009

Ans : (c) Continuous thin line is used for dimension line.

• It is terminated at its outer end with an arrow head touching the outline extension line or center line.

———————
Thin

155. The hatching lines are inclined at which angle?

(a) 30^0 (b) 45^0
(c) 60^0 (d) 75^0

RRB Chandigarh Section Engineer (Electrical), 15.03.2009

Ans : (b) Hatching line–To display the cut part of the object 0.3 or 0.4 mm in that part draw thin continuous lines inclined at 45º.

• Parallel is made by keeping same distance between these lines.
• These lines are drawn with H or 2H pencil.

156. Which type of line is used for reduced space in a long section drawing?

(a) Dimension line (b) Dotted line
(c) Short break line (d) Long break line

RRB Chennai Section Engineer, 12.02.2012

Ans : (d) Long break line are used for reduced space in a long section drawing.

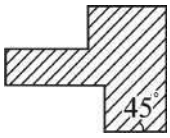
• These lines are thin ruled lines provided with short zig-zags at suitable intervals.
• It is drawn to show long breaks.

157. What should be the minimum distance between hatching lines ?

(a) 0.6 mm (b) 0.7 mm
(c) 0.8 mm (d) 0.9 mm

Ans : (b) The minimum distance between the hatching lines is near about 0.7 mm.

• They are uniformly spaced thin lines (1 to 2 mm spaced) and inclined at 45° to the main outline of the section.
• Thin continuous lines, used for showing the section evidently.

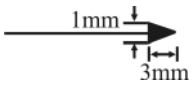


158. How is the centre line shown-
RRB Chennai Section Engineer, 12.02.2012
(a) Continuous line
(b) Long double dotted narrow line
(c) Long dotted narrow line
(d) Dotted narrow line

Ans : (c) The centre line is shown as a long dotted narrow line. It shown the axis of all solids and the path of any point. —-—-—-—

159. What is the ratio of length and height of arrow mark ?
(a) 1 : 3 (b) 3 : 1
(c) 1 : 2 (d) 2 : 1
RRB Bhopal Section Engineer, 24.11.2002

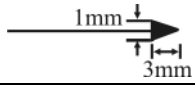
Ans : (b) Arrow head should be made carefully at the ends of the dimension line.
- The ratio of the length and height of the arrow is kept a 3 : 1.



- This type of arrow head is also called closed and tilled arrow head.

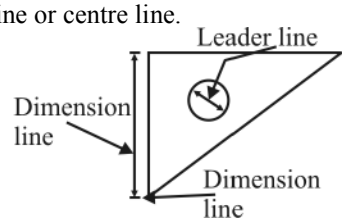
160. The length of the top of the arrow head is-
(a) Same as thickness
(b) Twice of the thickness
(c) Thrice of the thickness
(d) Four times of the thickness
RRB Bhopal & Mumbai Apprentice Section Eng. 23.03.2003

Ans : (c) The length of the top of the arrow head is kept thrice of the thickness.
- The ratio of their thickness and length should be 1:3.
- The top should always be filled with pencil.
- It is also known as closed & filled arrow head.



161. Which lines are thin lines ?
RRB Kolkata Jr. Engineer-II Electrical/ DRG & Design 11.06.2006
(a) Leader line (b) Extension line
(c) Dimension line (d) All of the above

Ans : (d) Leader line, Extension line & dimension lines all of these are type of lines are thin lines.
- **Leader Line:** It is a continuous thin line which is used for showing details and information about the drawing.
- **Extension Line:** It is also a continuous thin line which is extends by about 2 to 3 mm beyond the dimension.
- **Dimension line:** It is continuous thin line, drawn parallel to edge or surface, whose measurement should be shown.
- It is terminated by arrow head, touching the outlines, extension line or centre line.



162. Find the correct match for the lines prescribed by the Indian standard institute (ISI)-

A.	Continuous &thick lines	(i)	As long barrier line
B.	Broken thick lines	(ii)	To outline of the object
C.	Chained thin lines	(iii)	To invisible outer line
D.	Continuous & thin lines	(iv)	As centre lines

Code:
(a) A-(i) : B-(iii) : C-(ii) D-(iv)
(b) A-(ii) : B-(iii) : C-(iv) D-(i)
(c) A-(ii) : B-(iv) : C-(iii) D-(i)
(d) A-(i) : B-(ii) : C-(iv) D-(iii)
RRB Secunderabad Section Engineer (Civil) 29.06.2008

Ans : (b) A-(ii) : B-(iii) : C-(iv) D-(i)

Lines	Representation
Continuous thick line	To outline of the object
Broken thick lines	To invisible outer line
Chained thin lines	As centre line
Continuous & thin lines	As long barrier line

163. ISI has divided different types of lines into groups based on their measurements. The following is the measurement of 'B' type line?
(a) 0.1 mm (b) 0.3 mm
(c) 0.2 mm (d) 1 mm
RRB Thiruvananthapuram Section Eng (Mechanical) 04.01.2009

Ans : (c) ISI has divided different types of lines into groups based on their measurements. The measurement of 'B' type line of line group is 0.2 mm.

164. Match correctly according the thickness of the lines -

A.	Dimension line	(i)	0.9 mm
B.	Centre line	(ii)	0.5 mm
C.	Cutting line	(iii)	0.3 mm
D.	Object line	(iv)	0.9 mm

Code:
(a) A-(iii) : B-(iii) : C-(ii) D-(i)
(b) A-(iii) : B-(i) : C-(ii) D-(i)
(c) A-(i) : B-(ii) : C-(ii) D-(iii)
(d) A-(ii) : B-(iii) : C-(iii) D-(i)
RRB Chandigarh Section Engineer (Electrical), 15.03.2009

Ans : (a) A-(iii) : B-(iii) : C-(ii) D-(i)

Dimension line	———————
Centre line	—— - —— - —— - ——

Cutting line	
Object line	
Hidden line	

165. Which of the following statement is correct with respect to the thickness of the line.

(a) Thick line is 3 times as compared to thin line.
(b) The middle line is 3 times as compared to thin line.
(c) Thick line is 4 times as compared to thin line
(d) None of the above

RRB Chennai Section Engineer, 12.02.2012

Ans : (a) In terms of thickness of lines, thick line is 3 times as compared to thin line, this statement is correct.

- Types of line according to the thickness -
  Thick line $\Rightarrow t \approx 1$ mm
  Medium line $\Rightarrow t \approx 0.5$ mm
  Thin line $\Rightarrow t \approx 0.3$ mm

166. Continuous thin straight line with zigzag is used for

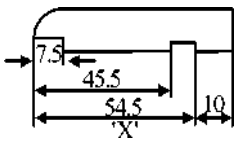
(a) Projection line (b) Leader line
(c) Long break line (d) Cutting plane

ISRO - (VSSC) Draughtsman (Mech.), 25-09-2016

Ans : (c) Continuous thin straight line with zigzag is used for long break line.

Sr N.	Object	Convention
1	Object line	Thick
2	Hidden line	Medium
3	Centre line	Thin
4	Construction & section line	Thin
5	Short break line	Thin
6	Long break line	Thin
7	Cutting plane line	Thick Thin Thic
8	Dimension line	Thin

167. Name of the line represented by 'X' in the figure.



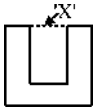
(a) Extension line
(b) Dimension line
(c) Dimension line termination
(d) Leader line

DMRC Junior Engineer (Electronics), 03.08.2014

Ans : (b) The line represented by 'X' is 'dimension line'.

- Continuous thin lines, used for giving dimensions of drawing.
- It is terminated at its outer end with an arrow head touching the outline, extension line or centre line.

168. Identify the line 'X' in the figure given below-



(a) Centre line (b) Invisible line
(c) Construction line (d) Object line

RRB Bhopal Section Engineer, 24.11.2002

Ans : (b) The line 'X' in the given figure represents the invisible line.

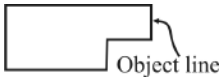
- Hidden or dotted lines represent medium thickness (0.5 mm) and equally spaced line segments of short 0.3 mm and long 1 mm.
- These lines are used to represent the invisible edges of the object.

169. Continuous thick lines are also called by name-

(a) Dimension line (b) Object line
(c) Extension line (d) Projection line

Ans : (b) Continuous thick lines are also called object line or principal line.

- These lines are drawn to represent visible edges and surfaces boundaries of objects.
- The thickness of these lines are near about 0.2 mm.



- Normally HB pencils are used to draw these lines.

Continuous thick line (Object line)

170. What is the ratio of thick and thin lines in drawing.

(a) 3:2 (b) 4:3
(c) 5:4 (d) 6:2

Ans : (d) The thickness of the thick line is three times than thin line and the medium line is twice as thick as the thin one.

- Hence the ratio of thick & thin lines is 6:2.

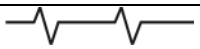
Continuous thick line
Thin line

171. Which of the following is used for drawing extension lines ?

(a)
(b)
(c)
(d)

Ans : (d) Extension line is drawn by continuous thin line.

Continuous thin line		To represent extension line
Chained thin line		To show the centre line

Chained thick line		To denote the Indication of line that provide a special requirement
Continuous thick line		To show object line
Short break line		To shorten on object.
Long break line		To represent long parts in less space

172. What is the ratio between thick and medium thick lines in drawing ?

(a) 5:2 (b) 4:5
(c) 6:3 (d) 4:3

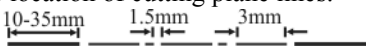
Ans : (c) The thick line in the drawing is about twice the length of the medium line.

- Hence the ratio of thick and medium line is 6:3.
- Thick line is show object outline.
- Medium thick line is used as construction line.

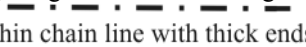
173. The thin chain line with thick ends are used to represent what?

(a) Cutting Plane line
(b) Centroidal lines
(c) Lines of Symmetry
(d) Outlines of adjacent parts

Ans : (a) Thin chain line with thick ends are used to show the location of cutting plane lines.

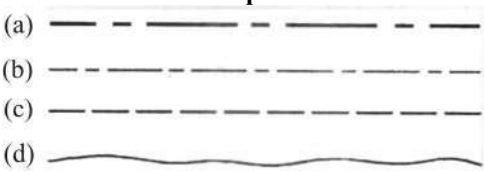
- 

- This is a heavy long- short - short - long kind of line.

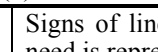
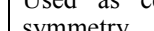
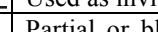
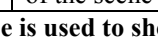


(Thin chain line with thick ends)

174. Which line is used to represent the centre line?



Ans : (b) The line used to represent the centre line is shown in option (b).

	Signs of line from which a special need is represent
	Used as centre line or line of symmetry
	Used as invisible line
	Partial or blocked as the boundary of the scene and the passage

175. Which line is used to show hidden edges-

(a) Centre line (b) Object line
(c) Dashed line (d) Cutting Plane line

Ans : (c) Dashed line is used to show hidden edges.

- They are medium thick and are used to show the invisible or hidden parts of the object on the drawing.
- They are closely and evenly spaced dashed lines of equal lengths.

Hidden or dashed line

176. A construction line of infinite length can be

(a) trimmed from one end only
(b) trimmed from both ends
(c) cannot be trimmed at all
(d) can be trimmed with construction line only

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Ans. (b) A construction line of infinite length can be trimmed from both ends.

- A construction line is a special type of infinite line that is typically used when quick drafting techniques are required, for example, to make projections of front and side views.

177. The surface roughness on a drawing is represented by

(a) Circles (b) Squares
(c) Zig-zag lines (d) Triangles

BPSC AE (GEN ENGG.)-03.12.2012

Ans. (d) : The surface roughness on a drawing is represented by triangles. These are classified into four groups

Group	Ra (μ m)
∇	8-25
∇∇	1.6-8
∇∇∇	0.025-1.6
∇∇∇∇	< 0.025

The ISO has recommended a series of preferred roughness values and corresponding roughness grade numbers. These grade numbers are used to specify surface roughness on drawings.

178. Which of the following describes the theory of orthographic projection?

(a) Projectors parallel to each other and oblique to the plane of projection
(b) Projectors parallel to each other and perpendicular to the plane of projection
(c) Projectors parallel to each other and parallel to the plane of projection
(d) Projectors perpendicular to each other and parallel to the plane of projection

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Ans : (b) In orthographic projection, the projectors are parallel to each other and also perpendicular to the plane but in oblique projection, the projectors are inclined to the plane of projection and projectors are parallel to each other.

- In orthographic projection each projection view represents two dimensions of an object..

1.8 Orthographic projections

179. When the receding lines are drawn to full size scale and the projectors inclined at an angle of 30^o or 45^o or 60^o to the plane of projection, such oblique projection is known as

(a) Cabinet projection (b) Vertical projection
(c) Cavalier projection (d) Horizontal projection

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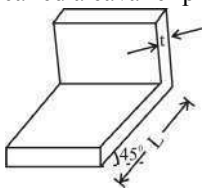
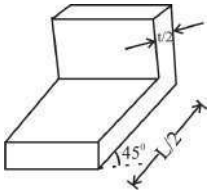
Ans. (c) : The word "oblique" means 'Slanting'. There are three axes-vertical, horizontal and oblique. The oblique axis, called receding axis is drawn either to 30^0 or 45^0 or 60^0.

Types of oblique drawing-

1. **Cavalier projection-** When an oblique drawing is prepared to the exact dimensions of an object, it is called a cavalier projection.



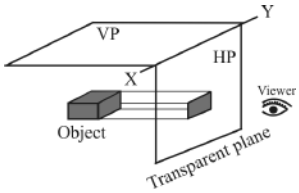
2. **Cabinet projection:-** To reduce distortion the dimensions of receding lines of an object can be drawn half-scale.



180. With reference to given Fig., in 3rd angle projection:

(a) The object is between observer and plane of projection
(b) Observer is between object and plane of projection
(c) Plane of projection is between observer and object
(d) Order of (a), (b) and (c) can be changed

Ans. (c) : With reference to the given fig. in 3rd angle of projection, plane of projection is between observer and object.

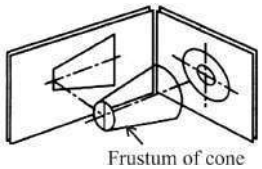


- In this case, plane of projection is assumed to be transparent.

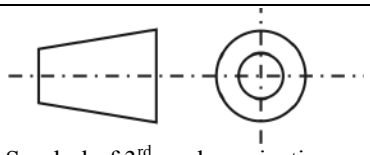
181. The recommended symbol for indicating the angle of projection shows two view of the frustum of a_____.

(a) Square pyramid (b) Triangular pyramid
(c) Cone (d) Any of these

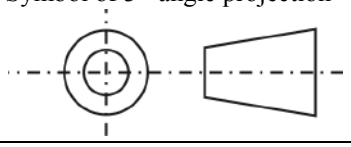
Ans. (c) : The recommended symbol for indicating the angle of projection shows two view of the frustum of a cone.



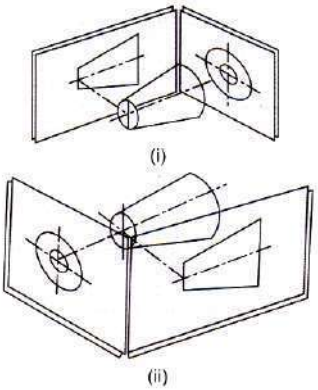
- Symbol of 1st angle projection–



- Symbol of 3rd angle projection–

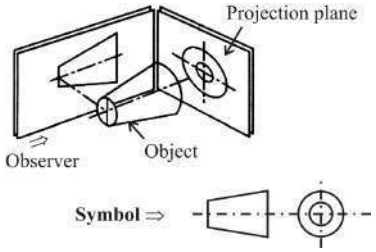


182. Figure–(i) and (ii) below show the method of obtaining 1st and 3rd angle projection symbol. Which one shows the principle of 1st angle projection symbol?



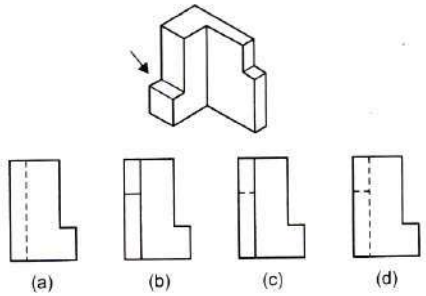
(a) (ii) (b) (i)
(c) either (i) or (ii) (d) Both (i) and (ii)

Ans. (b) : From the figure, given in question, figure (i) shows the 1st angle of projection system because in this figure, object is lie between plane of projection and observer.

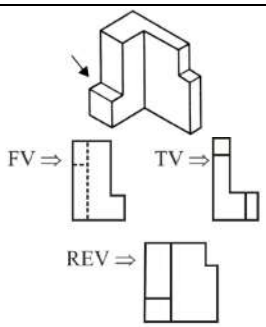


- Figure (ii) shows the symbol of 3rd angle projection because the plane is lie between the object and observer.

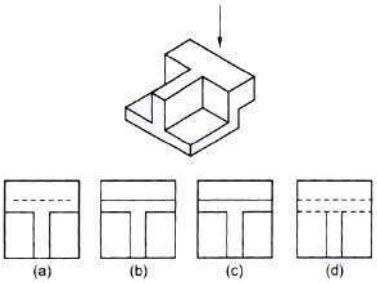
183. Choose the correct orthographic view as per the direction shown in isometric



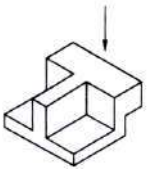
Ans. (d) : For an isometric view, given in question, according to shown direction.



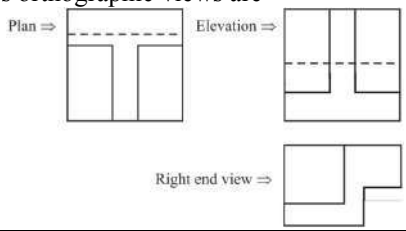
184. Find out the plan/top view of the object as per the direction of arrow in isometric view?



Ans. (a) : The plan/top view of the given object as per the direction of arrow in isometric view in given figure.



■ It's orthographic views are–



185. An object is shown by more than one views in a drawing. It is called_____.

(a) Isometric projection
(b) Oblique projection
(c) Perspective projection
(d) Orthographic projection

Ans. (d) : An object is shown by more than one views in a drawing. It is called orthographic projection.

- In this projection, projectors (or sight rays) are parallel to each other and perpendicular to the plane.

186. Orthographic projection is a_____projection.

(a) One view (b) Two view
(c) Multi view (d) Four dimensional

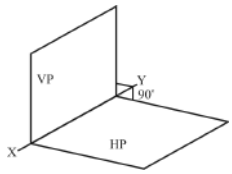
Ans. (d) : Projection in which when the projectors are parallel to each other and perpendicular to the plane, is called orthographic projection.

- This projection is a multi views projection because in this projection for the complete description of the 3D object at least two or more than two projections are drawn.
- Front view projection is drawn on vertical principal plane, top view projection on horizontal plane and other any side view projection on an auxiliary plane.

187. The two principal planes (HP and VP) are ..... degrees to each other.

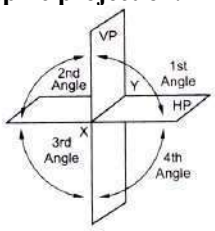
(a) 30° (b) 60°
(c) 90° (d) 180°

Ans. (c) : Two principal planes (HP and VP) intersect to each other at 90^{o}.



- The line X-Y of intersection of both principal planes is known as reference line.
- When drawn the projection of object on drawing paper, reference line works as basic line between plan and elevation.

188. Figure given below shows_____principal planes for orthographic projection.

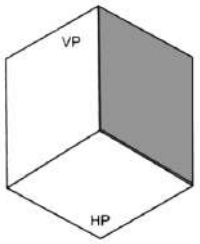


(a) 4 (b) 3
(c) 1 (d) 2

Ans. (d) : Figure given in question shows 2 principal planes for orthographic projection.

- These principal planes are – (1) Horizontal plane (HP) (2) Vertical plane (VP).

189. In the figure the shaded vertical plane is known as_____.



(a) HP (b) VP
(c) AVP (d) All of these

Ans. (c) : In the figure given in question the shaded vertical plane is known as AVP.

- This plane is used for showing or drawing the side view of an object.

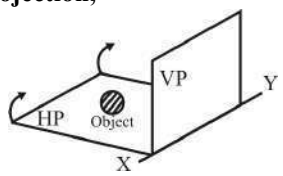
190. We can draw the orthographic projection in_____angles.

(a) 1^{st} and 2^{nd} (b) 1^{st} and 3^{rd}
(c) 1^{st} and 4^{th} (d) 2^{nd} and 4^{th}

Ans. (b) : We can draw the orthographic projection in 1^{st} and 3^{rd} angles.

- We can not draw the orthographic projection in 2nd and 4th angles because, in this system–

2nd angle projection,

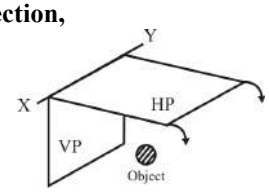


- When we draw orthographic projection, HP and VP both come above X-Y line.

X —— VP, HP ——— Y

- Hence front and top view projections both are overlapped to each other.

4th angle projection,



- When we draw orthographic projection, HP and VP both come below X-Y line.

X ——— HP, VP ——— Y

- Hence front and top view projections both are overlap to each other.
- Due to this difficulty we can not use these systems in orthographic projection.

191. On auxiliary vertical Plane (AVP). _____view is projected.

(a) Front (b) Top
(c) Side or end (d) Any one of these

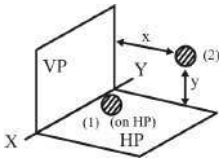
Ans. (c) : Side or end view is projected on auxiliary vertical plane (AVP).

- Some times some features of an object lie on its left or right side. Top and front views will not be sufficient to show these features in their true shape. In such cases, the objected is projected either on a left or right side plane.
- This side plane is known as auxiliary plane.

192. In 1st quadrant (i.e. for 1st angle projections) the object is placed_____.

(a) On HP (b) Above HP
(c) Below HP (d) (a) or (b)

Ans. (d) : In 1st quadrant (i.e. for 1st angle projections) the object is placed above H.P. and some times on HP.

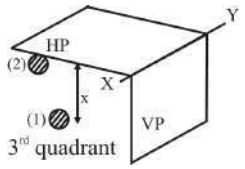


- From, the figure, object (1) is placed on HP, and (2) is above HP and in front of VP.

193. In 3rd quadrant (i.e. for 3rd angle projections) the position of the object with reference to HP is_____.

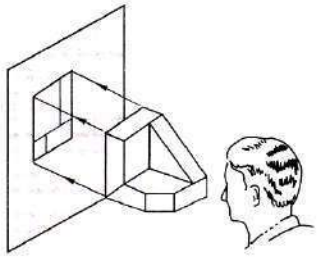
(a) On HP (b) Below HP
(c) above HP (d) (a) and (b)

Ans. (d) : In 3rd quadrant (i.e. for 3rd angle projections) the position of the object with reference to HP is on HP or below HP.



- From the figure, object (1) is placed below HP and object (2) is placed on HP.
- When the object is placed in 3rd quadrant the projection of that is called 3rd angle of projection.

194. Figure below shows the principle of_____angle projection.

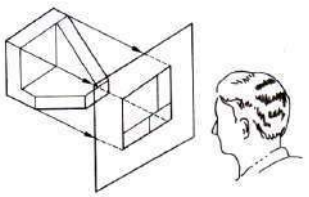


(a) 3rd (b) 1st
(c) Both (a) and (b) (d) None of these

Ans. (b) : Figure above (given in question) shows the principle of 1st angle projection, because the object is situated between the plane of projection and viewer or observer.

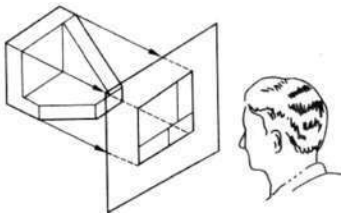
- In this case, projection of plane considered to be non-transparent.

195. Figure below shows the principal of_____angle orthographic projection.



(a) 1st (b) 3rd
(c) 4th (d) 2nd

Ans. (b) : Figure given in question shows the principle of 3rd angle of orthographic projection, because plane of projection is situated between object and observer.

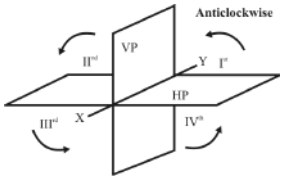


- In this projection system, plane of projection is to be considered as transparent.

196. Four quadrant for drawing orthographical projections are numbered_____.

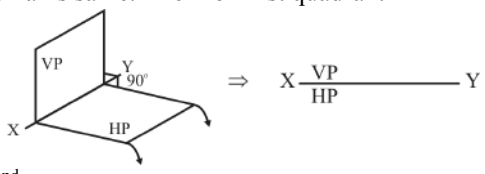
(a) Clock wise (b) Anticlock wise
(c) Both (a) and (c) (d) None

Ans. (b) : Four quadrant for drawing orthographical projections are numbered anticlockwise.

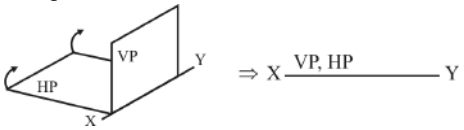


- In projection process plane is rotated as clockwise direction.

1. For drawing first quadrant projection, HP is rotated clockwise, then it comes below X-Y line, but V.P. remains same. Then for first quadrant–

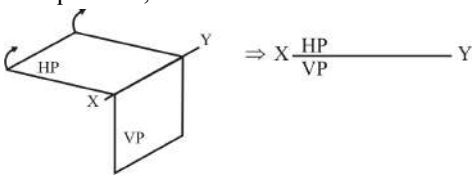


2. II[nd] quadrant,



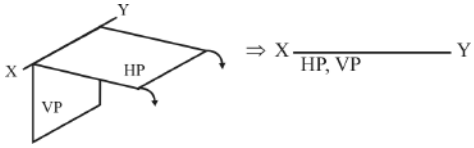
(∵ HP rotated clockwise and comes on VP)

3. III[rd] quadrant,

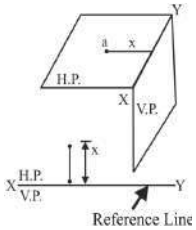


(H.P. comes above X-Y line)

4. IV[th] quadrant,



(H.P. comes on)



197. The projection obtained on the V.P. of the object is called-

(a) Elevation (b) Octegon
(c) Side view (d) Circle

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Ans. (a) : The projection obtained on the VP of the object is called elevation.

- Projection obtained on the Horizontal plane - Plan
- projection obtained on the vertical plane (A.V.P.)- Side view or end view.

198. In third angle projection method, the relative positions of the object, plane of projection and observer are–

(a) Plane of projection is placed between both of them
(b) Object is placed between both of them
(c) Observer is placed between both of them
(d) May be placed in any order

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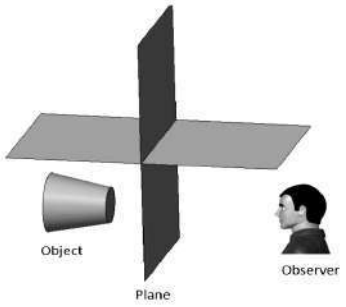
Ans. (a) : Third angle projection:

- If the Object is situated in third quadrant. The plane of projection lies between observer and object.
- H.P. and V.P. is located above and below the reference line respectively.
- In this case, plane of projection is assumed to be transparent.



Note: In first angle projection, the object lies between and observer and the plane of projection.

199. In orthogonal projection if an object is placed below HP and behind V.P. then at what angle will be the object will be located at which angle?

(a) First angle (b) Second angle
(c) Third angle (d) Fourth angle

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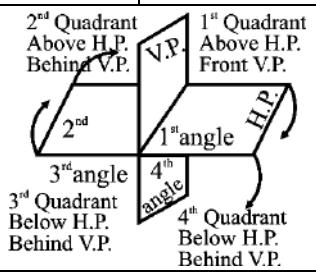
Ans. (c) :

First angle projection:	Object is situated in front of V.P. and above to the H.P.
Second angle projection:	Object is situated behind the V.P. and above to the H.P.
Third angle projection	Object is situated behind the V.P. and below to the H.P.
Fourth angle projection	Object is situated in front of V.P. and below to the H.P.



200. The "front view" and "top view" of a line are represented below and above the X–Y line respectively. The projections are drawn in–

(a) First angle
(b) Second angle
(c) Third angle
(d) It's an orthographic projection

(RRB JE (Shift-2), 29.8.2015)

Ans : (c) During projection the front view is always obtained in the vertical plane (V.P.) and the top view is always obtained in the horizontal plane.

- If front view is below from XY line and top view is above to the XY reference line than an object or line is always located in third angle.

(i) First angle $X\frac{V.P.}{H.P.}Y$

(ii) Second angle $X\frac{H.P.\ \ V.P.}{}Y$

(iii) Third angle $X\frac{H.P}{V.P}Y$

(iv) Fourth angle $X\frac{}{V.P.\ H.P.}Y$

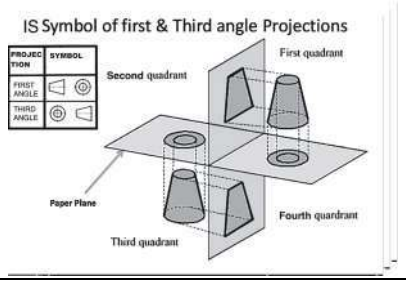
201. In third angle projection, the top view of a body is always drawn:

(a) Below the front view
(b) Above the front view
(c) Left side of front view
(d) Right side of front view

(Rajsthan Water Resource Department JE 12.01.2014)

Ans : (b) In third angle projection, the top view of a body is always above the front view

- In first angle projection the top view of a body is always drawn below the front view.

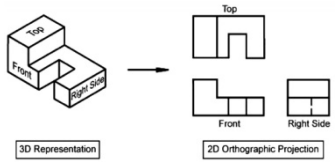


202. That view of an object, which is formed on an additional vertical plane when it viewed from the side ,is called-

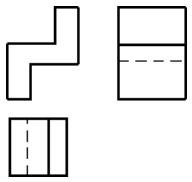
(a) Front elevation (b) Side elevation
(c) Top views (d) Horizontal view

RRB Chandigarh Section Eng. (Mech.), 26.02.2012

Ans : (b) The view of an object, which is formed on an additional vertical plane when it viewed from the side it is called side elevation.



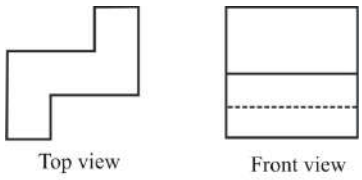
203. There are some vertical and axial surface in three views of an object
How many horizontal surfaces are there in this object.



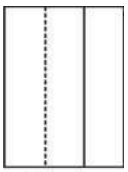
(a) 6 (b) 5
(c) 4 (d) 3

RRB Chandigarh Section Engineer (Electrical) , 15.03.2009

Ans. (d) :



In the given figure there are 3 horizontal surfaces and 4 vertical surfaces.

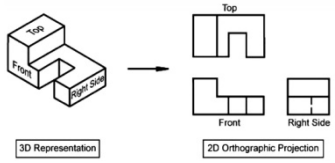
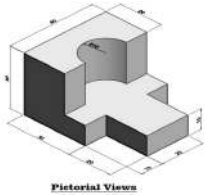


204. What are the methods of making projections ?

(a) Orthographic view (b) Pictorial view
(c) Both the above (d) None of these

RRB Secunderabad Technical (Eng.), 20.05.2007

Ans. (c) : Projections are mainly made in two ways. (a) Orthographic Projection (b) Pictorial projection

Orthographic view	Pictorial view
Orthographic views is a 2 dimensional Projection	Pictorial views is a 3 dimensional projection
Projection in which when the projectors are parallel to each other and perpendicular to the plane is called orthographic projection 	The projection in which the description of the object is completely understand in one view is known as Pictorial projection 

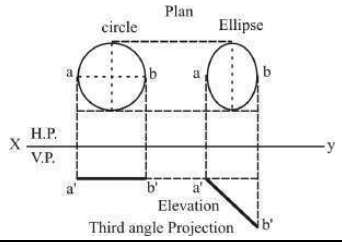
205. In which position should a circle be placed so that one view of its, is an ellipse and the other is a line?

(a) Perpendicular to V.P. and inclined to H.P.
(b) Parallel to both V.P. and H.P.

(c) Perpendicular to both V.P. and H.P.
(d) All of the above

RRB Ranchi Signal Maintainer Group-III , 20.11.2005

Ans. (a) : If a circle is kept perpendicular to V.P. and inclined to H.P. then, an ellipse will be obtained in its reflection, while a line will be obtained in front of it.



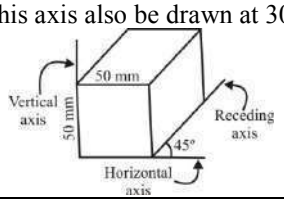
206. The decreasing line of oblique projection is inclined at which angle.

DMRC Station Controller, 09.09.2007

(a) 35^0 (b) 45^0
(c) 60^0 (d) 75^0

Ans. (b) : For drawing oblique view, two axes are drawn as horizontal and vertical axes while the third axis (also known as oblique axis or receding axis) is generally or mostly drawn at an angle of 45^o.

- Some times this axis also be drawn at 30^o or 60^o.



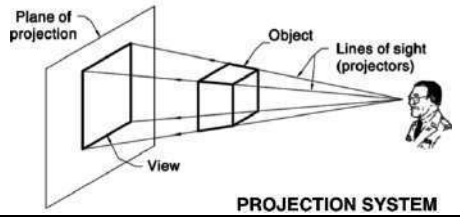
207. The lines which connect the object and the projection are called -

(a) Projectors (b) Extension lines
(c) Centre line (d) Dash line

RRB Ranchi Signal Maintainer Group-III, 20.11.2005

Ans. (a) : Lines, which are connecting the object and the projection are called projectors.

- The plane on which the projection is made is called the 'Plane of projection'.
- Projectors are lines which going from external points on the surface of an object to the projection plane.



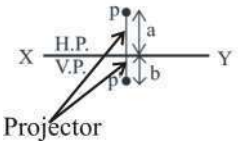
208. The line joining the front and top views of a point is called–

(a) Connector (b) Reference line
(c) Projector (d) Locus

RRB Allahabad Signal Maintainer-II, 22.01.2006

Ans. (c) : The line joining the front and top view of a point is called projectors.

- This line which represented by XY is called reference line.



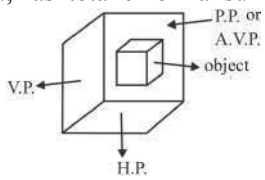
- H.P. and V.P. are called the principal plane projective or projector line is always perpendicular to the principal planes.

209. If the definition of a normal surface is one that is parallel to a principal plane of projection (frontal, horizontal or profile), then for the object pictured, how many normal surface are there? (Count ALL surfaces)

(a) 4 (b) 5
(c) 6 (d) 7

RRB JE Ranchi Yellow Paper 04.01.2015

Ans : (c) According to the question if the definition of the normal surface is on that is parallel to a principal plane of projection (frontal, horizontal profile), then for the object pictured, has total 6 normal surfaces.

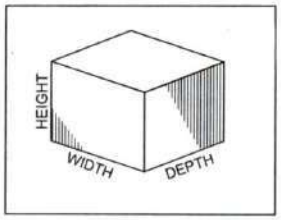


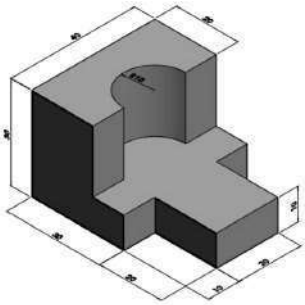
210. Pictorial drawing or pictorial projection is-

RRB Bhubaneswar App. Electrical , 19.08.2001

(a) Two dimensional (b) Three dimensional
(c) Both of the above (d) None of these

Ans. (b) Pictorial projection is a three dimensional projection method which shown the three faces indicating the height, width and depth of the object.





- 2D Illustration of a 3D object provides a realistic view of a 3D object.

211. The view, which formed when an object is view from its top view is called?

(a) Top view (b) Left side view
(c) Right side view (d) Front view

RRB Bhopal Section Engineer, 24.11.2002

Ans. (a) : When the object is viewed from its front then it is called front view or elevation

- When the object is viewed from its Top then it is called Top view or plan
- When the object is viewed from its side then it is called side view or lateral view

212. The top view of an object should be drawn–

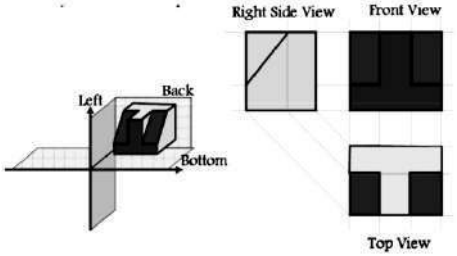
(a) Right or left the front view
(b) Below or above the front view
(c) Below or right of the front view
(d) Above or left of the front view

RRB Chandigarh Section Engineer (Electrical) , 15.03.2009

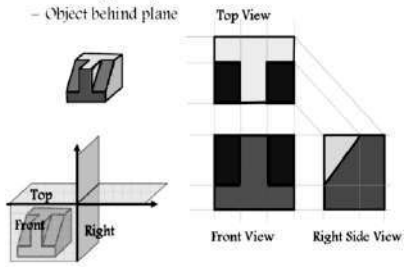
Ans. (b) : The top view of an object should be drawn below or above to the front view.

- In the first angle projection, the top view should be drawn below and in third angle projection it should be drawn above of the front view.

1st angle of projection



3rd angle of projection

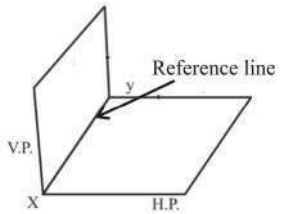


213. The lines on which the horizontal planes (H.P.) and the vertical plans (V.P.) are intersect each other is called-

(a) Principal line (b) Reference line
(c) Auxiliary line (d) None of these

RRB Chandigarh Section Engineer (Civil), 26.02.2012

Ans. (b) The line on which the horizontal planes (H.P.) and the vertical plans (V.P.) are intersect each other is called reference line.
This line is represented by XY.



214. In the human eyes, the image of an object an which formed on the retina ..... then the size of the object?

(a) Smaller (b) Larger
(c) Same (d) Nothing

RRB Secunderabad Section Engineer (Civil) 29.06.2008

Ans. (a) : In the human eyes, the image of an object which formed on the retina is smaller and inverted than the real size of the object.

- The human eye has an 'Ocular lens' which is a convex lens.

215. What is the maximum number of auxiliary views of any given object ?

(a) Infinite (b) 6
(c) 1 (d) 3

RRB ALP & Tech. 21.01.2019 Shift-I

Ans. (a) : Any given object has an infinite number of auxiliary views.

- Sometimes two view of an object (front view & top view) are not sufficient to convey all information regarding to the object.
- In this condition the additional view called auxiliary view and projected on that plane known as auxiliary plane.

Auxiliary view may also be used for determining:

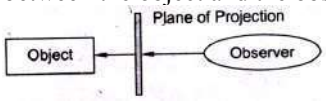
(a) The true length of a line
(b) The point view of a line
(c) The side view of a line
(d) The true size and shape of a plane.

216. In third-angle projection ,_____,

(a) the object lies in the second quadrant
(b) the plane of projection lies between the object and the observer
(c) the object lies in the first quadrant
(d) the object lies between the observer and the plane of projection

RRB ALP & Tech. 22.01.2019 Shift-I

Ans : (b) In third angle projection, the plane of projection lies between the object and the observer.



- The plane of projection is assured to be transparent.
- H.P. and V.P. is located above and below the reference line respectively.
- Projection is drawn same side to the viewly.

217. If straight lines are drawn from various points on the contour of an object to meet a plane, then the figure obtained on the plane is called the..... of the object.

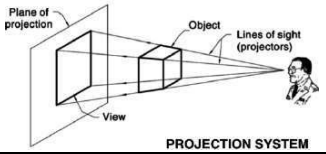
(a) Animation (b) Development
(c) Dimensioning (d) Projection

RRB ALP & Tech. 23.01.2019 Shift-III

Ans : (d) If straight lines are drawn from various points on the contour of an object to meet a plane, then the object is said to be projected on that plane.

- The points at which these lines meet, that plane is called the projection of the object.
- The lines from the object to the plane are called projectors.

- The figure formed by joining, in the correct sequences the points at which the lines meet the plane is called projection of that object.

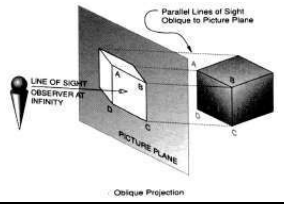


218. In an isometric drawing, vertical lines are drawn vertically, and horizontal lines in the width and depth planes are shown at_____to the horizontal.

(a) 60 degrees (b) 30 degrees
(c) 45 degrees (d) 90 degrees

RRB ALP & Tech. 08.02.2019 Shift-I

Ans. (b) : In an isometric drawing, the Vertical **lines** are drawn vertically, and the width line in the horizontal and depth lines are shown at 30° to the horizontal.



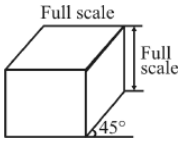
219. A ..... projection is an oblique projection in which the depth of the object is shown in full size.

(a) Orthographic (b) Fisheye
(c) Cavalier (d) Perspective

RRB ALP & Tech 23.01.2019 Shift-II

Ans : (c) A Cavalier projection in an oblique projection in which the depth of the object is shown in full size.

- Projection lines make an angle of 45° with the plane of projection.



EXAM POINTS

- Number of principle plane views are– **6**
- In orthographic angular position of projection line and projection plane with respect to each other is– **Perpendicular**
- Technical drawing typically serves the purpose is– **Visualization, communication, documentation**
- In a perspective drawing, the object always touches the– **Ground line**
- The position of object with respect to picture plane in order to obtain and enlarged perspective view should be– **Object should be in front of picture plane**
- Projection of a helix is– **Sinusoidal**
- Circular shape appear in this fashion when viewed at an angle other than 90º– **Elliptical**
- Principle views associated with orthographic projection are– **Front veiw, Top view, Side view**
- The front view of a cube when it is resting on HP on one of its face and other face is parallel to VP is– **Square**
- The point from which the observer is assumed to view the object is called– **Centre of projection**
- Orthographic projection is also known as– **Multiview projection**
- If the front and top view of an object is above the reference line then it implies– **Object is above HP and behind VP**
- A right circular cone rests on the generation on the HP and has its axis inclined at 45º to the VP. The angle between the reference line and top view of the axis will be– **Greater than 45º**

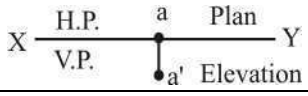
1.9 Projection of points

220. If a point is situated in vertical plane then where its plan will be made ?

RRB Secunderabad Section Engineer (Civil) 29.06.2008

(a) On H.P. (b) On V.P.
(c) On A.V.P. (d) On XY line

Ans. (d) : If a point is situated in vertical plane then its plan will be obtained on the XY line and the front view of this point will be obtained at some distance from the XY line.



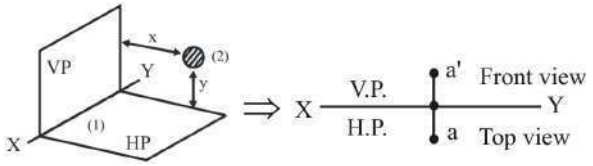
221. What are the maximum possible positions of a point in any quadrant ?

(a) Two (b) Three
(c) Four (d) Five

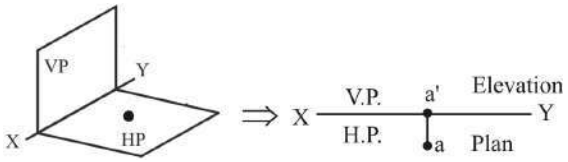
RRB Kolkata Jr. Engineer-II Electrical/DRG & Design 11.06.2006

Ans. (c) : All most four maximum position of a point are possible in any quadrant.

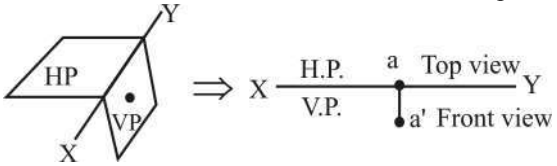
- Point is located at certain specified distances from the horizontal plane and the vertical plane.



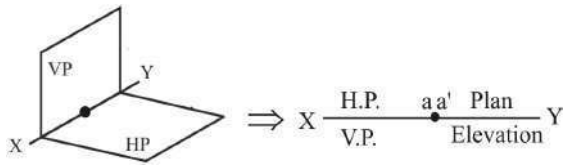
- The point should be situated in the horizontal plane and at some distance from the vertical plane.



- The point should be at situated at some distance from the H.P. and should be situated in the vertical plane



- The Point should be located in both the H.P. and V.P.

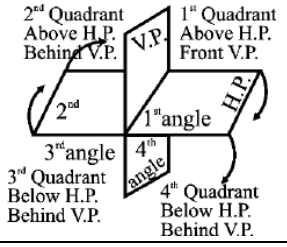


222. If the plan of a point is below from XY line its will be V.P. point-

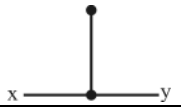
(a) Above (b) Behind
(c) Below (d) Front

RRB Chandigarh Section Engineer (Electrical) , 15.03.2009

Ans. (d) : If the plan of a point is below from x-y line then it will be always in front of V.P. Because the plan of a point is below from XY line that means the point is situated either in first quadrant or in fourth quadrant in both conditioned the point is obtained in front of V.P.



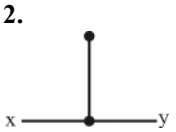
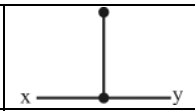
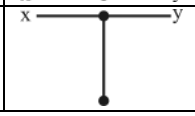
223. Match List-I (Position of point) with List-II (Orthographic projection) and select correct answer using the codes given below the lists:

List-I	List-II
A. On HP in front of VP	**1.** 
B. On HP behind VP	**2.** 
C. On VP above HP	
D. On VP below HP	

	A	B	C	D
(a)	2	1	1	2
(b)	1	2	2	1
(c)	1	1	2	2
(d)	2	2	1	1

Indian Ordnance Factory Fitter 2013

Ans. (b) :

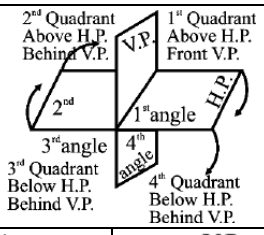
List-I	List-II
A. On H.P. and in front of V.P.	**1.** 
B. On H.P. and behind the V.P.	**2.** 
C. On V.P. and above to the H.P.	
D. On V.P. and below to the H.P.	

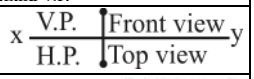
224. A point whose elevation is above to the reference line, is probably situated in the–

(a) First quadrant (b) Second quadrant
(c) Both (a) and (b) (d) None of these

MES Electrician Tradesman 2015

Ans. (c) : A point whose elevation is above to the reference line is probably situated in the first quadrant and second quadrant.



A. First quadrant	
B. Second quadrant	

225. If a point is below H.P. then elevation from XY line.

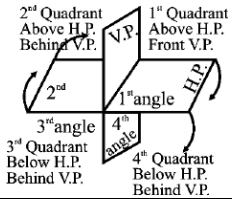
(a) Below (b) Above
(c) Behind (d) Front

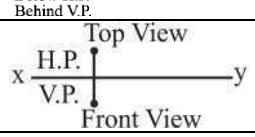
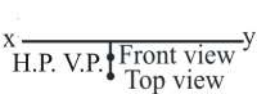
RRB Chennai Section Engineer, 12.02.2012

Ans. (a) : Third angle projection, object is situated below H.P. and behind the V.P.

Fourth angle projection object is situated below H.P. and front the V.P.

- In both cases the elevation of that point will be below the reference line XY while the plan can be below or above XY.



A. Third quadrant	
B. Fourth quadrant	

226. If a point (G) is situated on ground line (G.L.) its ..... always obtained on G.L.

(a) Plan (b) Viewers
(c) Elevation (d) Both a b

RRB Chandigarh Section Engineer (Civil), 26.02.2012

Ans. (c) : In the first angle projection the XY line itself act as the ground line, while in the third angle projection the ground line is drawn separately at a suitable distance below the XY line.

- If any point or object is located on the ground line (G.L.), then its elevation is always obtained on the ground line.

227. If a point is found on the top view of a line, then that line will be from the horizontal plane-

(a) Inclined (b) Parallel
(c) Perpendicular (d) None of these

RRB Secunderabad Section Engineer (Civil) 29.06.2008

Ans : (c) If a point is found on top view of a line then that line will perpendicular from the horizontal plane.
In any quadrant, there can be the following conditions for the line to be in the principle plans.

(i) Parallel to both the reference plant.
(ii) Perpendicular to one reference plant and parallel to the other.
(iii) Perpendicular to one reference plane and inclined to the other.

228. The point at which the line intersects the vertical plane is known as–

(a) horizontal trace (b) vertical trace
(c) profile trace (d) auxiliary trace

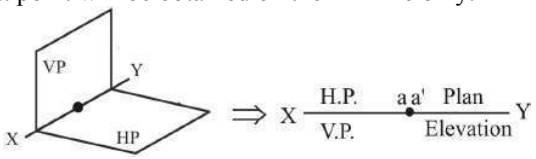
DRDO Mechanic Diesel 2016

Ans : (b) The point at which the line intersects the vertical plane is known as vertical trace.
Note: The plane to which the line is parallel, does not get the luminous sign.

229. The projection of a point on the XY line will be obtained when that point from the reference plane. will be-

(a) At a specified distance
(b) at zero distance
(c) Both situations a and b are possible
(d) None of the above is possible

Ans. (b) : If a point is situated at zero distance from both the reference plane (H.P. and V.P.) i.e. on the XY line then both the projection (front view and top view) of that point will be obtained on the XY line only.



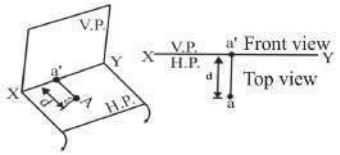
The point 'a' lies on the XY line. Both the front view and tap view of this point will be obtained on the XY line.

230. If the front view of a point is on the XY line then that point will be located in which plane.

(a) Vertical plane (b) Horizontal plane
(c) Profile plane (d) One the XY line

RRB Bangalore Section Engineer (Civil) 01.02.2009

Ans. (b) : If the front view of a point is on the XY line so that point will be located in the horizontal plane.



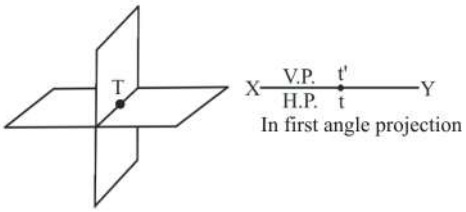
A point lies in the horizontal plane (H.P.) in the first quadrant and is at a distance d from the point V.P. The front view of this point a is located on the XY line and the plan is obtained at a distance d from the XY line.

231. If the point is located on both planes then the front view is obtained where?

(a) On V.P. (b) On H.P.
(c) On A.V.P. (d) On XY

RRB Chandigarh Section Engineer (Mech.), 26.02.2012

Ans. (d) : If the point is located on both planes then the front view is obtained on XY line.



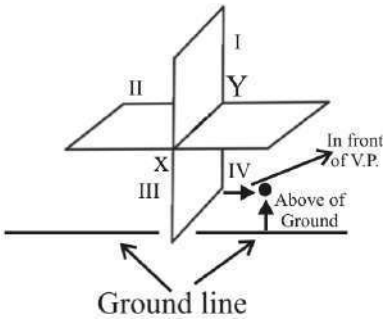
232. If any point is situated in fourth quadrant then it will be above to the ground and—— of V.P.

(a) Behind (b) Front
(c) Above (d) Down

RRB Jammu Section Eng. (Mech, Elec/Elect./Telecom), 2013

Ans. (b) : If any point is situated in fourth quadrant then it will be above to the ground and in front of V.P.

- If this point is above to the ground and behind to the V.P. then it will be situated in the third quadrant.



Note - In the first angle projection the XY line itself act as the ground line, while in the third angle projection the ground line is drawn separately at a suitable distance below the XY line.

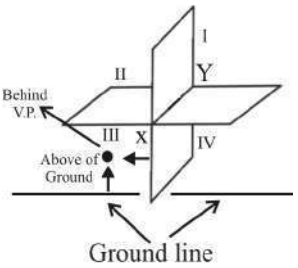
- If any point or object is located on the ground line (G.L.), then its elevation is always obtained on the ground line.

233. If any point is situated above the ground and behind to V.P., then than point will be situated in which quadrant.

(a) First quadrant (b) Second quadrant
(c) Third quadrant (d) Fourth quadrant

RRB Bhubaneswar App. Electrical , 19.08.2001

Ans. (c) : If any point is situated above the ground and behind to V.P., then than point will be situated in which quadrant in third quadrant.



Note - In the first angle projection the XY line itself act as the ground line, while in the third angle projection the ground line is drawn separately at a suitable distance below the XY line.

- If any point or object is located on the ground line (G.L.), then its elevation is always obtained on the ground line.

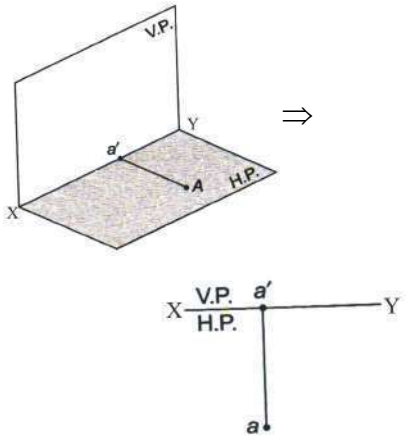
234. A point lying in the HP which top view is above to above reference line. Then its front view is located–

(a) Above reference line (b) On reference line
(c) below reference line (d) Any of the above

RRB Ranchi Signal Maintainer Group-III, 20.11.2005

Ans. (b) : If a point is lying in the HP and its top view is above to the reference line then its front view is situated on the reference line.

- This point will be located in the second or third quadrant and the actual distance from the line of this point will be visible in the top view only.



235. The point at which line intersects the H.P., if extended, is known as

(a) Horizontal trace (b) Profile trace
(c) Auxiliary trace (d) Vertical trace

RRB S.S.E. (Secunderabad) 02.09.2015 (Shift-I)

Ans : (a) The point of intersection of given line, produced or extended if necessary, where it meets one of the principal planes is called its trace.

- The point of intersection of a given line if extended with the H.P is called the horizontal trace. It is usually denoted by H.T or H.
- The point of intersection of a given line if extended with the V.P is called the vertical trace and is usually denoted by V.T or V.

1.10 Projection of lines

236. If a line is inclined to the H.P. and parallel to the V.P., then it has

(a) no trace
(b) only V.T. but no H.T.
(c) both H.T. and V.T.
(d) only H.T. but no V.T.

ESE (PRE) 2023

Ans. (d) : If a line is inclined to the H.P. and parallel to the V.P., then it has only H.T. but no V.T.

237. A cone resting on its base in horizontal plane (HP) is cut by a plane inclined to the axis and parallel to one of its generators, the sectional view will be

(a) Ellipse (b) Parabola
(c) Hyperbola (d) Circle

ESE (Pre) 2019

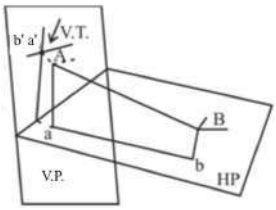
Ans. (b) : If a regular cone is been cut by plane which is inclined to axis of cone and cutting all generators then the section formed will be ellipse and if section plane is inclined with axis with angle less than half of the angle between the slanting ends then section formed is parabola.

238. If a line is perpendicular to the V. P. and its V. T. coincides with its front view which is a point, then

(a) V. T. is a point on H. P.
(b) H. T. is a point on V. P.
(c) It has no V. T.
(d) It has no H. T.

ESE (Pre) 2022

Ans. (d) :



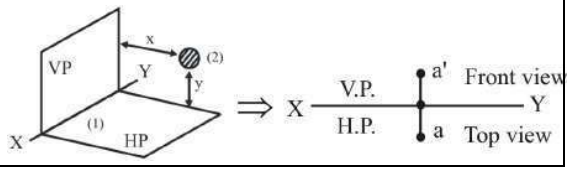
→ V.T. is a point on V.P.
→ It has no H.T.

239. In horizontal plane, the plan of a point will be at the same distance from the XY line whatever distance of this point is located from-

(a) V.P. (b) H.P.
(c) XY Line (d) None of these

RRB Thiruvananthapuram Section Eng (Mechanical) 04.01.2009

Ans. (a) : A point is how far from the vertical plane it's plan will be formed at the same distance from the XY line and This point is how far from the horizontal plane it's front view will be formed at the same distance in V.P.

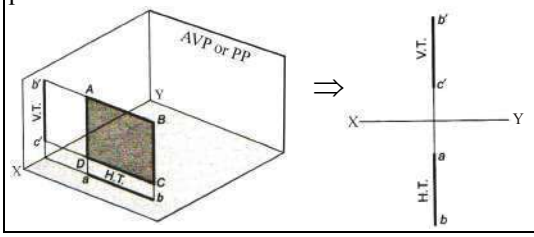


240. The plane which is perpendicular to both the planes H.P. and V.P. is called.

(a) Oblique plane (b) Orthogonal plane
(c) Horizontal plane (d) All of these

RRB Kolkata Chemical & Metallurgical Er., 01.12.2002

Ans. (b) : There are two principal planes (H.P. and V.P.) in the orthogonal projection, which are perpendicular to each other. In ordinary there is an auxiliary vertical plane which is perpendicular to both these planes. This plane is also called perpendicular plane or P.P.



241. Match List-I with List-II and choose the correct answer using the codes given below the lists :

List-I	List-II
A. Line parallel to both HP and VP	**1.** HT exists but VT does not
B. Line parallel to HP and perpendicular to VP	**2.** HT and VT both exists
C. Line inclined to both HP and VP	**3.** VT exists but HT does not
D. Line parallel to VP and inclined to HP	**4.** Neither HT nor VT exists

	A	B	C	D
(a)	1	4	3	2
(b)	1	2	3	4
(c)	4	3	2	1
(d)	4	1	3	2

Vizag Steel Electrician 2015

Ans. (c) :

List-I	List-II
A. Line parallel to both HP and VP	**4.** Neither HT nor VT exists
B. Line parallel to HP and perpendicular to VP	**3.** VT exists but HT does not
C. Line inclined to both HP and VP	**2.** HT and VT both exists
D. Line parallel to VP and inclined to HP	**1.** HT exists but VT does not

242. Planes which are inclined to both the HP and the VP are called–

(a) Profile planes (b) Oblique planes
(c) Auxiliary planes (d) None of these

Mazagon Dock Shipbuilders Ltd. Fitter 2013

Ans. (b) : The Planes which are inclined to both the reference planes (H.P. and V.P.) are called oblique planes.

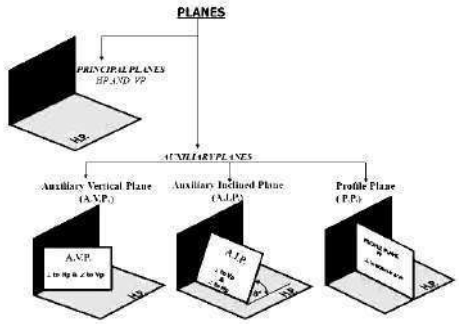
- Perpendicular planes the planes which are perpendicular to one or both the reference plane i.e. H.P. and V.P. called perpendicular planes.

Profile Plane: In such cases the object is projected either on a left or light side plane known as profile plane (P.P.)

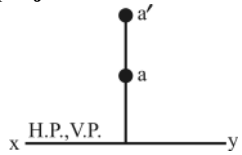
- The view projected on it is known as profile view or side view.

Auxiliary Plane: Sometimes two views of object (front view & top view) are not sufficient to convey all information's regarding the object.

- In this conditions view, called auxiliary view and projected on that plane known as auxiliary plane.



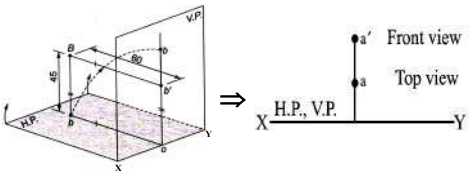
243. For the given orthographic projection, what will be the position of point with respect to planes of projection?



(a) First Quadrant (b) Second Quadrant
(c) Third Quadrant (d) Fourth Quadrant

Indian Ordnance Factory Fitter 2015

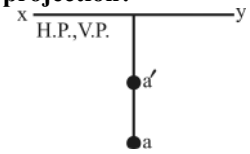
Ans. (b) :



The above condition shows, that the point is situated in second quadrant.

- In second quadrant the point is situated behind the V.P. and above to the H.P.
- When the horizontal plane is rotated 90° in a clockwise direction, the top and front views will overlap and these overlapping projection views create confusion in the drawing. Therefore the II[nd] quadrant is not used.

244. For the given orthographic projection, what will be the position of point with respect to planes of projection?

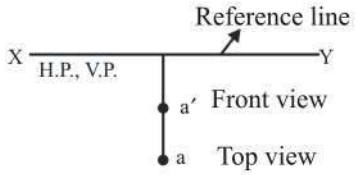


(a) First Quadrant (b) Second Quadrant
(c) Third Quadrant (d) Fourth Quadrant

Indian Ordnance Factory Fitter 2014

Ans. (d) : For the given orthographic projection the position of point with respect to planes of projection is the point is in fourth quadrant.

- In fourth quadrant the pint is situated below to the H.P. and in front of V.P..
- After rotating the H.P., 90° in clockwise direction H.P. and V.P. are overlapped to each other and the projection, both of top view and front view obtained below to the reference plane.
- If a point is situated below H.P. then its front view is below the XY line and the distance of the front view from the XY line is equal to the distance of the given point from the H.P.

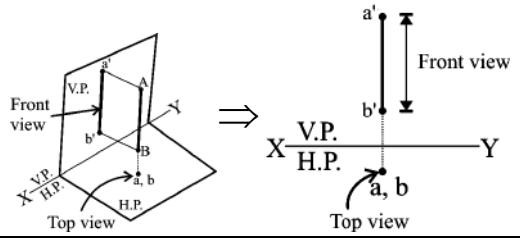


245. If top view of a line is a point, its front view is

(a) Perpendicular to reference line and equal to its true length
(b) Perpendicular to reference line and of apparent length
(c) Parallel to reference line and of true length
(d) Parallel to reference line and of apparent length

(RRB SSE (shift-II), 02.09.2015)
RRB Thiruvananthapuram Section Eng (Mechanical) 04.01.2009

Ans : (a) If top view of a line is a point, its front view is perpendicular to reference line and equal to its true length.

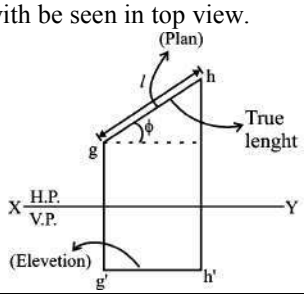


246. If a line is parallel to H.P. and inclined to V.P., its true length will be seen in :

(a) Front view (b) Top view
(c) Side view (d) Both front and top views

(RRB JE (Shift-III), 26.08.2015)
(RRB JE Mumbai (Shift-II), 27.08.2015)

Ans : (b) If a line is parallel to H.P. and inclined to V.P. its true length with be seen in top view.

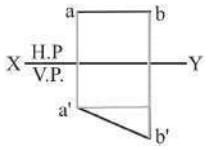


247. If a line is parallel to V.P. and inclined to H.P. then its view ..... will be parallel to XY.

(a) Front view (b) Top view
(c) Side view (d) All of above

DMRC Secunderabad Section Eng. (Civil), 29.06.2008

Ans : (b) If a line is parallel to V.P. and inclined to H.P. then its Top view will be parallel to XY which will be a straight line.



248. When the axis of solid is perpendicular to the V.P. then it will be..... to H.P.-

(a) Perpendicular (b) Parellel
(c) Vertical (d) Horizontal

RRB Bangalore Section Engineer (Civil) 01.02.2009

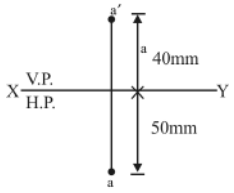
Ans. (b) : When the axis of solid is perpendicular to the V.P. then it will be parallel to H.P. and the cross section of that solid will be parallel to V.P.

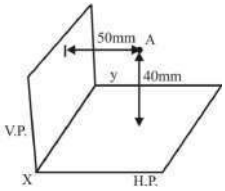
249. The elevation of a point is 40mm above to reference line and the plan is 50mm below to reference line. That point is–

(a) 40mm below HP (b) 40mm above HP
(c) 50mm in front of HP (d) 50mm behind VP

RRB Kolkata Diesel/Electrical Ass., 06.02.2005

Ans. (b) :





The elevation of a point is 40 mm above reference line and the plan is 50 mm above reference line the point is 40 mm above to the horizontal plane.

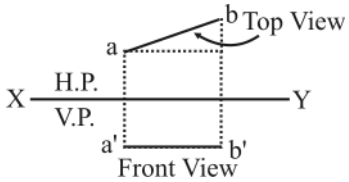
250. If a line is parallel to H.P. and inclined to VP, then which view of it is parallel to XY line -

(a) Side view (b) Top view
(c) Front view (d) None of these

RRB Bhopal & Mumbai Apprentice Section Eng. 23.03.2003

Ans : (c) If any line is parallel to H.P. and inclined to VP, then its front view will be a parallel to XY line.

- In top view an inclined line will be obtained

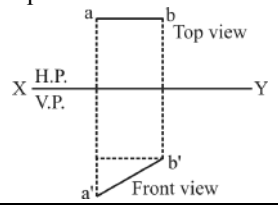


251. A line is inclined to HP and parallel to VP. Then the true length of a line is represented in

(a) Plan (b) Elevation
(c) Left side view (d) Right side view

ISRO-(VSSC) Draughtsman (Mech.), 25-09-2016

Ans : (b) If a line is inclined to HP and parallel to V.P. Then the true length of a line is to V.P. Then the true length of a line is represented in elevation.



252. If the vertical trace (V.T.) of a plane is a line parallel to the XY line, then that plane will If____ to the horizontal plane.

(a) Inclined (b) Perpendicular
(c) Parallel (d) None of these

Kolkata Jr. Engineer-II Electrical/DRG & Design 11.06.2006

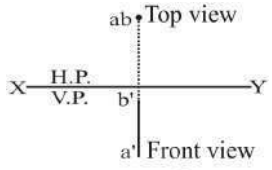
Ans : (c) If the vertical trace (V.T.) of a plane is a line parallel to the XY line, then that plane will be parallel to the horizontal and perpendicular to the vertical plane.

253. If a line is perpendicular to H.P. then which of its view is found a point-

(a) Top view (b) Front view
(c) Side view (d) None of these

SAIL Durgapur Steel Plant 05.09.2014

Ans : (a) If any line is perpendicular to H.P., So a point is found on its top view. Whereas a line is found on its front view.



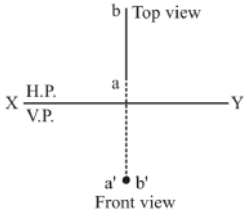
254. If a line is perpendicular to the V.P., then in which view it is perpendicular to XY-

(a) Front view (b) Side view
(c) Top view (d) None of these

SAIL Bokaro Steel Plant 2016

Ans : (c) If a line is perpendicular to the V.P. So in its top view, we found a line which is also perpendicular to XY.

- And a point is found in its front view.

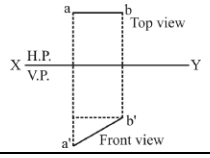


255. One line which is parallel to V.P. and inclined at any angle from H.P.
Then what is found in its front view ?

(a) A point (b) A line
(c) Both (d) None of these

Vizag Steel Fitter 2015

Ans : (b) If one line is parallel to V.P. and inclined at any angle from H.P. then we found a line on its front view.



256. No line can ever be of both the reference planes-

(a) Parallel (b) Perpendicular
(c) Inclined (d) None of these

NTPC Fitter 2014

Ans : (b) No line can ever be perpendicular to both the reference plane when the line is parallel to the horizontal plane then it is perpendicular to the vertical plane and when the line is parallel to the vertical plane then it is perpendicular to the horizontal plane.

- It can be parallel with both at once, but this line is never perpendicular to both the vertical plane and the horizontal plane simultaneously.

257. In the front view of a line, the actual length of the line will be visible only when the line is in the vertical plane-

(a) Parallel (b) Vertical
(c) Inclined (d) In all condition

BHEL Hyderabad Fitter 2014

Ans : (a) If a line is found equal to its actual length in front view, then this line is parallel to V.P. while it may be vertical or inclined from H.P.

258. If a line is parallel to H.P., so its top view is-

(a) A point (b) A straight line
(c) A curve (d) None of these

COAL India Fitter 2013

Ans : (b) If a line is parallel to H.P., so in its top view a line is found which is parallel to H.P.

- If this line is vertical to V.P. so a point is found on its V.P. in front view.

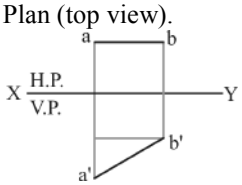
259. If a line is inclined to H.P. & parallel to V.P., so its top view about X-Y line is -

(a) Inclined (b) Vertical
(c) Parallel (d) None of these

CRPF Constable Tradesman 2016

Ans : (c) If a line is inclined to H.P. & parallel to V.P. then a straight line will be obtained in its top view, which will be slightly smaller than its actual length, It is parallel to XY.

- This is called Plan (top view).



260. If both the front and top views of a line are perpendicular to the reference line, the true inclination of line with HP and VP may be respectively–

(a) 30^0 and 60^0 (b) 20^0 and 70^0
(c) Both 45^0 (d) Any of these

HAL Fitter 2015

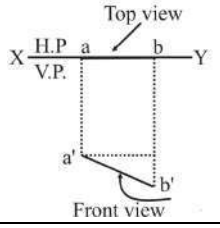
Ans : (d) It both the front and top views of a line are perpendicular to the reference line, the true inclination of line with HP and VP may be respectively at any angle, may be 30° and 60° or 20° and 70° or both at 45°.

261. If a line is situated on VP then which view is found on XY ?

(a) Front view (b) Top view
(c) Side view
(d) Top view and front view both

Mazagon Dock Shipbuilders Ltd. Fitter 2013

Ans : (b) If a line is situated on V.P. then top view is found on XY.



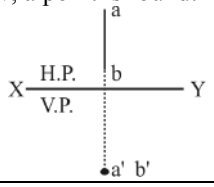
262. A line is kept perpendicular to V.P., so is top view is-

(a) A line (b) A point
(c) A rectangle (d) None of these

MES Fitter Tradesman 2015

Ans : (a) If any line is kept perpendicular to V.P. So a line of equal length is found on its top view which is also perpendicular to XY.

- In front view, a point is found.



263. If a line is inclined to both the planes then in which projection will the actual length of the line will found ?

(a) Top view (b) Front view
(c) Both of these (d) None of these

Indian Ordnance Factory Fitter 2016

Ans : (d) If a line is inclined from both the planes, then an inclined line will be obtained in both view i.e. top and front view, which will be of less in length than the actual length of the line.

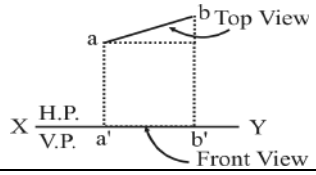
- The tilt of these projections will appear higher than the actual tilt.

264. If a line is located at H.P., then which of its view is on XY-

(a) Top view (b) Front view
(c) Side view (d) All of these

Indian Ordnance Factory (Itarsi) Fitter 08.05. 2016

Ans : (b) If a line is located at H.P., so its front view is found on XY.



265. Trace of inclined line is obtained from H.P.-

(a) H.T (b) V.T
(c) T.L (d) V.P

RRB Secunderabad Section Engineer (Civil) 29.06.2008

Ans : (a) On extending the line H.P., the point at which intersects the line, that point line is called Horizontal trace (H.T.) and on extending the line V.P., the point at which intersects the line V.P. (Vertical trace).

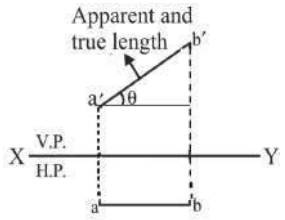
- The plane from which the line in inclined, the luminous sign is obtained.
- The trace of the inclined line H.P. intersects will get H.T.

266. If the apparent and the true inclinations of a line with HP are equal, the line is–

(a) parallel to vertical plane
(b) parallel to horizontal plane
(c) inclined to both reference planes
(d) parallel to profile plane

DRDO Turner 2016

Ans : (a) If the apparent and the true inclinations of a line with HP are equal, the line is parallel to vertical plane.



267. For a line situated in the first quadrant, which of the following statements is not correct?

(a) HT and VT may lie above xy
(b) HT and VT may lie below xy
(c) HT may lie above xy and VT below xy
(d) HT may lie below xy and VT above xy

DRDO Motor Mechanic 2016

Ans : (c) In first quadrant VP is located above the reference line X-Y and H.P. located below the reference line.

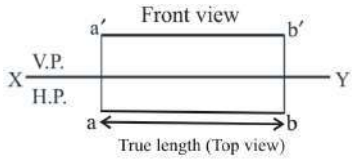
- In this situation the H.T. & VT of the line can be obtained above or below to the reference line X-Y.
- V.T. can never be obtained below X-Y line and H.T. can be obtained above X-Y line.

268. If the front view of a line is parallel to the XY its true length is shown in–

(a) top view (b) front view
(c) side view (d) both front and top view

CRPF Constable Tradesman 2016

Ans. (a) : If the front view of a line is parallel to the XY line then its true length is shown in top view and its measurement will be equal to the actual measurement of the line.



269. The front view and top view of a line both lie above the XY line. The line is located in :
(a) First Quadrant (b) Second Quadrant
(c) Third Quadrant (d) Fourth Quadrant

RRB JE 28.08.2015 (Shift-II)

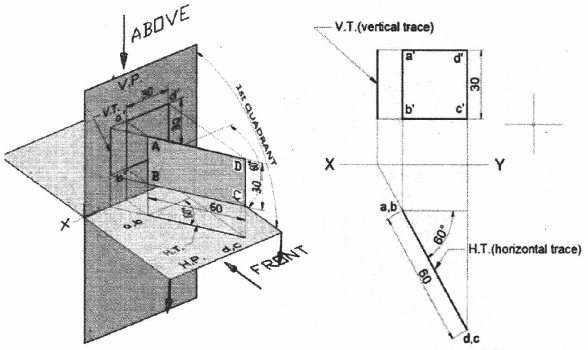
Ans. (b) : The front view and top view of a line both lie above the xy line, the line is isolated in second quadrant. In the second quadrant, view above the horizontal plane and behind the vertical plane.

1.11 Projection of Planes

270. A plane, extended if necessary, will meet the reference planes in lines, unless it is parallel to any one of them. These lines are called
(a) Projection lines (b) Traces of the plane
(c) Dimension lines (d) Imaginary lines

ESE (PRE) 2024

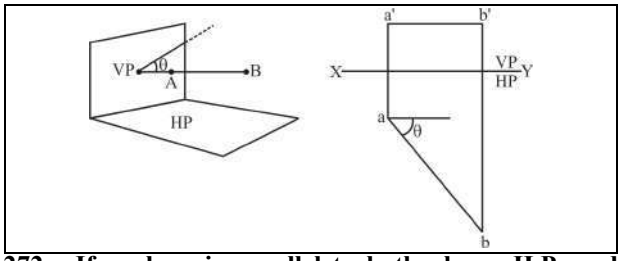
Ans. (b) : Traces of a plane are defined as line of intersection of plane or plane extended with reference planes or planes of projection.



271. If a line is inclined to Vertical Plane and parallel to Horizontal plane, then which of the following statements is always correct?
(a) True Length = Plane Length
(b) True Length = Elevation Length
(c) True Length < Plane Length
(d) Vertical Trace of the line is above the XY plane.

ESE (Pre) 2017

Ans. (a) : The line is inclined to the vertical plane and parallel to horizontal plane, its front view is shorter than its true length but parallel to xy, its top view is equal to its true length and is inclined to xy at its true inclination with the vertical plane.
When a line is inclined to one plane and parallel to the other, its projection on the plane to which it is inclined, is a line shorter than its true length but parallel to the reference line.



272. If a plane is parallel to both planes H.P. and V.P. then which trace will be obtaind ?
(a) H.T. (b) V.T.
(c) Both H.P. VP (d) None of these

Mazagon DOCK Ltd. Electrician 2013

Ans. (d) : If a plane is parallel to both Horizontal plane and Vertical plane the line will not meet those planes so the line will not have traces on those planes but it will have a trace on profile plane.

273. If a rectangle is placed parallel to V.P. then his front view will be-
(a) Straight (b) Rectangle
(c) Square (d) Point

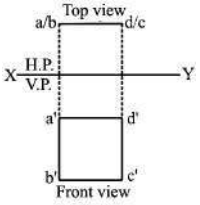
ESIC Electrician 2015

Ans. (b) : If a rectangle is placed parallel to V.P. then his front view will be rectangle and a straight line is obtained in its top view.

274. If a square is perpendicular to H.P. and parallel to V.P. the its top view will be-
(a) A rectangle (b) A square
(c) A line (d) A point

THDC Electrician 2015

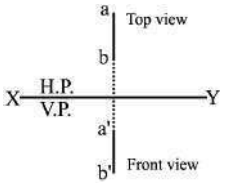
Ans. (c) : If a Square is perpendicular to H.P. and Parallel to V.P. the its top view will be a line then its will be obtained side view.



275. If a circle is perpendicular to both H.P. and V.P. then its will be circle in side view.
(a) A circle (b) A line
(c) A Point (d) None of these

Indian Ordnance Factory Electrician 2016

Ans. (a) : if a circle is perpendicular to both H.P. and V.P. then a circle will be obtained at the profile plane in side view.
• A line will be obtained in the front view and top view of the circle.



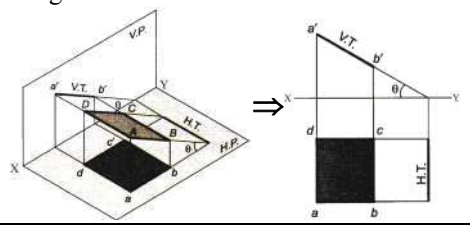
276. If a rectangle is inclined at an angle of θ° from H.P. and perpendicular to V.P., then which of its views will be inclined to the XY line?

(a) Top view (b) Front view
(c) Side view (d) None of these

Indian Ordnance Factory Electrician 2015

Ans. (b) : If a rectangle is inclined at an angle of θ° from H.P. and perpendicular to V.P., then then its front view will be inclined to the XY line-

- The projection (plan) or top view of this plane will found a quadrilateral of less area as compare to the actual rectangle.



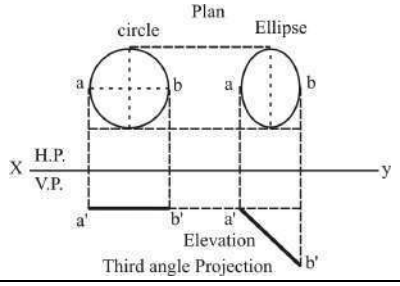
277. A circle is placed at which condition, so that its top view is a square?

(a) parallel to both H.P. and V.P.
(b) Perpendicular to both H.P. and V.P.
(c) Perpendicular to H.P. Parallel V.P.
(d) None of these

Indian Ordnance Factory Electrician 2014

Ans. (d) : By placing the circle in any position on the plane we will never found a square .

- if a circle is parallel to the V.P. and inclined to H.P. then an ellipse will be obtained in its top view (Plan), whereas an inclined line from XY reference will be obtained in its front view.



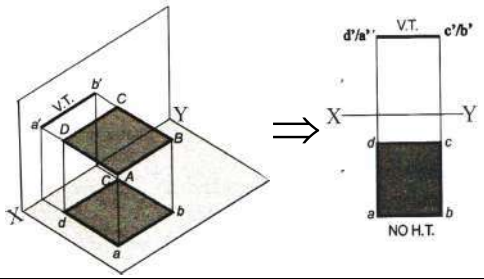
278. If a square is parallel to H.P. and perpendicular to V.P. then its H.T. will be-

(a) A line (b) A rectangle
(c) Either of them (d) None of these

Indian Ordnance Factory Electrician 2013

Ans. (d) : In the front view of this square we will obtained a straight line, which will display the vertical trace point of the square.

- No trace point will be obtained in the plane to which it is parallel.

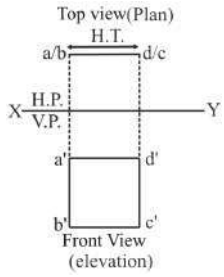


279. If a rectangle is parallel to V.P. then its H.T. ..... will be

(a) Parallel to XY line (b) Below the XY line
(c) On the XY line (d) None of these

RRB Bhopal Section Engineer, 24.11.2002

Ans. (a) : A line , Parallel to the XY line is obtained in the top view of this rectangular which displayed the H.T. of the rectangle.



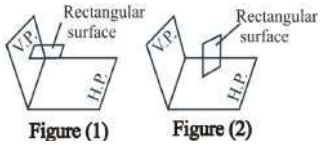
280. Any plane can not be —— to both the reference planes -

(a) Vertical (b) parallel
(c) Inclined (d) None of these

RRB Bhopal & Mumbai Apprentice Section Eng. 23.03.2003

Ans. (b) : Any plane can net be parallel to both the reference planes.

- If a plane is Parallel to the horizontal plane (H.P.), then it will be perpendicular to the vertical Plane (V.P.) and vice versa.



- In figure (1) the rectangular plane is perpendicular to V.P. and parallel to the H.P.
- In figure (2) the rectangular plane is parallel to V.P. and Perpendicular to H.P.

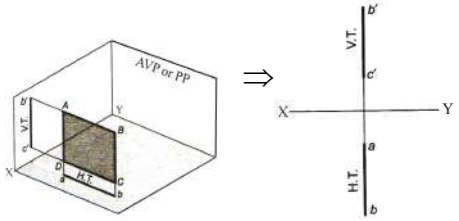
281. If a square plane is kept perpendicular to both the horizontal and vertical planes, its true shape is seen in–

(a) VP (b) HP
(c) PP (d) Auxiliary inclined plane

COAL India Fitter 2013

Ans. (c) : If a square plane is kept perpendicular to both the horizontal and vertical planes, its true shape is seen in profile plane.

- **Profile Plane:** In such cases, the object is projected either on a left or right side plane, known as profile plane (P.P.)
- The view projected on it is known as profile view or side view.

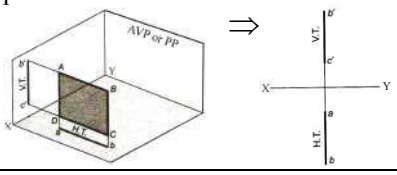


282. If both the front and top views of a plane are straight lines, it may be :

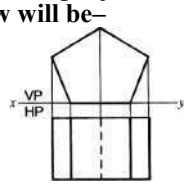
(a) perpendicular to both horizontal and vertical planes
(b) parallel to horizontal plane and perpendicular to vertical plane
(c) perpendicular to horizontal plane and parallel to vertical plane
(d) parallel to both horizontal and vertical planes

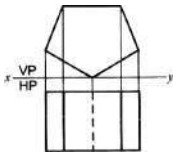
(RRB JE Mumbai (Shift-II), 27.08.2015)

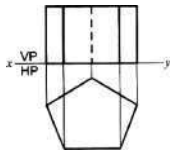
Ans : (a) If both the front and top views of a plane are straight lines it may be perpendicular to both horizontal and vertical planes.

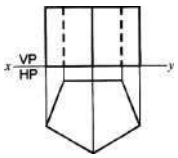


283. A Pentagonal prism whose edges are perpendicular to V.P. and the base is parallel to V.P. If its rectangular faces are parallel to H.P. then the projections of their top view and front view will be–

(a) 

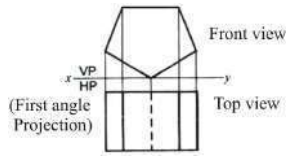
(b) 

(c) 

(d) 

RRB Kolkata Technical-III, 20.08.2006

Ans. (b) :

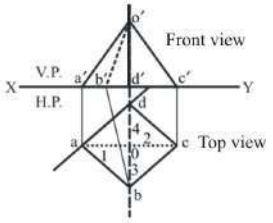


284. A square pyramid is resting on its base on HP. One side of the base is inclined at 60^0 to VP. The number of dotted lines will appear in the front view–

(a) 1 (b) 2
(c) 3 (d) Zero

RRB Kolkata Jr. Engineer-II Electrical/DRG & Design, 11.06.2006

Ans. (a) : A square pyramid is resting on its base on H.P. One side of the base is inclined at 60° to V.P. The number of dotted lines will appear in front view is 1 and 4 Dotted lines will appear in its top view.



1.12 Projection of solids

285. A triangular prism, base 40 mm side and axis 50 mm long is resting on the of its bases on the H.P. with a vertical face perpendicular to the V.P. What is the front view of the prism?

(a) a triangle
(b) a rectangle
(c) combination of triangle and rectangle
(d) combination of triangle and circle

ESE (PRE) 2023

Ans. (b) : A triangular prism base 40 mm side and axis 50 mm long is resting on one of its bases on the H.P. with a vertical face perpendicular to the V.P. then the front view of the prism will be a rectangle.

286. Which of the following are the methods for determining the line of intersection between surfaces of two interpenetration solids?

(a) Line method and cutting plane method
(b) Line method and box method
(c) Co-ordinate method and cutting plane method
(d) Co-ordinate method and box method

ESE (PRE) 2024

Ans. (a) : There are two methods of determining the line or curve of intersection between surface of two interpenetrating solids.

Line methods:- A numbers of lines are drawn on the lateral surface of one of the solids and in the region of the line of intersection. Points of intersection of these lines with the surface of the other solids are then located. The line or curve drawn through there points will be the line or curve of intersection.

Cutting plane method:- The two solids are assumed to be but by a series of cutting planes. The intersection points of sections of two solids and lying on surface of solid are the required points. These intersection points when joined in proper sequence give the line or curve of intersection.

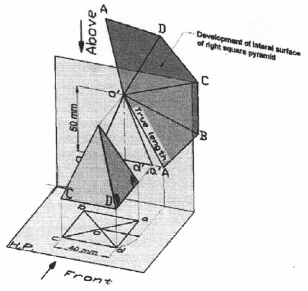
287. Which one of the following is used for pyramids and cones in which the true length of the slant edge or the generator is used as radius?

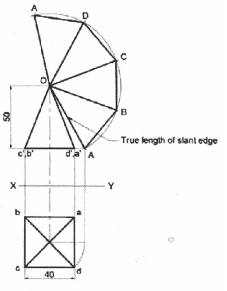
(a) Parallel-line development
(b) Radial-line development
(c) Triangulation development
(d) Approximate method

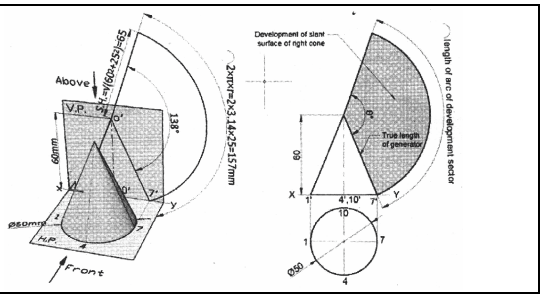
ESE (PRE) 2024

Ans. (b) : Radial line development method is used for the development of lateral surfaces of right pyramids in which the true length of slant edge is used as radius.

Radius line development method is used for development of lateral surface of right cone in which the true length of generator is used as radius of development sector.





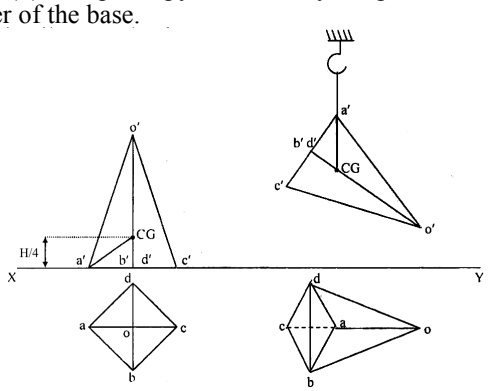


288. If a square pyramid is freely suspended from one of the corners of its base, then the imaginary line joining that corner with the centre of gravity of the pyramid will be

(a) Inclined at 60° with the vertical
(b) Inclined at 45° with the vertical
(c) Inclined at 30° with the vertical
(d) Vertical

ESE (Pre) 2017

Ans. (d) : Square pyramid freely suspended from a corner of the base.



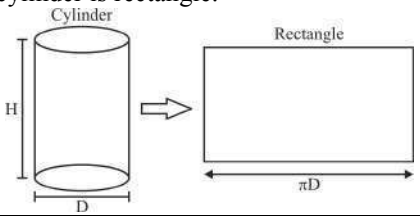
When a solid is freely suspended from a corner, then line joining point of contact & C.G. remains vertical.

289. Which one of the following statements is correct in the development of lateral surfaces of solids?

(a) The development of a right cone is a triangle
(b) Triangulation is the recommended method in the development of a prism
(c) The development of the lateral surface of a right circular cylinder is a rectangle
(d) The elements of an elliptical cone are equal in length

ESE (Pre) 2017

Ans. (c) : ■ Assume object hollow and mode-up of thin sheet cut open it from one side and unfold the sheet completely. The shape of that unfolded sheet is called development of lateral surface of that object or solid. Lateral surface is the surface excluding solid's top and base. The development of the lateral surface of right circular cylinder is rectangle.



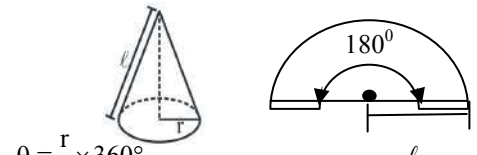
H = Height
D = Base diameter

290. If the development of the lateral surface of a cone is a semicircle, then

(a) The slant height of the cone < diameter of the base of the cone
(b) The slant height of the cone > diameter of the base of the cone
(c) The slant height of the cone = diameter of the base of the cone
(d) The slant height of the cone = radius of the base of the cone

ESE (Pre) 2017

Ans. (c) : The slant height of the cone = Diameter of the base of the cone.



$\theta = \frac{r}{\ell} \times 360°$

Now for semicircle, $\theta = 180^0$

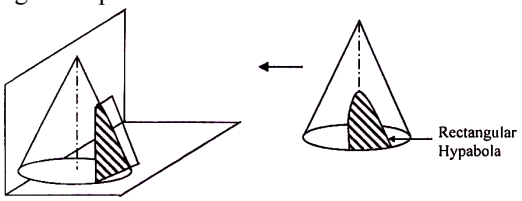
$\because \quad \ell = d = 2r$

291. A cone is resting with its base on HP. A section plane parallel to VP cuts the cone. The section plane is some distance away from the centre and does not pass through the apex. The true shape of the section is

(a) Hyperbola
(b) Rectangular Hyperbola
(c) Parabola
(d) Rectangular Parabola

ESE (Pre) 2017

Ans. (b) : When a cone is cut by a plane, the curve formed along the section is known as conic. If the angle α is less than θ (section plane D–D) the curve at section is hyperbola. The curve of intersection is hyperbola, even if $\alpha = \theta$, provided the section plane is not passing through the apex of the cone.



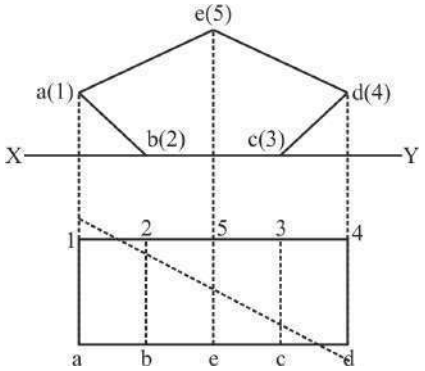
A Cutting plane parallel to axis of the cone not passing through vartex is rectangular hyperbola.

292. A pentagonal prism is lying on HP on one of its rectangular faces. When it is cut by a section plane, the largest possible section thereof has

(a) Five edges (b) Six edges
(c) Seven edges (d) Eight edges

ESE (Pre) 2017

Ans. (c) : Front base edges = 2 (c – d, d – e)
Rare base edges = 2 (1 – 2, 1 – 5)
Longer edges = 3 (2 –b, 5 – e, 3 – c)
Total 7 edges

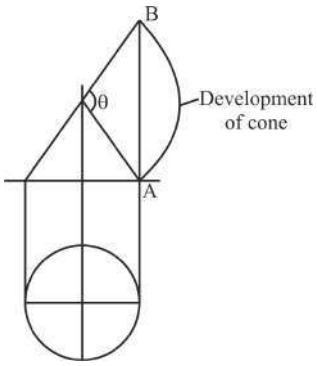


293. If a thread is wound around a cone, starting from a point on the base, and brought back to the same point, then the shortest possible length of the thread is equal to the

(a) Diameter of the base of the cone
(b) Slant height of the cone
(c) Largest chord of the development sector
(d) Length of the perpendicular from a corner of the development sector to the opposite edge

ESE (Pre) 2017

Ans. (c) :



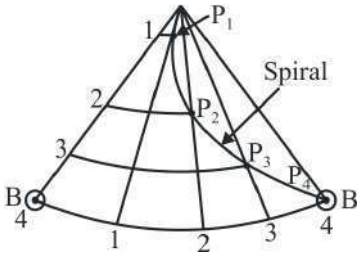
AB is the shortest possible length of the thread "chord of the development sector"

294. The locus traced by a point moving along a pendulum from one end to another, when the pendulum oscillates, is

(a) A spiral (b) An involute
(c) A cycloid (d) A helix

ESE (Pre) 2017

Ans. (a) :



If a line rotates in a plane about one of its and the same time, if a point moves along the line continuously in one direction, the curve traced out by the moving point is called spiral.

An involute is a particular type of curve that is dependent on another shape or curve.

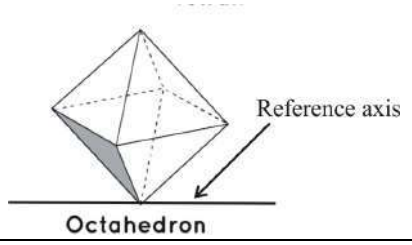
295. The plane which is inclined equally to the reference axis is called .....

(a) hexahedral plane (b) tetrahedral plane
(c) pentagonal plane (d) octahedral plane

(M.P. Vyapam 09.07.2017, 9 am)

Ans : (d) The plane which is inclined equally to the reference axis is called octahedral plane.

- An octahedron has 6 vertices 12 edges, and 8 faces,
- It is composed by 8 equilateral triangles, four of which meet at each vertex.
- In an octahedron, the planes are inclined equally to the reference axis.

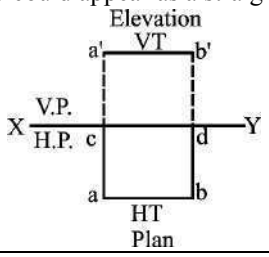


296. A square shaped plane which is lying on H.P. Its front view would appear as a -

(a) square of reduced size
(b) square of equal size
(c) rhombus
(d) straight line

(RRB JE (Shift-I), 29.8.2015)

Ans : (d) A square shaped plane which is laying on H.P. Its front view could appear as a straight line.



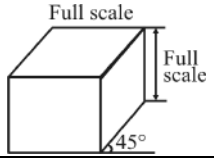
297. In the cabinet projection the ratio of the length of principal face lines and reducing lines is-

(a) 1:1 (b) 1:2
(c) 2:1 (d) 4:1

NTPC Fitter 2014

Ans. (c) : In the cabinet projection the ratio of the length of principal face lines and reducing lines is 2:1

- Projection lines make an angle with the projection plane, it becomes about half of both the axis by decreasing scale.



298. In Cavalier projection, the ratio between the lengths of the line of principal face and the reducing lines is-

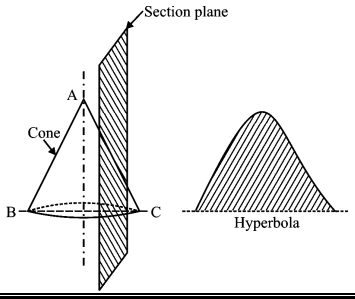
(a) 1:2 (b) 2:1
(c) 1:1 (d) 4:1

Vizag Steel Fitter 2015

Ans. (c) : The ratio of the lengths of the line of principal face and reducing lines in the Cavalier projection is 1:1.
Cavalier Projection: Projection lines make an angle of 45° with the plane of projection in full size.

299. A cone is cut by a section plane parallel to the profile plane, Its true shape of section is seen in-
(a) front view (b) top view
(c) side view (d) auxiliary view
BHEL Hyderabad Fitter 2014

Ans. (c) : If a cone is cut by a section plane parallel to the profile plane, Its true shape of section is seen in side view
- The size can be obtained only by its lateral observation.



EXAM POINTS

- Symmetric objects can be shown effectively using– **Half section**
- The cutting plane line indicates both the location of cutting plane and the direction of sight, the type of view is– **Auxiliary section**
- That surface which development method is used for sphere– **Zone and lune method**
- Zone method is used to develop– **Sphere**
- Development of surface is used in the development of– **Piping, Air conditioning duct, Buckets**
- A tetrahedron has four equal ..... faces– **Triangular**
- If a solid is cut by a cutting plane parallel to the base of the solid and top part is removed, the remaining part is called– **Frustum of solid**
- When a sphere is cut by a plane in such a way that section plane is parallel to the HP, the true shape of section is always a– **Circle**
- The distance a screw thread advances axially is one turn is– **Lead**
- Gear teeth formed on the flat surface are called– **Rack**
- Some objects are made by intersection of solids because intersection of solids give..... . **Leak-proof joint**
- When the cone is cut by a plane in such a way that plane makes the same angle with axis as do the generators the curve is a– **Parabola**
- The curve generated by a point on the circumference of a circle rolling along another circle outside is– **Epicycloid**
- If the ratio of distance from focus to that of from the directrix is less than one is called– **Ellipse**
- When the cone is cut by a plane in such a way that plane is parpendicular to axis, the curve– **Circle**
- A right circular cylinder is resting on HP on its base and it is cut by a section plane inclined to HP bisecting its axis. True shape of section is– **Ellipse**
- That method which is used to draw ellipse– **Concentric circle method, Oblong Method, Trammel method**

1.13 Oblique and Isometric view

300. Consider the following points while drawing the isometric view of any solid:
1. the isometric view should be drawn according to the given views and in such a way that maximum possible details are visible.
2. At every points for the corner of solid, at least three lines for the edges must converge. Of these, at least two must be for visible edges.
3. Two lines (for visible edges) will never cross other.
Which of the above statements are correct?
(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1,2 and 3
ESE (PRE) 2023

Ans. (d) : Isometric view is a two-dimensional representation of a three dimensional object that uses three axes to show the object dimensions and how its part fit together. In Isometric view all lines on each axis are parallel to each other and do not converge. The angles between the projection of the X, Y and Z axes are all the same angle of 120°. Two lines will never cross each other.

301. Which one of the following methods is used when the non-isometric lines of their ends line in isometric planes?
(a) Co-ordinate method (b) Box method
(c) Offset method (d) Visual
ESE (PRE) 2023, 2022

Ans. (b) : The box method is used when the non-isometric lines of their, ends line in isometric planes. The object is assumed to be enclosed in a rectangular box.

302. Oblique drawing has the following advantage over isometric drawing?
(a) Distortion can be increased by foreshortening measurements along the receding axis
(b) A greater choice is permitted in orthographic top view
(c) Circular of irregular outlines on the front face show in their true shape
(d) Oblique drawing is often less flexible
ESE (PRE) 2021

Ans. (c) : Circular or irregular outlines on the front face slow in their true shape.
Isometric projection- it is a type of pictorial projection in which the dimensions along the three axes of the solid are shown in one view and in true size.
Oblique Projection- It is a simple type of technical drawing of graphical projection used for producing two-dimensional images of three dimensional objects.

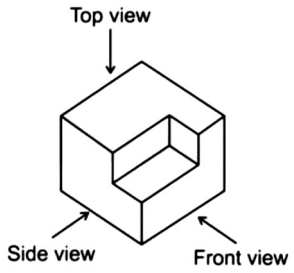
303. On a multi view drawing a visible or invisible line represents the following:

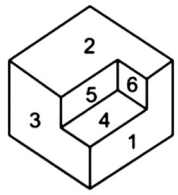
1. Intersection of two surface
2. Edge view of a surface
3. Limiting elements of as surface
Which of the above points are correct?

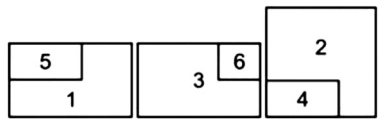
(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

ESE (PRE) 2021

Ans. (d) :







Form the front view, top view and side view we can get the intersection of many surfaces, edge view of any surfaces and limiting elements of surfaces. thus all three lines are possible in multi-view drawing.

304. In which one of following projection type, the object is kept in such a way that its three mutual perpendicular edges make equal angles with the plane of projection and the object stands on one of its corners?

(a) Non Isometric projection
(b) Oblique projection
(c) Isometric projection
(d) Point projection

ESE (PRE) 2021

Ans. (c) : Isometric projection is a technique for representing 3-D objects in 2-D. It's a type of axonometric projection where the three coordinate axes are equally foreshortened, and the angle between any two of them is 120.

Same characteristics of Isometric projection.

1. Equal Angles
2. Equal foreshortening
3. True dimensions
4. Preferred when three views are important

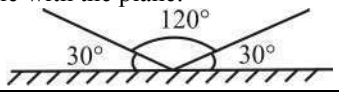
305. An isometric projection is a :

(a) To view in 2D
(b) To view in 3D
(c) To view in $2^{1/2}$D
(d) To view in perspective

(RRB JE Bhopal Paper-I (Shift-II), 28.08.2015)

Ans : (b) An isometric projection is a 3D view.

- Isometric projection is a type of axonometric projection
- In this projection method isometric axis are equipaced to each other at 120° and makes 30 ° angle with horizontal.
- In this projection, all the three face of a cube make equal angle with the plane.



306. While making isometric projection, the ellipse is preferably drawn by-

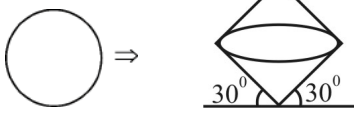
(a) concentric circle method
(b) four centered method
(c) parallelogram method
(d) System method

(RRB SSE (shift-II), 02.09.2015)

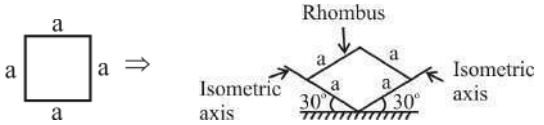
Ans : (b) While making isometric projection, the ellipse is preferably drawn by four centered method.

- In Isometric projection of an object, the dimension of its length and width are at an angle of 30° to the horizontal & dimensions of height are at 90° to the horizontal.
- In isometric view,

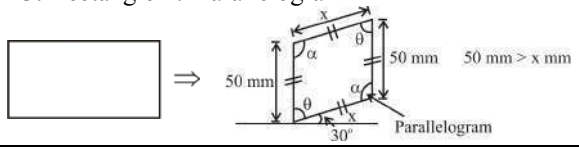
1. Circle ⇒ Ellipse



2.Square ⇒ Rhombus



3. Rectangle ⇒ Parallelogram



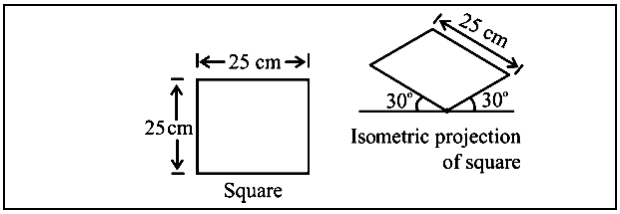
307. Which statement is NOT correct

(a) Isometric scale is used to draw isometric projection
(b) Isometric scale is not used to draw isometric projection
(c) A square is seen as rectangle in isometric
(d) A rectangle is seen as parallelogram in isometric

(RRB SSE Secunderabad (yellow), 21.12.2014)

Ans : (a) Isometric projection are drawn by real scales. Isometric scale is not used to draw isometric projection

- If the isometric projection of the rectangle is drawn, than a parallelogram is obtained and if we draw the projection, of a square we get a rhombus.



308. A circle is represented as a "top view", "front view" and "side view". If all these views are converted into isometric views then–

(a) All the three isometric view shall be same
(b)Isometric views of "front view" and "side view" shall be same
(c) "top view" and "front view" shall be same
(d) Neither the "top view", "front view" or "side view" shall be the same

(RRB SSE Secundrabad (Shift-I), 02.09.2015)

Ans : (d) In orthogonal projection, the top view, front view and side view of a circle will never be same as the isometric view.

- In isometric view only one projection of the circle is drawn and the projection of a circle becomes an ellipse.

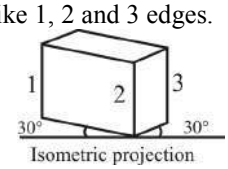
309. Vertical edges of an object appear in its isometric view as–

(a) Vertical
(b) Inclined at 30^0 clockwise
(c) Inclined at 30^0 counter clockwise
(d) Inclined at 15^0

(RRB JE (Shift-I), 29.8.2015)

Ans : (a) The isometric axis make 30° angle with horizontal or reference line.

- Vertical edges of an object appear in vertical in isometric view like 1, 2 and 3 edges.



- In isometric projection the projection of object is obtained in three dimensions (3D).

310. In comparison to an isometric projection, the appearance of an isometric view is :

(a) more accurate (b) More realistic
(c) smaller (d) larger

(RRB SSE (Shift-III), 01.09.2015)

Ans : (d) In comparison to an isometric projection, the appearance of an isometric view is larger.
Isometric view is easier to draw than isometric projection. It can also be drawn by free hand.

311. In Isometric Projection, those lines which are not parallel to isometric plane is ..... called.

(a) Projection line (b) Isometric line
(c) Non-Isometric line (d) None of these

RRB Kolkata Chemical & Metallurgical Er., 01.12.2002

Ans. (c) : In Isometric projection, those lines which are not parallel to isometric plane are called non isometric line.

- In isometric projection those lines which are parallel to isometric plane is called isometric line.

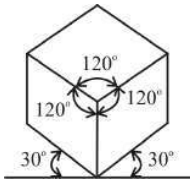
312. Isometric view is...

(a) 2D view (b) 3D view
(c) 4D view (d) 1D view

RRB Kolkata Jr. Engineer-II Electrical/DRG & Design 11.06.2006

Ans. (b) : Isometric view is a 3D view. Its all three dimension are equispaced each other at 120° and makes 30° angle with horizontal.

- All the three faces of cube make equal angles with the plane.

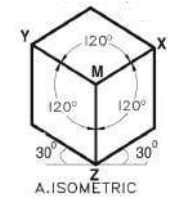
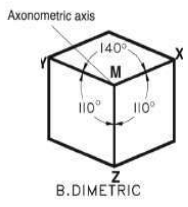
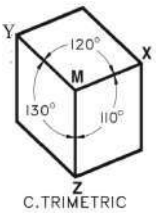


313. The view, in which all three faces of the cube make unequal angle with the plane is called -

(a) Dimetric view (b) Trimetric view
(c) Isometric view (d) Perspective view

RRB Secunderabad Section Engineer (Civil) 29.06.2008

Ans. (b) :

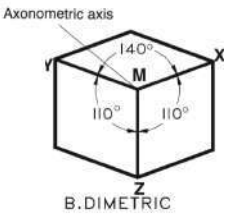
Isometric Projection	Dimetric Projection	Trimetric Projection
All the three faces of cube make equal angle with the plane.	Any two faces of cube make equal angles with plane.	All three faces of cube make unequal angles with plane.
 A.ISOMETRIC	 B.DIMETRIC	 C.TRIMETRIC

314. In which view, the two faces of cube make equal angles with the plane?

(a) Dimetric view (b) Trimetric view
(c) Isometric view (d) Perspective view

RRB Thiruvananthapuram Section Eng (Mechanical) 04.01.2009

Ans. (a) : In Dimetric view two faces of a cube make equal angles with the plane.

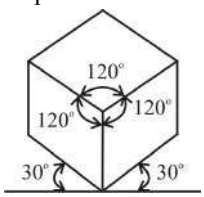


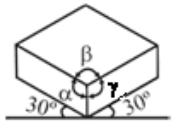
315. In which view the three faces of cube make equal angles with plane.

(a) Dimetric view (b) Trimetric view
(c) Isometric view (d) Perspective view

RRB Bangalore Section Engineer (Civil) 01.02.2009

Ans. (c) : In isometric view all the three faces of cube make equal angles with plane.

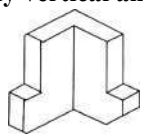




From the figure −

$\alpha = \beta = \gamma$

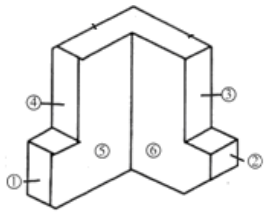
316. In the isometric view of the object there are many vertical and horizontal surfaces.



How many vertical surface in the given object ?

(a) 4 (b) 6
(c) 8 (d) 10

Ans : (c) There are total 8 vertical surfaces in the given figure.



- In this figure 6 vertical surfaces are marked by the number 1, 2, 3, 4, 5, 6 is shown. One vertical surfaces is behind the surface numbered 5 and one surface behind the surface number 6.

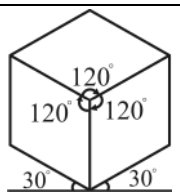
317. What is the angle between the three isometeric axis in isometric view ?

(a) 30^o (b) 60^o
(c) 90^o (d) 120^o

RRB Chennai Section Eng., 12.02.2012

Ans : (d) In isometric view, the angle between the three isometric axis is 120°

- Isometric views of objects are made to show as much as possible, typically with technical drawings.
- An isometric view is a type of drawing that shows an object as if it is viewed from a corner, with three axes equally inclined to the plane of projection.



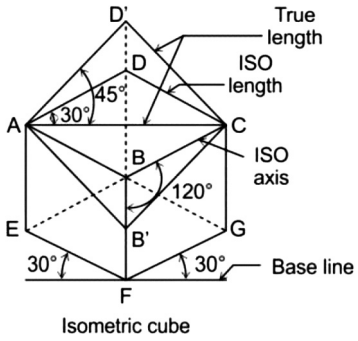
318. The Isometric plane which make an angle of 30° with the horizontal is called.

(a) Inclined projection
(b) Reference projection
(c) Orthogonal projection
(d) Isometric projection

DRDO Turner 2016

Ans. (d) : The Isometric plane which make an angle of 30° with the horizontal is called Isometric projection.

- In this projection method, isometric axis are equispaced to each other at 120° and makes 30° angle with horizontal.
- In this projection all the three faces of a cube make equal angle with the plane.



Isometric cube

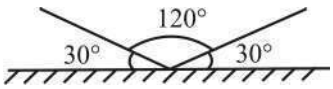
319. Characteristic of Isometric projection-

(a) 2D Projection (b) 3D Projection
(c) 4D Projection (d) 1D Projection

DRDO Motor Mechanic 2016

Ans. (b) : Isometric projection is a 3D projection, because there are 3 isometric axes with an angle of 120° between them and makes 30° angle with horizontal or reference line

- Isometric projection is a type of axonometric projection which axes are equispaced to each other.



320. The prospective projection is made at an angle of how many degrees from the horizontal ?

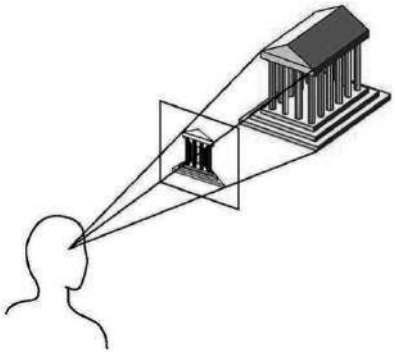
(a) 45^0–45^0 (b) $0 – 45^0$
(c) 30^0 –30^0 (d) $0 – 30^0$

DRDO Mechanic Diesel 2016

Ans. (a) : Prospective projection is also a type of pictorial projection. It is made at 45° angle from the horizontal plane.

- It is a natural view of an object which perceived by a human eye.
- As the distance of an object from the observer increases, its size in this projection view decreases.

- It is used by architects. This view is not usfull for manufacturing purpose or in industry.



321. What is the angle of object in the oblique projection ?

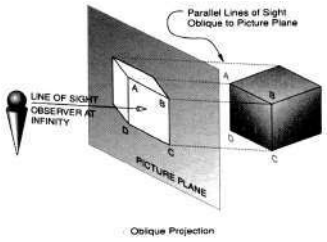
(a) 30^0 (b) 45^0

(c) 60^0 (d) Any of these

SAIL Bokaro Steel Plant 2016

Ans. (d) : One dimension of object is parallel to horizontal and other is vertical to horizontal and the third is at angle of 30° or 45° to the horizontal.

- In this projection the front face and faces parallel to front face are presented in true shape and size other is vertical to the horizontal and third side face is at an angle of 30°, 45° or 60° to the horizontal.



Oblique Projection

322. What is oblique projection or oblique drawing-

(a) Pictorial projection

(b) Orthographic projection

(c) Pictorial or orthographic projection

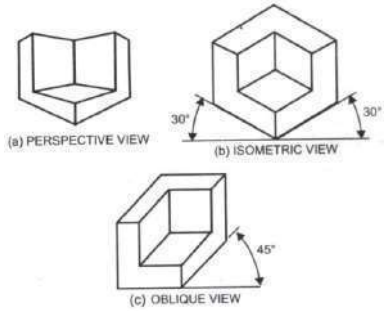
(d) None of these

BHEL Hyderabad Fitter 2014

Ans : (a) Oblique projection or oblique drawing is a pictorial projection.

- Some commonly used pictorial drawing (images) are the following -

1. Perspective view
2. Isometric view
3. Oblique view



323. In which projection, all the three faces of the cube make an unequal angle reference to the plane?

(a) Dimetric projection

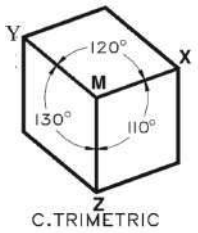
(b) Trimetric projection

(c) Isometric projection

(d) Perspective projection

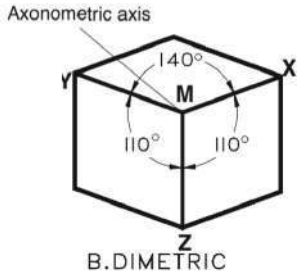
RRB Kolkata Supervisor (P.Way), 20.02.2000

Ans. (b) : In the trimetric projection, all three faces of the cube make unequal angle with the plan.



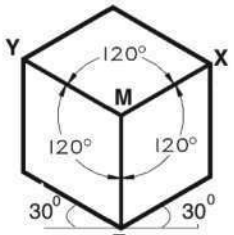
C.TRIMETRIC

- In diametric projection, the two faces of the cube make equal angles with the plane.



B.DIMETRIC

- In isometric projection, all three faces of the cube make equal angle with the plane.



A.ISOMETRIC

324. In isometric projection, a circle appears as

(a) An ellipse

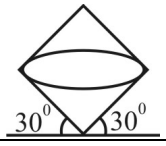
(b) An involute

(c) A cycloid

(d) A circle

RRB S.S.E. (Secunderabad) 02.09.2015 (Shift-I)

Ans : (a) A circle will appear on an isometric drawing as an ellipse. It can be derived by using four-centre method. In this method, a given circle is enclosed by a square.



02. Engineering Materials

2.1 Chemical Bonding

1. In case of insulating material the energy gap between valence band and conduction band is:

(a) very small (b) infinite
(c) very large (d) near to zero

UPPSC AE-2007 (General) P-I

Ans. (c) : In insulating materials, the energy gap between the valence band and the conduction band is very large. This large energy gap prevents electrons from easily moving from the valence band to the conduction band.

2. Consider the following statements regarding metallic bonding:

1. **The metallic sharing changes with time and the bonding electrons resonate between different atoms.**
2. **The metallic state can be visualized as an array of positive ions, with a common pool of electrons to which all the metal atoms have contributed their outer electrons.**
3. **These electrons have freedom to move anywhere within the crystal and act like an all-pervasive, mobile glue holding the ion cores together.**

Which of the above statements are correct ?

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

ESE (PRE) 2024

Ans. (d) : In metallic bonding the valence electrons are not bound to any particular atom in the solid and are more or less free to drift throughout the entire metal. Metallic bonding is responsible for many of a metals, Physical properties including its strength malleability, Conductivity, and luster. They may be thought of belonging to the metal as a whole, or forming a "sea of electrons" or an "electron cloud".

3. In the case of ionic bonding, the molecule is stable as long as the number of bonding electrons is

(a) Equal to the number of antibonding electrons
(b) Less than the number of antibonding electrons
(c) Greater than the number of antibonding electrons
(d) Equal to the number of antibonding neutrons

ESE (Pre) 2017

Ans. (c) : In the case of ionic bonding, the molecule is stable as long as the number of bonding electrons is greater than the number of antibonding electrons.

• Bond factor (BF) = $\frac{1}{2}$ (Bonding electrons in the molecule – antibonding electron in the molecule)

4. Consider the following assumptions made while developing the ionic packing theory:

1. **Cations and anions are spherical but these spheres are not hard.**
2. **Cations are always smaller than anions.**
3. **Each cation would tend to be surrounded by the maximum number of anions permitted by geometry.**
4. **Cations and anions do not touch each other.**

Which of the above assumptions are correct?

(a) 1 and 3 (b) 1 and 4
(c) 2 and 4 (d) 2 and 3

ESE (Pre) 2017

Ans. (d) : The theory that substances whose solution conduct an electric undergo electrolytic dissociation on dissolution. The assumption explains both the law of electrolysis and the abnormal collegative properties, such as osmotic pressure of electrolyte solution.
Electrolytes– A substance that dissolves in water to give an electrically conducting solution.
■ Arrhenius Ionic theory of solution is popular theory.

5. Match the following:

	LIST I		LIST II
A.	**Thompson**	**I.**	**The concept of converting mechanical work into heat**
B.	**James P. Joule**	**II.**	**The theory of relativity**
C.	**Max planck**	**III.**	**The energy characteristics of light**
D.	**Albert Einstein**	**IV.**	**The energy equivalence between heat, work and electric power**

Select the correct matching using the code given below :

	A	B	C	D
(a)	(iii)	(iv)	(i)	(ii)
(b)	(i)	(iv)	(iii)	(ii)
(c)	(iii)	(ii)	(i)	(iv)
(d)	(i)	(ii)	(iii)	(iv)

ESE (PRE) 2021

Ans. (b) : The correct match is following.

LIST I		LIST II	
A.	Thompson	I.	The concept of converting mechanical work into heat
B.	James P. Joule	II.	The energy equivalence between heat, work and electric power

C.	Max planck	III.	The energy characteristics of light
D.	Albert Einstein	IV.	The theory of relativity

6. **Statement (I) :** Atoms can neither be created nor destroyed.
Statement (II) : Under similar conditions of temperature and pressure, equal volumes of gases do not contain an equal number of atoms.
(a) Both Statement-I and Statement-II are individually true and Statement-II is the correct explanation of Statement-I
(b) Both Statement-I and Statement-II are individually true but Statement-II is not the correct explanation of Statement-I
(c) Statement-I is true, but Statement-II is false
(d) Statement-I is false, but Statement-II is true

ESE (Pre) 2018

Ans. (c) :
- According to Dalton's Atomic Theory; Atoms of one element cannot be changed into atoms of a different element by chemical reactions and atoms can neither be created nor destroyed in chemical reactions.
- Avogadro's law states that "equal volumes of all gases, at the same temperature and pressure, have the same number of molecules". For a given mass of an ideal gas, the volume and amount (moles) of the gas are directly proportional if the temperature and pressure are constant.

$$v \propto n$$

$$\left[\frac{v}{n} = k\right]$$

where, v = volume of gas
n = amount of gas
k = constant for a given temperature and pressure.

$$\left[\frac{v_1}{n_1} = \frac{v_2}{n_2}\right]$$

7. **A state for ionic compounds wherein there is the exact ratio of cations to anions as predicted by the chemical formula is**
(a) Electroneutrality (b) Stoichiometry
(c) Equiliometry (d) Frankel defect

ESE (Pre) 2019

Ans. (b) : Stoichiometry–It is defined as state for any compounds where in there is the exact ratio of cations to anions as predicted by the chemical formula.

$$\text{Stoichiometric Ratio of NaCl} = \frac{Na^+}{C\ell^-} = \frac{1}{1} = 1$$

8. **Stereoisomerism denotes the situation in which atoms are linked together :**
(a) In the different order and also differ in their spatial arrangement.
(b) In the different order but same in their spatial arrangement
(c) In the same order (head-to-tail) but differ in their arrangement
(d) In the same order (head-to-tail) and also same in their spatial arrangement

ESE (Pre) 2022

Ans. (c) : Stereoisomerism are isomers that differ in spatial arrangement of atoms rather than order of atomic connectivity. One of their most interesting type of isomer in the mirror image Stereoisomer's. A non-super imposable set of two molecules that are mirror image of one another.

9. **'Positive and negative ions by virtue of their net electrical charge, attract one another', these attractive bonding forces are**
(a) Coulombic (b) Magnetic
(c) Electromagnetic (d) Non-magnetic

ESE (Pre) 2022

Ans. (a) : Positive ion(cation) and negative ion (anion) attract one another with electrostatic force (columbic force) of attraction to form ionic bond.

10. **In which one of the following types of bonds, the bond formation is by free moving electrons in an array of positive ions ?**
(a) Homopolar bond (b) Electrostatic bond
(c) Metallic bond (d) Covalent bond

ESE (Pre) 2020

Ans. (c) : Metallic Bonds– In metals, each atom looses all its valence electrons and hence, becomes a positively charged ion. These valence electrons from an electron gas or cloud throughout the space occupied by the atoms. The valence electrons move freely within the crystal due to the influence of other atoms and are not bonded to individual atoms.

Metallic bonds are formed while sharing a variable number of electrons by a variable number of atoms. It is weaker than ionic bond and covalent bonds, but stronger than van der waals type bonds.

Covalent or Homopolar Bonds– A covalent bond is formed when two or more similar atoms form molecules by sharing their valence electrons. Therefore, it is called as homopolar or homonuclear bonding.

11. **Which of the following are the characteristics of covalent compounds ?**
1. They are mostly gases and liquids.
2. They are usually electric insulators.
3. They are directional in nature.
4. They are insoluble in polar solvents like water but are soluble in non-polar solvents.
(a) 1, 2 and 3 only (b) 1, 2 and 4 only
(c) 1, 3 and 4 only (d) 1, 2, 3 and 4

ESE (Pre) 2020

Ans. (d) : Characteristic of Covalent Compounds–
- Covalent bond is directional in nature.
- Gases, liquids or solids at room temperature.
- Low melting points and boiling points.
- Neither hard nor brittle.
- Soluble in organic solvents.
- Non-conductors of electricity.
- Exhibit iso merism.
- Molecular reactions and they are slow.

12. If the ionic radius of iron is 1.24 A, which of the following would be the approximate bond length in Fe-Fe?

(a) 1.24 A (b) 0.62 A
(c) 2.48 A (d) 0.31 A

UKPSC AE (Re-Exam) 14.08.2023, Paper-I

Ans. (c) : Fe-Fe bonds of lengths ranging from 2.13 to 2-73 $\mathring{A}$. Fe-Fe bond orders ranging from 0.5 to 2.

2.2 Crystallography

13. If the atoms or molecules in solid are periodical at regular intervals of distances in three dimensions, then that solid is known as:

(a) liquid crystals (b) crystalline solid
(c) amorphous solid (d) None of the above

FACT MT 2022

Ans. (b) : If the atoms or molecule in solid are periodical at regular intervals of distances in three dimensions, then that solid is known as crystalline solid.

14. Which of the following properties of solids are dependent on crystal imperfections?

1. Yield stress 2. Melting point
3. Semi-conductivity 4. Ductility

Select the correct answer using the codes given below.

(a) 1 and 3 (b) 1, 3 and 4
(c) 2, 3 and 4 (d) 2 and 4

UPPSC AE 13.12.2020 (I.E.) P-I

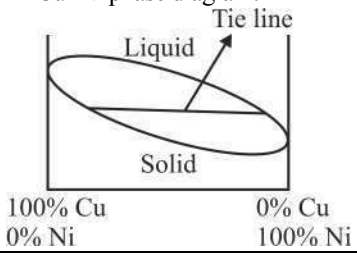
Ans. (b) : The properties of solids are dependent on crystal imperfections –
- Yield stress
- Semi conductivity
- Ductility

15. ***Statement (I):*** The tie line is constructed across the two-phase region at the temperature of the alloy.

Statement (II): The overall alloy composition is located on the tie line.

ESE (PRE) 2019

Ans. (b) :
- To find the composition of the individual phases in the two-phase region, a horizontal line called tie, line is drawn.
- The relative fractions of the phases at a given temperature for an alloy composition Co is obtained by the lever rule. This rule gives the fraction of a phase by the ratio of the lengths of the tie line between Co and composition of the other phase to the total length of the tie line. Ex–Cu–Ni phase diagram.



16. Statement (I) : The slip mode of deformation is the common mode in only one crystal at ambient and elevated temperature.

Statement (II) : A slip plane and a slip direction that lies on it together constitute as slip system.

ESE (PRE) 2021

Ans. (d) : Statement (I) is false but statement II is true. It means A slip plane and a slip direction that lies on it together constituted a slip system.

17. Consider the following statements regarding phase diagram rules for the crystal:

1. According to the gibbs phase rule, the degree of freedom, (F) = number of components (C) + number of phases (P) + 2.
2. The tie-line rule is applied to determine the compositions of two co-existing phases in a binary phase diagram.
3. In the lever rule, the tie-line at the temperature of interest is treated as a lever arm, with the fulcrum at the overall composition.

Which of the above statements are correct ?

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

ESE (PRE) 2024

Ans. (c) : According to Gibbs phase rule –

$$P + F = C + N$$

Where,

P = Number of phase
F = Degree of freedom
C = Numbers of Components forming the system
N = System variable
N = 2 → variable are temperature and pressure
N = 1 →variable temperature only

Lets take, N=2 (for alloy)

$$P + F = C + 2$$
$$F = C - P + 2$$

18. Consider the following statements regarding the gas carburizing:

1. Case depth can be obtained accurately.
2. More floor space is required than pack carburizing.
3. Process is rapid as less time is required than in pack carburizing.

Which of the above statements are correct?

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

ESE (PRE) 2024

Ans. (b) : Gas carburizing :- is almost similar to pack carburizing except for the part where the supply of carbon-mono oxide gas to the heated furnace and carbon decomposition.
- Gas carburizing is very Popular and widely used for case depth ranging from 0.2 mm to 0.3 mm.
- Possible to achieve narrow bonds of case depth requirement.
- Charcoal is used as carburizing agent in pack carburizing where so natural gas or propane used as carburizing agent in gas carburizing.

19. A screw dislocation

1. **Lies parallel to Burger's vector**
2. **Lies perpendicular to Burger's vector**
3. **Moves in a direction perpendicular to the Burger's vector**
4. **Moves in a direction parallel to Burger's vector**

Select the correct answer using the codes given below :

(a) 1 and 4 (b) 1 and 3
(c) 2 and 3 (d) 2 and 4

UPPSC AE 13.12.2020 (I.E.) P-I

Ans. (b) : A screw dislocation moves perpendicular to its Burger's vector and lies parallel to its Burger's vector. Also, the Burger's vector is parallel to the dislocation line.

20. A cation vacancy and anion vacancy in a crystal AB is called

(a) Schottky defect (b) Frenkel defect
(c) Pair of vacancies (d) None of the above

UPPSC AE 13.12.2020 (I.E.) P-I

Ans. (a) : A Schottky defect occurs when there is a pair of vacancies, one for a cation and one for an anion, in a crystal. This defect maintains the overall change neutrality of the crystal. In the case of a crystal AB, a cation vacancy and an anion vacancy together form a schottky defect.

21. Consider the following statements regarding the characteristics of covalent compounds and covalent solids:

1. **Covalent compounds are soluble in paraffin's.**
2. **Covalent solids do not form closed-packet structures because the covalent bonds are very strong and rigid.**
3. **The simplest covalent structure is that of diamond which is fairly open and empty and far from close-packed.**

Which of the above statements are correct?

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

ESE (PRE) 2024

Ans. (d) : • Covalent compounds are soluble in paraffin's.

• Covalent solids do not form closed-packet structures because the covalent bonds are very strong and rigid.

• The simplest covalent structure is that of diamond which is fairly open and empty and far from close-packed.

22. Which one of the following factors does NOT characterize the formation of non-crystalline structure?

(a) Presence of primary bonds in the directions
(b) Non-formation of three-dimensional primary bond
(c) Weak secondary bond
(d) Open network of the atomic packing

ESE (PRE) 2021

Ans. (a) : The factors characterize the formation of non-crystalline structure are:

- Non-formation of three-dimensions primary bond.
- Weak secondary bond.
- Open Network of the atomic packing.
- Non-crystalline solid do not have consistent arrangement of particles.
- Non-crystalline solid have well define geometrical shape, have short range order.

23. If a pair of one cation and one anion is missing in an ionic crystal such that those pairs of ions are equal to maintain electrical neutrality, then that pair of vacant sites is called :

(a) Schottky imperfection (b) pair of vacancies
(c) Frenkel defect (d) point imperfection

ESE (PRE) 2020

Ans. (a) : Schottky Imperfection– A pair of positive and negative ions missing from the interior place of the crystal structure is called schottky defect. These defects involve vacancies of pairs of ions of opposite charge in an ionic or ceramic crystal. Schottky imperfection is also called ion vacancy.

Frenkel Defects– In any ionic crystal, cations being smaller in size can occupy an interstitial close to its original site thus causing an error in the charge distribution and no net change in the electrical charge.

Point Imperfections– The point imperfections are zero-dimensional imperfections and these are restricted to one or two atomic diameters in the crystal lattice. This defect is completely localized at one point.

24. The density of α-Fe is 7.87×10^3 kg/m^3. Atomic weight of Fe is 55.8. If α - Fe crystallises in BCC space lattice, what is the lattice constant approximately? (Take Avogadro's numbers (N) = 6.02×10^{26}/kg mole and numbers of atoms per unit cell is 2)

(a) 0.666 Å (b) 1.766 Å
(c) 2.866 Å (d) 3.966 Å

ESE (PRE) 2023

Ans. (c) : Density of α - Fe = 7.87×10^3 kg/m^3 Atomic weight of Fe = 55.8

Avogadro's number $N_A = 6.02\times 10^{26}$ kg/mole number of atom per unit cell = 2

$$\rho = \frac{nA}{V_C\, NA}$$

$$V_C = \frac{nA}{\rho NA}$$

$$= \frac{2\times55.8}{7.87\times10^3\times6.02\times10^{26}}\ m^3$$

$a = 2.866\times10^{-10}$m

a = 2.866 Å

25. Which one of the following is NOT a classification of microscopic diffusion?

(a) Inter-diffusion (b) Vacancy diffusion
(c) Surface diffusion (d) Lattice diffusion

ESE (PRE) 2022

Ans. (b) : Microscopic diffusion– A kinetic phenomenon that results in the intermingling and homogenization of chemical component microscopic approaches are used to model surface interaction for short time scales.

• **Vacancy diffusion–** One vacancy position is shifting to another so there is no significant movement of atoms.

• **Surface diffusion–** Suppose two surface are in contact and still the atoms are moving from one surface to another. So there oho diffusion is taking place from one or two atomic distance only.

• **Lattice diffusion-** It is taking place within the gain so here also the movement in not significant.

• **Inter-diffusion-** In case of bi-materials alloy when we are mixing there material atoms of one method moves almost close to 150 to 200 atomic distance just to make the homogenization. Hence, in case of inter diffusion, movement of atoms is quite significant so it will not fall under microscopic diffusion.

26. Consider the following regarding their crystal structure :

1. Alpha iron **2. Aluminium**

3. Zinc **4. Nickel**

Which of these belong to FCC structure?

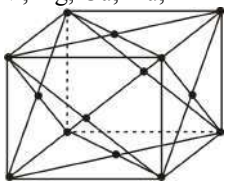
(a) 1 and 2 only (b) 2 and 4 only

(c) 3 and 4 only (d) 1, 2, 3 and 4

UPPSC AE 13.12.2020 (I.E.) P-I

Ans. (b) : Face centered cubic FCC:- In this arrangement, each face has an atom and corners are also occupied by atoms.

Ex. Al, Ni, Ag, Cu, Au,



27. The number of atoms per unit cell in a BCC structure is

(a) 2 (b) 4

(c) 9 (d) Infinite

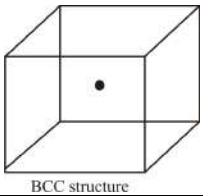
UPPSC AE-2007 (Special) P-I

Ans. (a) : For a body centered cubic structure

$$\text{Number of atoms per unit cell} = 1+\frac{1}{8}\times 8$$

$= 1 + 1$

$= 2$



BCC structure

28. The crystal structure of most of the common metals is

(a) cubic (b) rhombohedral

(c) tetragonal (d) triclinic

UPPSC AE-2007 (Special) P-I

Ans. (a) : The crystal structure of most of the common metals is cubic.

29. The imperfection in the crystal structure of metal is called

(a) slip (b) dislocation

(c) cleavage (d) impurity

UPPSC AE-2007 (Special) P-I

Ans. (b) : The imperfection in the crystal structure of metal is called dislocation. Dislocations are defects in the crystal lattice that allow deformation to occur more easily under stress.

30. The crystal structure of brass is

(a) BCC (b) FCC

(c) HCP (d) None of the above

UPPSC AE-2007 (Special) P-I

Ans. (b) : Brass, an alloy primarily composed of copper and zinc, typically has a face-centered cubic (FCC) crystal structure.

31. The crystal structure of the following material is not FCC:

(a) Tungsten (b) Copper

(c) Aluminium (d) Nickel

UPPSC AE-2007 (Special) P-I

Ans. (a) : Face centered cubic (FCC) In this arrangement, each face has an atom and corners are also occupied by atoms.

Ex. Al, Ni, Ag, Cu, Au,

32. Packing efficiency of Body Centred Cubic (BCC) crystal is

(a) 0.68 (b) 0.74

(c) 0.50 (d) 0.65

UPPSC AE -13.12.2020 P-I

Ans. (a) : Packing efficiency of BCC crystal:-

$$\text{Atomic packing factor} = \frac{\pi\sqrt{3}}{8}$$

$$= \frac{3.14\times 1.732}{8}$$

$$= 0.68$$

33. Twin boundaries are which type of crystal defect?

(a) Line defect (b) Point defect

(c) Surface defect (d) None of the above

UPPSC AE -13.12.2020 P-I

Ans. (c) : Twin boundaries are a type of surface defect in crystals. They occur when there is a symmetrical, mirror-like misorientation between two adjoining crystal lattices

34. Atomic radius of Face Centred Cubic (FCC) crystal is

a = lattice parameter

(a) $\frac{a\sqrt{2}}{4}$ (b) $\frac{a\sqrt{3}}{2}$

(c) $\frac{a\sqrt{3}}{4}$ (d) $\frac{a\sqrt{2}}{3}$

UPPSC AE -13.12.2020 P-I

Ans. (a) : Atomic radius of FCC crystal

$$r = \frac{a\sqrt{2}}{4}$$

Where a = lattice parameter

35. Which of the following phase of steel is NOT present in iron-carbon phase diagram?

(a) Ferrite (b) Cementite
(c) Austenite (d) Martensite

UPPSC AE -13.12.2020 P-I

Ans. (d) : Martensite is not present in the phase diagram of iron-carbon.
In the iron carbon phase diagram ferrite, cementite and austenite are present.

36. Solubility of two non ferrous metals both in liquid and solid states is governed by

1. Crystal structure
2. Relative size factor
3. Chemical affinity factor
4. Relative valency factor

Select the correct answer using the codes given below.

Codes:

(a) 2, 3 and 4 only (b) 1 and 4 only
(c) 1, 2 and 3 only (d) 1, 2, 3 and 4

UPPSC AE 29.05.2022 P-I

Ans. (d) : The solubility of two non-ferrous metals, both in liquid and solid states, is governed by four key factors according to the assumptions of Hume-Rothery's rules :
Relative size factor : The atomic radius difference between the metals should be less than 15%.
Relative valency factor : The valency of both metals should be identical.
Chemical affinity factor : The electron electronegativity and electron affinity of both metals should be similar.
Crystal structure factor : The crystal structures of both metals should be the same.

37. Crystal structure of γ iron is

(a) HCP (b) BCC
(c) BCT (d) FCC

UPPSC AE 29.05.2022 P-I

Ans. (d) :
When iron is cooled in the temperature range from 1400ºC to 910ºC, it forms the FCC (Face-Centered Cubic) structure, which is known as gamma iron (γ-Fe) or austenite.

38. The number of atoms per unit cell and the number of slip systems respectively for a Face Centered cubic crystal are

(a) 3, 12 (b) 4, 12
(c) 3, 3 (d) 4, 48

UPPSC AE 29.05.2022 P-I

Ans. (b) : Slip system: The combination of slip plane and its direction of slip is known as slip system

	No of atoms per unit cell	No of slip system
FCC	4	12
BCC	2	48
HCP	6	3

39. The effective number of lattice points in unit cell of simple cubic, body centered cubic and face centered cubic space lattices, respectively are

(a) 1, 2, 4 (b) 2, 3, 4
(c) 1, 2, 2 (d) 2, 4, 4

UPPSC AE 29.05.2022 P-I

Ans. (a) : Effective no of lattices point.
Simple – 1
Body centred cubic – 2
Face centred cubic – 4

40. The crystal structure of all the following materials is FCC except of

(a) tungsten (b) copper
(c) aluminium (d) nickel

UPPSC AE-2004 P-I

Ans. (a) : The crystal structure of all the following materials is FCC except of tungsten.

41. Vectorial sum of the Burger's vector of dislocations meeting at a nodal point is

(a) zero (b) 1
(c) – 1 (d) none of the above

UPPSC AE-2004 P-I

Ans. (a) : The Vectorial sum of the Burger's vectors of dislocation meeting at a nodal point is zero.

42. Co-ordination number of a crystalline solid is

(a) Number of atoms in unit cell
(b) Number of nearest neighbors to a given atom in the unit cell
(c) Number of face centered atoms in the cell
(d) None of the above

UPPSC Poly. Lect. 22.12.2021 P-I

Ans. (b) : Co-ordination number of a crystalline solid is number of nearest neighbors to a given atom in unit cell.

43. Number of effective atoms in a unit cell of HCP lattice is

(a) 1 (b) 2
(c) 3 (d) 6

UPPSC Poly. Lect. 22.12.2021 P-I

Ans. (d) : An a Hexagonal close – packed (HCP) lattice each unit cell contains 6 atoms. This is because each atom is surrounded by 12 nearest neighbors and each atom is shared by 6 unit cell.
Formula:- The total number of effective atoms in a unit cell of HCP lattice is-
2 (from corners) + 1 (from faces) + 1 (from center) + 2 (from the two additional atoms in the unit cell) = 6

44. In a eutectic system, two elements are completely

(a) insoluble in solid and liquid state
(b) soluble in liquid state
(c) soluble in solid state
(d) insoluble in liquid state

UPPSC Poly. Lect. 22.12.2021 P-I

Ans. (b) : In a eutectic system the two elements of components are completely soluble in the liquid state but exhibit limited or no solubility in the solid state. This results in the formation of a eutectic mixture, which solidifies at a lower temperature than either of individual components melting points.

45. Which of the undernoted statements is correct for ascending order of packing density of crystal structures of metals?

(a) Simple cubic -face centred cubic-body centred cubic
(b) Simple cubic - body centred cubic - face centred cubic
(c) Body centred cubic - simple cubic-face centred cubic
(d) Body centred cubic - face centred cubic-simple cubic

UPPSC AE 31.07.2010 P-I

Ans. (b) : The correct ascending order of packing density (Packing efficiency) for crystal structure of metals is

- Simple cubic – body centred cubic – face centred cubic

Simple cubic (SC):-

- Packing efficiency ≈ 52%
- Atoms are arranged with a lot of empty space.

Body Centred Cubic (BCC):-

- Packing efficiency ≈ 68%
- More efficient packing than simple cubic but still has some void spaces.

Face-Centred cubic (FCC):-

- Packing efficiency ≈ 74%
- The most efficient packing among these structures.

46. Which of the following structures has the highest packing factor?

(a) Simple cubic
(b) Body centred cubic
(c) Face centred cubic
(d) Body centred tetragonal

UPPSC AE 31.07.2010 P-I

Ans. (c) : Face-Centred Cubic (FCC)

- Packing Efficiency ≈ 74%
- Highly among these options as the atoms are packed most efficiently.

Hence, the face centred cubic (FCC) structure has the highest packing factor among the given options.

47. The elastic strain energy per unit length of dislocation having Burgers vector $\bar{b}$ is

(a) $G\bar{b}/2$ (b) $G\bar{b}^2/4$
(c) $G\bar{b}^2/2$ (d) $G\bar{b}/4$

UPPSC AE 31.07.2010 P-I

Ans. (c) : The elastic strain energy per unit length of dislocation having Burgers vector $\bar{b}$ is $G\bar{b}^2/2$.

48. The direction along the face diagonal of a unit cell of cubic crystal is denoted by

(a) [1 1 1] (b) [1 0 0]
(c) [1 1 2] (d) [1 1 0]

UPPSC AE 31.07.2010 P-I

Ans. (d) : The direction along the face diagonal of a unit cell of cubic crystal is denoted by :

	x	y	z
Intercepts	1	1	0
Reduced	1	1	0
Inclosing	1	1	0

The direction of face diagonal of unit cell is [110]

49. Which of the following phase of steel is NOT present in iron-carbon phase diagram ?

(a) Ferrite (b) Cementite
(c) Austenite (d) Martensite

UPPSC ITI Principal 09.01.2022

Ans. (d) : Martensite is not present in the equilibrium iron-carbon phase diagram because it forms under non-equilibrium conditions, typically through rapid quenching of austenite. It is a supersaturated solid solution of carbon is Body Centered Cubic (BCC) or body centered tetragonal (BCT) iron.

50. Austenite is a solid solution of carbon in

(a) Alpha iron (b) Beta iron
(c) Gamma iron (d) Delta iron

UPPSC ITI Principal 09.01.2022

Ans. (c) : Austenite is a solid solution of carbon in gamma iron (γ). Gamma iron is a the face- centered cubic (FCC) form of iron.

51. Eutectoid reaction occurs at 727 ^{0}C with 0.77% carbon is

(a) Austenite → ferrite + perlite
(b) Austenite → ferrite + martensite
(c) Austenite → ferrite + cementite
(d) Austenite → martensite + bainite

UPPSC ITI Principal 09.01.2022

Ans. (c) : Eutectoid reaction occurs at 727 ^{0}C with 0.77% carbon is,

Austenite → ferrite + cementite.

52. The direction of the line of intersection of the planes (111) and (112) is

(a) [0 1 2] (b) [1 1 0]
(c) [0 1 1] (d) [0 2 1]

UPPSC AE-2011 P-I

Ans. (b) : For the given planes:

1. Plane (111) has normal vector (1, 1, 2)
2. Plane (112) has normal vector (1, 1, 2)

Now, to find the direction of the line of intersection we calculate the cross product of these two normal vectors.

$N_1 = (1, 1, 1), N_2 = (1, 1, 2)$

The cross product is given by the determinant of the following matrix:

$$N_1 \times N_2 = \begin{vmatrix} i & j & k \\ 1 & 1 & 1 \\ 1 & 1 & 2 \end{vmatrix}$$

$N_1 \times N_2 = i\,(1\times2-1\times1) - j\,(1\times2-1\times1) + k\,(1\times1-1\times1)$

$= i - j + 0\,k$

Thus, the direction vector of the line of intersection is $(1, -1, 0)$

This corresponds to the crystallographic direction [110].

53. In a crystal, line imperfection is called

(a) frenkel defect (b) schottky defect
(c) edge dislocation (d) staking fault

UPPSC AE-2011 P-I
UPPSC AE 29.05.2022 (I.E.) P-I

Ans. (c) : A line imperfection in a crystal, specifically one that involving the misalignment of atomic planes, is called an edge dislocation. It involves an extra half-plane of atoms inserted into a crystal.

54. A particular Fe-C alloy contains less than 0.83% carbon. It is called

(a) hypoeutectoid steel (b) hypereutectoid steel
(c) high speed steel (d) cast iron

UPPSC AE 29.05.2022 (I.E.) P-I

Ans. (a) : In a Fe-C phase diagram, the eutectoid composition is 0.83% carbon, and alloys with less than this amount (but greater than 0.2% carbon) are classified as hypoeutectoid steels. These steels predominantly consist of ferrite with a small amount of pearlite.

55. Effective number of lattice points in the unit cell of simple cubic, body centered cubic and face centered cubic space lattices respectively are

(a) 1, 2, 2 (b) 2, 4, 4
(c) 2, 3, 4 (d) 1, 2, 4

UPPSC AE 29.05.2022 (I.E.) P-I

Ans. (d) : The effective number of lattice point in the unit cells of simple cubic, body-centred cubic and face-centred cubic lattices are 1, 2 and 4 respectively.

56. In a binary system of A and B, a liquid of 20% A is co-existing with a solid of 70% A. For an overall composition having 40% A, the fraction of solid is

(a) 0.50 (b) 0.60
(c) 0.40 (d) 0.75

UPPSC AE 29.05.2022 (I.E.) P-I

Ans. (c) : Given,
$C_L = 20\%$
$C_O = 40\%$
$C_S = 70\%$
We know that,

$$f_{solid} = \frac{C_L - C_O}{C_L - C_S} = \frac{20-40}{20-70}$$

$$= \frac{-20}{-50} = 0.40$$

57. Match List - I with List - II and select the correct answer using the code given below.

List-I (Materials)	List-II (Structure)
A. Charcoal	1. F.C.C.
B. Graphite	2. H.C.P
C. Chromium	3. Amorphous
D. Copper	4. B.C.C

Code:

	A	B	C	D
(a)	3	2	4	1
(b)	2	3	4	1
(c)	3	2	1	4
(d)	2	3	1	4

UPPSC AE 29.05.2022 (I.E.) P-I

Ans. (a) : In crystallography, crystal structure is a description of ordered arrangements of atoms ions or molecules in a crystalline material.
Different materials has different crystal structures:

Eg-	Material	Crystal structure
A-	Charcoal	Amorphous
B-	Graphite	H.C.P
C-	Chromium	B.C.C
D-	Copper	F.C.C

58. Which of the following factors govern solubility of two non-ferrous metals both in liquid state as well as in solid state?

1. Crystal structure
2. Relative size factor
3. Chemical affinity factor
4. Relative valance factor.
Select the answer using codes given below.
Code:

(a) 2, 3 and 4 only (b) 1 and 4 only
(c) 1, 2 and 3 on1y (d) 1, 2, 3 and 4 all

UPPSC AE 29.05.2022 (I.E.) P-I

Ans. (d) : Solubility of two non-ferrous metals both in liquid state as well as solid states when it followed the condition of "Hume Rothery rules.
Hume-Rothery condition for alloying-

- **Atomic size –** The atoms size gap between solvent and solute must not exceed 15%.
- **Valency factor –** The valencies of solvent and solute should be as such that they don't form any bonds.
- **Crystal structure –** Crystal structure of both solute and solvent should be same.
- **Electronegativity factor –** There should not be an appreciable gap into the electro-negativity of material otherwise the form ionic bond.

So, all the four factors governs solubility of two non-ferrous metals both in liquid as well as solid state.

59. Gold which has an atomic radius of 0.144 nm, crystallizes in a FCC structure. The lattice parameter of the gold is

(a) 0.407 nm
(b) 0.333 nm
(c) The same as the atomic radius
(d) 0.576 nm

UPPSC AE 29.05.2022 (I.E.) P-I

Ans. (a) : Given
Atomic radius of gold, r = 0.144 nm
For face unit cell,

$$a = 2\sqrt{2}r$$

Where, a = lattice parameter of cell

$$a = 2\sqrt{2} \times 0.14$$

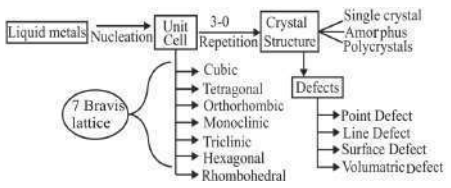
$$a = 0.407 \text{ nm}$$

60. How many space lattices does the Bravis lattices consist of ?

(a) 3 (b) 7
(c) 9 (d) 14

UPPSC AE 12.04.2016 P-I

Ans. (d) : There are 14 Bravis lattices is seven lattice system.



61. Schottky imperfection is a

(a) Point imperfection (b) Line imperfection
(c) Surface imperfection (d) Volume imperfection

UPPSC AE 12.04.2016 P-I

Ans. (a) : Schottky imperfection is a point imperfection from a regular lattice of cations & anions, if a cation goes missing then it is called as Frenkel defect but if a pair of cation and anions goes missing, it is called Schottky defect.

62. The co-ordination number for FCC crystal structure is

(a) 4 (b) 8
(c) 12 (d) 16

UPPSC AE 12.04.2016 P-I

Ans. (c) : The co-ordination number for FCC crystal structure is 12.

Crystal structure	Co-ordination number	Effective no. of atoms	APF	Examples
SC	6	1	0.52	Alpha-polonium
BCC	8	2	0.68	Mo, Ta, V, W, Cr, etc.
FCC	12	4	0.74	Pt, Si, Ni, Cu, Al, etc.
HCP	12	6	0.74	Mg, α-Ti, Zn, Be, Cd etc.

63. Which of the following constituents of steel is the most soft and the least strong ?

(a) austenite (b) pearlite
(c) ferrite (d) cementite

UPPSC AE-2007 (General) P-I

Ans. (c) : Ferrite is the constituent of steel which is most soft and the least strong.
Percentage of maximum carbon in ferrite iron is 0.0025. It has BCC crystal structure.

64. Which of the following properties of a solid are dependent on crystal in imperfections?

(i). yield stress
(ii). melting point
(iii). semi-conductivity
(iv). ductility

Select the answer using the codes given below:

(a) (i), and (iii) (b) (i), (iii) and (iv)
(c) (ii), (iii) and (iv) (d) (ii) and (iv)

UPPSC AE-2007 (General) P-I

Ans. (b) : Crystal imperfection is defects or irregularities in the structure of solid crystal.
Yield stress, semiconductivity, ductility of a solid are dependent on crystal imperfections.

65. Deformation in plastics occurs by:

(a) twin (b) slip
(c) yield (d) cross-linking

UPPSC AE-2007 (General) P-I

Ans. (b) : Plastic deformation of materials occurs due to slipping of atom in their crystal structure.

66. The number of effective atoms per unit cell in FCC structure is:

(a) one (b) four
(c) six (d) two

UPPSC AE-2007 (General) P-I

Ans. (b) : There are four effective number of atoms per unit cell in FCC structure.

67. Motion of an edge dislocation on a plane perpendicular to the glide plane is known as :

(a) cross slip (b) vacancy diffusion
(c) climb motion (d) creep

UPPSC AE-2007 (General) P-I

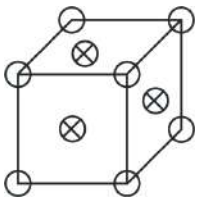
Ans. (c) : Motion of an edge dislocation on a plane perpendicular to the glide plane is known as climb motion.

68. What is the volume of an FCC unit cell in terms of its atomic radius R ?

(a) $\sqrt{3}R^3$ (b) $16R^3\sqrt{2}$
(c) $16R^3\sqrt{3}$ (d) $\sqrt{2}R^3$

ESE (Pre) 2018

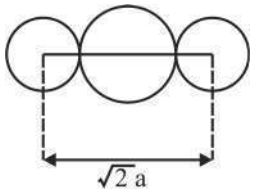
Ans. (b) : For FCC–



Unit cell = $6\times\frac{1}{2}+8\times\frac{1}{8}=4$

APF = 0.74

Relation between a and R



$$4R=\sqrt{2}a$$

$$a=\frac{4}{\sqrt{2}}\times R$$

$$a=\frac{\sqrt{2}\times\sqrt{2}\times 2}{\sqrt{2}}R$$

$$\boxed{a=2\sqrt{2}R}$$

$$\text{Volume}=a^3=\left(2\sqrt{2}R\right)^3=8\times 2\sqrt{2}\times R^3$$

$$\boxed{V=16\sqrt{2}R^3}$$

69. In which one of the following phase transformations, there are no compositional alterations?

(a) Incongruent transformations
(b) Congruent transformations
(c) Non-equilibrium transformations
(d) Equilibrium transformations

ESE (Pre) 2019

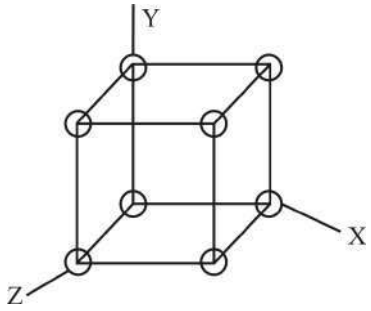
Ans. (b) : Phase Transformation– It is two type–
(a) **Congruent–**There are no chemical compositional alternation
(b) **Incongruent–** At least one of phase will change composition

70. In a simple cubic structure, atomic power factor is nearly

(a) 0.9 (b) 0.7
(c) 0.5 (d) 0.3

ESE (Pre) 2019

Ans. (c)



Effective no. of atom = $\frac{1}{8}\times 8 = 1$

Relationship between atomic radius (R) and lattice parameter (a)

$\boxed{a = 2R}$

Atomic packing factor

$$= \frac{\text{total volume of atoms inside unit cell}}{\text{volume of unit cell}}$$

$$= \frac{n \times \frac{4}{3}\pi R^3}{(2R)^3}$$

APF = 0.52

$\boxed{\%\,APF = 52\%}$

Note–Question is dropped by UPSC.

71. The number of atoms per unit length whose centres lie on the direction vector for a specific crystallographic direction is called

(a) Linear density (b) Theoretical density
(c) Atomic density (d) Avogadro number

ESE (Pre) 2019

Ans. (a)

Linear Density–Number of atoms per length whose centers lie on the direction vector for specific crystallographic direction.

$$\text{Linear density} = \frac{\text{Number of atoms centred on direction vector}}{\text{Length of direction vector}}$$

72. Which of the following features of atoms determine the degree to which the solute atoms dissolve in the solvent atoms?

1. Atomic size factor
2. Crystal structure
3. Electronegativity

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2 and 3

ESE (Pre) 2019

Ans. (d) : The Hume-Rothery rule are basic condition for an element to dissolve in metal–

1. The atomic radius of the solute and solvent atom must differ by not more than 15% for substitution alloy and solute atoms are much small in interstitial alloy
2. The solute and solvent should have similar electronegatives
3. Same crystal structure for pure material.

73. When the metal changes its crystal structure with respect to the temperature, it is known as __.

(a) Allotropy (b) Homogeneity
(c) Crystalline shift (d) Changeability

DSSSB AE (E&M) 08.03.2022 (Shift -II)

Ans. (a) : When the metal changes its crystal structure with respect to temperature, it is known as Allotropy.

Allotropes of Iron : At atmospheric pressure, three forms of iron exist at different temperature ranges and these forms are ferrite/alpha iron, Austenite/gamma iron and delta ferrite/ delta iron.

74. The coordination number of a simple cubic space lattice is-

(a) Six (b) Twenty
(c) Twelve (d) Eighteen

BDL Mech. 12.03.2023

Ans. (a) : In a simple cubic lattice, the co-ordination number is 6 and it contains 1 atom per unit cell.

Coordination number is the number of atoms, ions or molecules that a central atom or ion holds as its nearest neighbours in a complex or coordination number or in a crystal.

75. Who discovered crystal structure ?

(a) Erasmus Jacobs
(b) Nicholas-Jacques Conte
(c) Max von Laue
(d) A.L. Lavoisier

UKPSC AE (Re-Exam) 14.08.2023, Paper-I

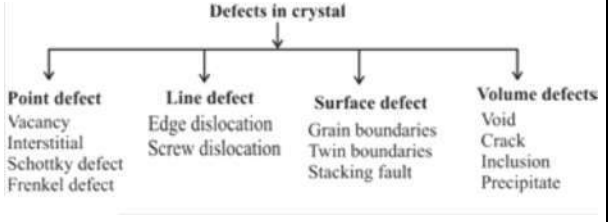
Ans. (c) : Max Von Laue was the German recipient of the Nobel Prize for physics in 1914 for his discovery of the diffraction of x-rays in crystals. This enabled scientists to study the structure of crystal and hence marked the origin of solid-state physics an important field in the development of modern electronics.

76. Which one of the following is not a crystal defect ?

(a) Grain boundary (b) Surface of the solid
(c) Ion formation (d) Vacancy

UKPSC AE (Re-Exam) 14.08.2023, Paper-I

Ans. (c) :



- So ion formation is not a crystal defect.

77. A cubic crystal system is represented by:

(a) $a = b = c \quad \alpha = \beta = \gamma = 90°$

(b) $a = b = c \quad \alpha = \beta = \gamma \neq 90°$

(c) $a = b \neq c \quad \alpha = \beta = \gamma = 90°$

(d) $a \neq b \neq c \quad \alpha = \beta = \gamma = 90°$

FACT MT 2022

Ans. (a) : A cubic crystal system is represented by-

$a = b = c$ and $\alpha = \beta = \gamma = 90°$

- For orthorhombic, parameter of unit cell

$a \neq b \neq c$ and $\alpha = \beta = \gamma = 90°$

- For rhombohedral , parameters of unit cell

$a = b = c$ and $\alpha = \beta = \gamma \neq 90°$

- For tetragonal parameters of unit cell.

$a = b \neq c$ and $\alpha = \beta = \gamma = 90°$

78. Atomic packing factor is maximum for:

(a) Prism (b) Simple cubic

(c) FCC (d) BCC

APPSC Tech. Asst. (Auto) 21.10.2022

Ans. (c) : The atomic packing factor is the highest for face centered cubic (FCC).

The atomic packing factor of different crystal structure is given in table.

Structure	Atomic packing factor
BCC	0.68
HCP	0.74
FCC	0.74
Diamond cubic	0.34
SC	0.52

79. Four atoms exist in a unit cell of _____ space lattice

(a) BCC (b) FCC

(c) HCP (d) Simple cubic

APPSC Tech. Asst. (Auto) 21.10.2022

Ans. (b) : Four atoms exist in a unit cell of FCC space lattice. Along with one atom at each Corner there is an atom on each face

$$n = 8 \times \frac{1}{8} + 6 \times \frac{1}{2}$$

$n = 4$ atoms

80. Which of the following is correct?

(a) Ferrite has FCC crystal structure.

(b) Ferrite has BCC crystal structure.

(c) Ferrite can dissolve 2% of carbon at room temperature.

(d) Ferrite has maximum solubility of carbon as 2% at 727ºC.

BHEL ET 24.08.2023

Ans. (b) :

- Ferrite has BCC crystal structure.
- The maximum solubility of Carbon in ferrite is 0.022%.

81. Rate of crystallization does not depend upon.

(a) Turbulence within the solution

(b) Number and active Surface area of the crystal

(c) Extent of super saturation

(d) None of these

IREL MT 24.09.2023

Ans. (d) : Crystallization is a separating technique that includes mass transfer from a liquid solution to a crystalline phase.

Rate of crystallization depend upon:

- Turbulance within the solution.
- Number and active surface area of the crystal.
- Extent of super saturation.

82. Which of the following materials exhibits piezoelectric behavior, allowing it to generate a voltage when mechanical stress is applied?

(a) Gray cast iron

(b) Stainless steel

(c) Quartz crystal

(d) Polyvinyl chloride

DSSSB Manager (DTC) 25.09.2023

Ans. (c) : Quartz crystal is exhibits piezoelectric behaviour :-

Piezoelectric Effect - It is the ability certain material to generate an electric change in response to applied mechanical stress.

Some piezoelectric materials are Quartz, Rochelle salt, Berlinite lead topaz.

83. A material is said to be allotropic if it has

1) fixed structure at all temperatures

2) atoms distributed in a random pattern

3) different crystal structures at different temperatures

(a) 3

(b) 1,2 and 3

(c) 2 and 3

(d) 1 and 3

JKPSC Lecturer (Auto). 15.11.2022

Ans. (a) : Allotropy or allotropism is the property of some chemical elements to exist in two or more different forms, in the same physical state, known as allotropes of the elements.

- It has different crystal structures at different temperature.

Allotropes or carbon include-

- Diamond
- Graphite
- Graphene
- Fullerenes

84. Twinning in a crystalline material is a result of:

(a) Phase transformation from one crystal structure to another

(b) A shear deformation that results in a mirrored lattice orientation

(c) Uniform plastic deformation throughout the material
(d) Slip along specific crystallographic places

DSSSB Manager (DTC) 25.09.2023

Ans. (b) : Twinning in a crystalline material is a result of a shear deformation that results in a mirrored lattice orientation.
Crystal twinning occurs when two seperate crystals share some of the crystal lattice points in a symmetrical manner . The result is an intergrowth of two seperate crystals in a variety of specific configurations.

Exam Points

- The type of diffusion of copper in Nickel is– **Self diffusion**
- That type of defect which has the presence of cations in the interstitial sites– **Frenkel defect**
- The ratio of atomic packing factor of FCC crystal to diamond cubic structure is– **2.176**
- The percentage of space occupied by copper atoms in a unit cell is– **74%**
- The number of axis in a hexagonal crystal is– **4**
- Some metals as well as non-metals may have more than one crystal structure, it is known as– **Polymorphism**
- Body centered cubic (BCC) space lattice is found in– **Alpha iron, tungsten, chromium and molybdenum**
- Consider following statements about solid state of a material. The molecules in a solid move– **Back and forth like tiny pendulums**
- That defect which arises due to dislocation in material– **Line defect**
- That methods which is used to examine crystal structure of a material– **X-ray techniques**
- A reversible change in the atomic structure of steel with corresponding change in the properties is known as– **Allotropic change**
- The crystal structure of alpha iron is– **Body centered cubic (BCC)**
- The recrystallization temperature can be lowered by– **Purification of metal**
- A material is known as allotropic or polymorphic if it– **Exists in several crystal forms at different temperatures**
- Hexagonal closed packed space lattice (HCP) is found in– **Zinc, Magnesium, Cobalt, Cadmium, Antimony and Bismuth**
- Gamma iron exists at– **Between 910°C and 1400°C**
- The most effective inhibitor of grain growth, when added in small quantities is– **Vanadium**
- Specify the Correct sequence in a heat treatment process for the crystalline materials– **Stress relief, recrystallisation, grain growth**

2.3 Electric Properties of Materials

85. The names of four materials have been given, select the one which has the least resistivity at 20^0C?
(a) Iron (b) Silver
(c) Glass (d) Nichrome

SSC JE 26.09.2019, Shift-II

Ans. (b) : Silver has the least resistivity in the given material.

TABLE OF ELECTRICAL RESISTIVITY FOR COMMON MATERIALS

Material	Electrical Resistivity at 20^0C (Ohm meter)
Aluminium	2.8×10^{-8}
Copper	1.7×10^{-8}
Gold	2.4×10^{-8}
Carbon (Graphite)	1.0×10^{-5}
Iron	1.0×10^{-7}
Lead	1.9×10^{-7}
Manganin	4.2×10^{-7}
Nichrome	1.1×10^{-6}
Silver	1.6×10^{-8}
Tin	1.1×10^{-7}
Tungsten	4.9×10^{-8}
Zinc	5.5×10^{-8}

86. Which of the following conductors has the lowest resistivity?
(a) Aluminium (b) Copper
(c) Gold (d) Silver

UPPCL JE 07.09.2021, Shift-I
NPCIL ST 2019 (Kakrapar)

Ans. (d) : Descending order of conductivity is given as follows

$$Ag > Cu > Au > Al$$

$$\because \text{ Conductivity } (\sigma) \propto \frac{1}{\text{Resistivity}(\rho)}$$

So, Ascending order of resistivity

$$Ag < Cu < Au < Al$$

87. Which of the following materials has the least resistivity?
(a) Iron (b) Brass
(c) copper (d) carbon

SSC JE 20.10.2020, Shift-I
UPPCL JE 25.11.2019, Shift-I
PGCIL Diploma Trainee 13.09.2018
SSC JE 2012

Ans : (c) The copper materials has the least resistivity.

Materials		Resistivity
Silver	–	$1.6 \times 10^{-8}\ \Omega$m
Iron	–	$9.7 \times 10^{-8}\ \Omega$m
Carbon	–	$5.8 \times 10^{-4}\ \Omega$m
Copper	–	$1.68\times10^{-8}\ \Omega$m

88. Which of the following materials has good conductivity?
(a) Silicon (b) Carbon
(c) Copper (d) Aluminium

PGCIL Diploma Trainee 14.11.2018

Ans : (c) In this option copper material has good conductivity

Table of resistivity and conductivity at 20^0C

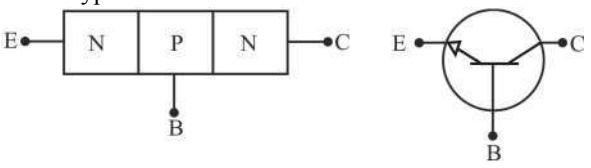
Material	$\rho(\Omega\text{-m})$ at 20^0C resistivity	σ at 20^0C conductivity
Silver	1.59×10^{-8}	6.30×10^7
Copper	1.68×10^{-8}	5.90×10^7
Gold	2.44×10^{-8}	4.10×10^7
Aluminium	2.82×10^{-8}	3.7×10^7

89. Which one of the following is correct in n-p-n transistor?

(a) Collectors and emitter terminals can be exchanged
(b) Collector is heavily doped, base width is small and emitter area is large
(c) Emitter, base and collectors regions are equally doped
(d) Emitter is heavily doped, base width is smalls and collectors area is large

ESE (PRE) 2021

Ans. (d) : N.P.N Transistor : It is formed by sand-witching a thin layer of p-type semiconductor between two N-type semiconductor.



Transistor Consists of three main regions i.e. emitter, Base, and collector.

Emitter (E) : It provides majority charge carriers by which current flows in the transistor.
therefore the emitter semiconductor is havily doped.

Base (B) :
The based region is thin and lightly doped.
It provides proper interaction between emitter and collector.

Collector (c) :
The size of the collector region is larger than the two other regions and it is moderately doped.
The main purpose of the collector is to collect majority charge carriers from the emitter.

90. Resistance temperature coefficient of copper at 20 ^{o}C is

(a) 0.0045/^{o}C (b) 0.0017/^{o}C
(c) 0.00393/^{o}C (d) 0.0038/^{o}C

SSC JE 2013

Ans: (c)

$\because$ Resistance at temperature T is

$$R_T = R_0 (1+ \alpha\Delta T)$$

Where,

R_0 = Resistance at 0°C
ΔT = temperature change
α = temperature coefficient of resistance

Copper is a conductor, hence α will be positive. The value of α is 0.00393/°C at 20°C.

91. The conductivity of aluminium as compared to copper is :

(a) 1 (b) 0.7
(c) 0.6 (d) 0.5

SSC JE 27.01.2018, Shift-II

Ans. (c) : The conductivity of Aluminium is lesser than that of copper and resistivity of Aluminium is high as compared to copper. The conductivity of Aluminium as compare to Cu is 0.6. Pure Aluminium has thermal conductivity of about 235 watt per kelvin per meter. Aluminium alloys can have much lower conductivities.

92. The value of free electron density of copper

(a) $16 \times 10^{28}/m^3$ (b) $1.69 \times 10^{19}/m^3$
(c) $8 \times 10^{28}/m^3$ (d) $8.5 \times 10^{28}/m^3$

DMRC JE 18.02.2017

Ans : (d) Free electron density of copper = 8.5×10^{28} / m^3
Resistivity of copper (ρ) = $1.72\times10^{-8}\Omega$-m

93. Resistivity of electrical conductors is affected by :

(a) temperature (b) pressure
(c) composition (d) all of the above

UPJN 2013

Ans : (d)

- Resistivity of electrical conductor is affected by temperature, pressure and composition also.
- The SI unit of resistivity is ohm-m (Ω-m) and it is represented by ρ.

$$\because\ R = \rho\frac{\ell}{A}$$

$$\boxed{\rho = \frac{RA}{\ell}}$$

94. The resistance of a copper conductor is --------.

(a) more than the resistance of Aluminium
(b) less than the resistance of silver
(c) more than the resistance of gold
(d) more than the resistance of silver

Vizag Steel JET 25.10.2018, Shift-II

Ans. (d) : The resistance of a copper conductor is more than the resistance of silver.

$$\because\ R = \rho\frac{\ell}{A}$$

$$\therefore R \propto \rho$$

Metal	Resistivity on (ohm-m) at Room temp.
Annealed Copper	1.72×10^{-8}
Silver	1.59×10^{-8}
Gold	2.44×10^{-8}
Aluminium	2.65×10^{-8}

95. The value of the resistance of an Aluminium conductor is ---------.

(a) Inversely proportional to its diameter
(b) Directly proportional to its area of cross section
(c) Inversely proportional to its length
(d) Directly proportional to its radius

Vizag Steel JET 25.10.2018, Shift-II

Ans. (a) : $R = \rho\frac{\ell}{A} = \rho\frac{\ell}{\frac{\pi}{4}d^2} = \frac{4\rho\ell}{\pi d^2}$

Resistance $R \propto \frac{1}{d^2}$

Where, d = diameter
ℓ = Length
ρ = Specific resistance

96. The value of the resistance of a copper conductor is ---------.
(a) Directly proportional to its area of cross section
(b) Directly proportional to its diameter
(c) Inversely proportional to its length
(d) Directly proportional to its length

Vizag Steel 25.10.2018 Shift-I

Ans. (d) : Resistance of conductor-

$$R = \frac{\rho\ell}{A}$$

Where, ρ = specific resistance,

$$R \propto \frac{\ell}{A}$$

$R \propto \ell$ and $R \propto \frac{1}{A}$

97. Which of the following element has maximum electric conductivity?
(a) Silver (b) Aluminium
(c) Copper (d) Stainless steel

WBPSC SAE 2003

Ans. (a) : Silver has maximum electric conductivity because silver has minimum resistivity (1.6×10^{-8} Ω-m).

98. ..... has zero temperature co-efficient of resistance.
(a) Carbon (b) Aluminium
(c) Porcelain (d) Manganin

UGVCL JE-2014

Ans. (d) : Manganin has zero temperature co-efficient of resistance. There is approximately no change in resistance with temperature we can consider the value of this coefficient as zero. The alloy of constantan and manganin has the temperature coefficient of resistance is nearly zero.

Manganin - 0.000002/°C
Aluminum - 0.0039/°C
Carbon - 0.0005/°C

99. Which property of an electrical conductor opposes the flow of current through it?
(a) Conductance (b) Resistance
(c) Reluctance (d) Permeance

SSC JE 10.12.2020, Shift-II
SSC JE 25.01.2018, Shift-II

Ans : (b) According to the diagram, in figure (a), we see that resistance opposes the current flowing in the circuit. The property of resistance is to oppose the current.

$\boxed{V = IR}$ Here, I = Current

$\left[I \propto \frac{1}{R}\right]$ R= Resistance

V= Voltage

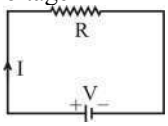


Fig (a)

100. Ohm is the S.I. unit of .....
(a) Capacitance (b) Inductance
(c) Resistance (d) Conductance

SSC JE 25.01.2018, Shift-II

Ans : (c) The S.I. unit of Resistance is ohm. It is represented by the symbol (Ω)
Unit of capacitance: Farad (F)
Unit of Inductance : Henry (H)
Unit of conductance : Mho ($\mho$)

101. Unit of conductance is-
(a) mho (b) Siemens
(c) both (d) none of these

SSC JE 27.01.2018, Shift-II
Vizag Steel JET 27.10.2018
UPSSSC JE 31.07.2016

Ans : (c) The unit of conductance is both mho and Siemens. The conductance of a conductor is inversely proportional to its resistance. Conductance is the property of circuit or material that helps in the flow of electric current.

$$\text{Conductance (G)} = \frac{1}{\text{Resistance (R)}}$$

$$G = \frac{1}{R} = \frac{1}{\rho}\times\frac{a}{\ell}$$

$$G = K\frac{a}{\ell} \qquad \text{Where, } K = \frac{1}{\rho}$$

Where, K is specific conductance (conductivity) of material.

102. For best conductivity, which type of copper is suitable?
(a) Pure annealed copper (b) Silicon mix copper
(c) Politer type of copper (d) Hard type of copper

UPPCL JE 07.09.2021, Shift-I

Ans. (a) : Pure annealed copper has best conductivity. When copper is heat treated its ductility is increases to make the copper soft and flexible. The process of heat treating is known as annealing. Annealed copper has increased conductivity.

103. Which of the following is the reciprocal of resistivity?
(a) Reluctivity (b) Susceptibility
(c) Conductivity (d) Permittivity

SSC JE 25.01.2018, Shift-I

Ans : (c) We know that the inverse of Resistivity is conductivity.

$$\left[\text{Resistivity} = \frac{1}{\text{conductivity}}\right]$$

unit of Resistivity = Ω-m(ohm-meter)
So unit of conductivity = (mho/meter)

104. The SI unit of conductivity is-

(a) Ohm-m (b) Ohm/m
(c) Mho-m (d) Mho/m

DSSSB JE 14.03.2021, Shift-I
NPCIL ST 2019 (Kakrapar)
MPMKVVCL (Bhopal) JE 2018
UPPCL JE 2018, Shift-II
Vizag steel JET 25.10.2018, Shift-II
UPPCL JE 27.08.2018, Shift-I
SSC JE 22.01.2018, Shift-I
HPSSB JE 2017 (Post code-579)
KPTCL JE 2015
SSC JE 2014, Shift-I
PGCIL Diploma Trainee 14.11.2011

Ans. (d) : The SI unit of conductivity is Mho/m.

$\because \quad R = \frac{\ell}{\sigma A}$

So, $\sigma = \frac{\ell}{RA} = \frac{\text{meter}}{\text{ohm}(\text{meter})^2}$

$= (\text{ohm meter})^{-1}$

$= \text{mho/meter} \qquad \because \Omega^{-1} = \text{mho}$

105. Resistance of a conductor is directly proportional to its-

(a) Length (b) Area
(c) Velocity (d) Pressure

NPCIL ST 2019 (Kakrapar)

Ans. (a) : Material property of resistance is defined

As $\boxed{R = \frac{\ell}{\sigma A}}$

Where

ℓ = length of the conductor

A = cross section area of conductor

σ = conductivity of conductor

Hence $\boxed{R \propto \ell}$

106. Electric charge is equal to :

(a) I t (b) I/t
(c) I^2t (d) I^2/t

Kerala PSC Draftman 2016, Grade II

Ans. (a) : Electric charge is the basic physical property of material that causes it on experience a force when kept in an electric or magnetic field.

$\boxed{Q = I.t}$ Coulomb

107. Unit of electric charge is:

(a) Tesla (b) Henry
(c) Coulomb (d) Farad

SSC JE 27.01.2018, Shift-I
UPPCL JE 27.08.2018, Shift-I
Kerala PSC Asst: Gr. II Electrical Inspectorate 2015
SSC JE 2013

Ans. (c) : The SI unit of electric charge is the Coulomb, which is defined as an ampere second.

$Q = I \times t$

108. Which of the following type of resistors has highest value of temperature coefficient?

(a) Wire wound (b) Carbon film
(c) Metal film (d) Carbon composition

DMRC JE 20.02.2020

Ans. (c) : Metal film resistors has highest value of temperature coefficient from given option.

109. Capacitance is the ability of a body to store an _____.

(a) Electrical charge (b) Electric current
(c) Voltage (d) All of the above

DGVCL JE 2016

Ans. (a) : Capacitance is the ability of a body to store an electrical charge.

$Q = CV$

$\therefore C = \frac{Q}{V}$

Where,

C = Capacitance
Q = Charge
V = Voltage

In other words, capacitance is a measure of charge per unit voltage that can be stored in a capacitor.

110. The SI unit of energy is:

(a) Joule (b) Newton
(c) Coulomb (d) Henry

DGVCL JE 2016

Ans. (a) : The SI unit of energy is Joule.
commercial unit of energy is Kilo watt hour

1 kWh = 1000 watt × 60×60 sec.
$= 3.6 \times 10^6$ watt sec.
$= 3.6 \times 10^6$ J

111. One kilowatt-hour is?

(a) 3.6 mega joules (b) 2.6 mega joules
(c) 1.6 mega joules (d) None of the above

DGVCL JE 2016

Ans. (a) : 1 kWh = 1000×3600 Joules
$= 3.6 \times 10^6$ Joules
= 3.6 mega Joule

112. 1 Joule of electrical energy equals:

(a) 1 watt. sec (b) 1 watt
(c) 1 watt/sec (d) 1 volt ampere

DMRC JE 2018, Shift-I

Ans. (a) : Energy consumed in electrical power system is-

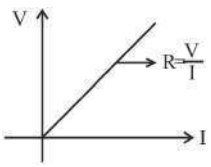
$E = P \times t$
Joule = watt.sec
1 Joule = 1 watt.sec

113. The ratio of voltage and current in a closed circuit :

(a) Varies (b) Remains constant
(c) Increases (d) Decreases

FCI JE 2015

Ans. (b) : According to Ohm's law, resistance is defined as the ratio of voltage and current. This ratio is always remain constant for closed circuit.



114. Which of the following has negative temperature coefficient of resistance?

(a) Silver (b) Copper
(c) Aluminum (d) Silicon

FCI JE 2015

Ans. (d) : Ag, Cu & Al are conducting material so they have + ve temperature coefficients.
Silicon (Si) is semiconductor material, so they have –ve temperature coefficient.

115. Electricity is a form of:

(a) Energy (b) Shock
(c) Lightening (d) Spark

Kerala PSC Asst: Gr. II Electrical Inspectorate 2015

Ans. (a) : Electricity is a form of energy. i.e. from one form of energy is converted into the other form of energy or from mechanical to electrical and from electrical to mechanical energy. Ex. motor, generator etc.

116. Electrically charged atom is generally termed as:

(a) Iron (b) Isotope
(c) Ion (d) Cations

Kerala PSC Asst: Gr. II Electrical Inspectorate 2015

Ans. (c) : When the atom becomes electrically charged, this is called an ion.

117. Conductors have _____ specific resistance.

(a) High (b) Low
(c) Very high (d) No

Kerala PSC Asst: Gr. II Electrical Inspectorate 2015

Ans. (b) : Conductors have low specific resistance. Good conductors have less resistivity.
For Example- Gold, Copper, Aluminium etc.

118. If length and area of cross-section is doubled, then new resistance of wire will

(a) Increases four times (b) Decrease four times
(c) Remains constant (d) Changes at random

HPSSSB JE-2017 (Post code- 579)
UPPCL JE 2015

Ans. (c) : We know,

$$R = \rho\frac{\ell}{A}$$

Where ρ = resistivity of material
ℓ = length of wire
A = cross section area

$\because \ell_{new} = 2\ell$ and $A_{new} = 2A$

$$R_{new} = \rho \times \frac{\ell_{new}}{A_{new}}$$

$$\therefore R_{new} = \rho\frac{2\ell}{2A}$$

$$= \rho\frac{\ell}{A}$$

Hence, resistance of both condition is same i.e. it remains constant.

119. The heat produced in an electric heater is termed as

(a) Apparent power
(b) True power
(c) Reactive power
(d) True and reactive power

HPSSSB JE-2017 (Post code- 579)

Ans. (b) : The true power is responsible for heat generated in an electric heater. Actual amount of power being used, or dissipated in circuit is called true power. It is measured in watts.

120. The temperature coefficient of resistance is negative for

(a) Tungsten (b) Steel
(c) Tin (d) Carbon

UPPCL JE 07.09.2021, Shift-I
HPSSSB JE-2017 (Post code- 579)
Kerala PSC Draftman 2016, Grade II
ESIC JE 2016 / ISRO TA 2016
WBPSC SAE 2003

Ans. (d) : Carbon has negative temperature coefficient of resistance.
Negative temperature coefficient of a material that means its resistance decreases with increase in temperature. Carbon is semiconductor material and semiconductor shows negative temperature coefficient of resistance.

121. The conductivity of a metal is determined by

(a) The no. of valance electrons per atom.
(b) The electrons concentration and mobility of the free electrons.
(c) Both (a) & (b)
(d) None of these.

HPSSSB JE 2018 (Post code 663)

Ans. (b) : The conductivity of a metal is determined by the electrons concentration and mobility of the free electrons.
The factor on which electrical conductivity of metal depends on-
- Number of free electron
- Their drift velocity through metal on applied electric field.

122. Which of the following is a linear component?

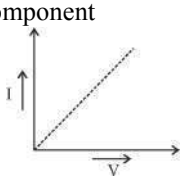
(a) Diode (b) Transistor
(c) Resistor (d) None of these

KPTCL JE 2015

Ans. (c) : According to ohm's Law

$$R = \frac{V}{I} = \text{Constant}$$

Resistor is linear component



A linear resistor is one whose resistance doesn't vary with the flow of current through it. The current through it will always be proportional to the voltage applied across it.

123. Which of the following is likely to have a positive temperature coefficient?

(a) Rubber (b) Germanium
(c) Mercury (d) None of these

KPTCL JE 2015

Ans. (c) : A positive temperature coefficient refers materials that experiences an increase in electrical resistance when their temperature is raised.

- Conductor have positive temperature coefficient
- Insulators and semiconductors have negative temperature coefficient.

Rubber-insulator
Germanium- semiconductor
Mercury-conductor

Here, mercury have a positive temperature coefficient.

124. Which of a the following are the passive elements?

(a) Resistor (b) Bulb
(c) Both (a) and (b) (d) None of the above

GSSSB SI 08.04.2018

Ans. (c) : A passive element is an electrical component that does not generate power, but instead dissipated, stores and/or releases it. Passive element include resistances, capacitor's and inductors.

125. Which one of the following units is a fundamental unit?

(a) Newton (b) Ampere
(c) Watt (d) Joule/sec

GSSSB SI 08.04.2018

Ans. (b) : Quantities independent of other physical quantities are known as fundamental physical quantities. There are 7 fundamental physical quantities–
(i) Length (meter)
(ii) Mass (kilogram)
(iii) Time (second)
(iv) Electric current (ampere)
(v) Temperature (Kelvin)
(vi) Amount of substance (mole)
(vii) Luminous intensity (candela)

126. Electric charge of a body is a condition due to:

(a) Deficiency or excess of neutrons
(b) Deficiency of electrons
(c) Deficiency or excess of electrons
(d) Excess of electrons

DMRC JE 18.02.2017

Ans : (c) The reason for the charge on the body is deficiency or excess of electrons. An atom gets an electric charge when it gains or loses electrons. In an independent state an atom is neutral because the number of electrons and protons are equal but the charge of opposite nature. Due to equal and opposite charge whole atom is neutral.

127. 1 Volt =_____.

(a) 1 Joule/ 1 Coulomb
(b) 1 Watt/ 1 Ohm
(c) 1 Joule / 1 Watt
(d) 1 Watt / 1 Coulomb

DMRC JE 18.02.2017

Ans : (a) One volt is defined as the electric potential or (electric pressure) between two points of a conducting wire when an electric current of one ampere dissipates one watt of power between those points.

$$\text{e.m.f.} = \frac{\text{Work done}}{\text{Charge}}$$

$$= \frac{W}{Q}\ \text{Joule/coulomb}$$

128. Permittivity of vacuum is:

(a) 9×10^{9}F/m (b) 8.854×10^{-12}F/m
(c) $4\pi \times 10^{-7}$F/m (d) 8.987×10^{-9}F/m

DMRC JE 18.02.2017

Ans : (b) Vacuum permittivity is denoted by ε_0. And it is given by–

$$\boxed{\varepsilon_0 = 8.85 \times 10^{-12}}\ \text{F/m}$$

129. What is the charge of a stable atom?

(a) uncharged
(b) positivity charged
(c) negatively charged
(d) charged positive or negative

JUVNL JE-2017

Ans. (a) : Atom is smaller particle of an element which takes part in chemical reaction. All substances are made up of atoms. Each atom consists of the following
1. Nucleus 2. Electrons
The charge of a stable atom is uncharged.

130. A conductor provides a path for flow of current in circuit due to the property of:

(a) conductance (b) resistance
(c) inductance (d) reluctance

JUVNL JE-2017

Ans. (a) : Conductance (G) is reciprocal of resistance. Conductance is the property of conductor. A conductor is a material which gives very little resistance to the flow of an electric current. The unit of conductance is the Siemens.

$$R = \rho\frac{l}{A}$$

$$G = \frac{1}{\rho}.\frac{A}{l} = \frac{\sigma A}{l}$$

131. What is an electric current?

(a) The power that moves the electrons
(b) The random movement of electrons in a conductor
(c) The pressure difference between two poles
(d) The movement of free electrons predominantly in one direction

NPCIL Stipendiary Trainee 2016

Ans. (d) : Electric current is the movement of free electrons predominantly in one direction.

$$\boxed{i = \frac{q}{t}}\ \text{Amp}$$

132. In electrical energy one Horse Power = _____:

(a) 436 W (b) 746 W
(c) 647 W (d) 1000 W

NPCIL Stipendiary Trainee 2016

Ans. (b) : In electrical energy one Horse Power is equal to the 746 W.
1 HP = 746 W.

133. Which of the following has the highest value of thermal conductivity?

(a) Aluminium (b) Brass
(c) Copper (d) Iron

SSC JE 24.01.2018, Shift-II

Ans. (c) : The highest value of thermal conductivity is 380-400 W/mK degrees for copper. The minimum value of thermal conductivity is solid ice.

134. Potential difference is measured in ……..

(a) Watt (b) Joule
(c) Volts (d) Ampere

SSC JE 27.01.2018, Shift-II

Ans. (c) : Potential difference is measured in volt whereas power is measured in watt and energy is measured in Joule and current is measured in Ampere. Potential difference is the difference in the amount of energy that charge carries having between two points in a circuit. It is also called voltage.

135. At what level of current flow during electric shock death is possible :

(a) 1 to 8 milli amp (b) 50 to 100 milli amp
(c) 10 to 20 milli amp (d) 20 to 50 milli amp

SSC JE 27.01.2018, Shift-II

Ans. (b) : 50 to 100 milli Ampere current flow during electric shock causes to death. Ventricular fibrillation is the most common cause of death in electric shock. An electric shock may cause burn or it may leave no visible mark on the skin. Under certain circumstances, even a small amount of electricity can be fatal.

136. When in dry condition human body resistance is around :

(a) 100KΩ (b) 10KΩ
(c) 1KΩ (d) zero

SSC JE 27.01.2018, Shift-II

Ans. (a) : The NIOSH (National Institute for Occupational Safety and Health) states "Under dry conditions, the resistance offered by human body may be as high as 100000 (100kΩ). Wet or broken skin may drop the body's resistance to 1000 ohm adding that high voltage electrical energy quickly breaks down human skin reducing human body resistance to 500Ω.

137. The resistivity of a conductor depends upon…..

(a) pressure
(b) temperature
(c) degree of illumination
(d) shape of cross–section

SSC JE 23.01.2018, Shift-II

Ans : (b) The resistivity of conductor depends upon temperature because the value of resistance coefficient changed with change in temperature.

$$R_t = R_0(1+\alpha_0 t)$$

$t = {}^0C$ (in centigrade)

α_0 = Resistance temperature coefficient

138. The curve representing Ohm's law is :

(a) Linear (b) Hyperbolic
(c) Parabolic (d) Triangular

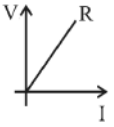
SSC JE 2009

Ans. : (a) The curve representing ohm's law is linear

$V \propto I$

$V = R.I$

$\boxed{R = \frac{V}{I}}$ [R = constant]



139. Specific resistance of a conductor depends upon:

(a) Dimension of the conductor
(b) Composition of conductor material
(c) Resistance of the conductor
(d) Both (a) and (b)

SSC JE 2009

Ans. : (b) Specific resistance of a conductor depends upon composition of conductor material and temperature also.

- Specific resistance does not depend on dimension of the conductor.
- **Resistivity or Specific resistance** - $(\rho) = \frac{RA}{\ell}$

The resistivity of a material is the resistance of a wire of that material of unit length and unit cross-sectional area.

140. Change in the frequency of supply does not affect the

(a) Dielectric heating
(b) Electrical resistance heating
(c) Induction heating
(d) Microwave heating

TSPSC AEE 2017

Ans. (b) : Electrical resistance heating does not affect in change in frequency because the property of resistor does not depends on frequency.

141. Dielectric heating is not used for

(a) preheating plastic performs
(b) heating of glass for glass working
(c) sterilizing surgical instruments
(d) wood gluing and glue line heating

UPPSC AE 2011, Paper-I

Ans. (c) : Dielectric heating- Dielectric heating is a non conducting material which can be polarized in the presence of electric field. They have ability to store energy when external electric field applied. A dielectric is always an insulator. Therefore dielectric heating is not used for sterilizing surgical instruments.

142. The dielectric losses occur in all solid and liquid dielectric due to

(a) Conduction current
(b) Hysteresis
(c) Both Conduction current & Hysteresis
(d) None of these are correct

MPPSC AE 2016

Ans. (c) : Solid and liquid dielectric have same resistance so there is conduction losses along with hysterisis loss.

143. The temperature independent polarization is

(a) Orientation polarization
(b) Space discharge polarization
(c) Electronic polarization
(d) Space charge polarization

Rajasthan Nagar Nigam AE 2016, Shift-I

Ans. (c) : The temperature independent polarization is electronic polarization..

144. Materials which are electrical insulators and in which an electric field can be sustained with a minimum dissipation of power can be named as

(a) Magnetic materials (b) Semi-conductors
(c) Super conductors (d) Dielectric materials

Rajasthan Nagar Nigam AE 2016, Shift-I

Ans. (d) : Dielectric materials are electrical insulators and in which an electric field can be sustained with a minimum dissipation of power in electric field, it works as conductor.

145. Which of the following capacitors is polarized?

(a) Mica (b) Ceramic
(c) Plastic Film (d) Electrolytic

GOA PSC Poly. Tech. Lect. 2019

Ans. (d) : The electrolytic capacitor is designed with polarity and managed to achieve a high amount of capacitance.

146. The ceramic dielectric used in electrical engineering includes:

(a) Porcelain and cermet
(b) Silicide and cordierite
(c) Cermet and silicide
(d) Cordierite and porcelain

UPPCL AE 2015

Ans. (a) The ceramic dielectric used in electrical engineering includes porcelain and ceramic.

147. Materials having high dielectric constant, which is non-linear, are called

(a) Hard dielectrics
(b) Ferroelectric materials
(c) Paramagnetic materials
(d) Super dielectrics

UPPCL AE 2015

Ans. (b) Materials having high dielectric constant, which is non linear are called ferroelectric materials.

148. Which of the following materials has the maximum dielectric strength?

(a) Soft rubber (b) Polystyrene
(c) Porcelain (d) Glass

UPPCL AE 2015

Ans. (a) Soft rubber material has the maximum dielectric strength. A perfect vacuum has the highest dielectric strength. Rated at 1×10^{12} MV/m

149. Polarization of a radio wave is taken as the:

(a) Normal to the direction of magnetic field
(b) Direction of magnetic field in space
(c) Normal to direction of the lines of force in the electric field
(d) Direction of the lines of force in the electric field.

UPPCL AE 2015

Ans. (d) Polarization of radio wave is taken as the direction of lines of force in the electric field.

150. For an insulating material, dielectric strength and dielectric losses should be, respectively.

(a) High and high (b) Low and high
(c) High and low (d) Low and Low

UPSC JWM 2017
ESE 2000

Ans. (c) : For insulating materials dielectric strength is high so, it can withstand maximum electric field without failure of dielectric strength and dielectric loss should be low because more dielectric loss results in more heat in dielectric material.

151. Which of the following capacitors have the least breakdown voltage?

(a) Ceramic (b) Paper
(c) Mica (d) Electrolytic

LMRC AM 2018

Ans. (d) : The dielectric strength of the electrolytic material is very less than the other type of dielectric materials. Hence, it has least value of breakdown voltage.
Thus, electrolytic capacitor have the least breakdown voltage.

152. When an alternating voltage of a given frequency is applied to a dielectric material, dissipation of energy occurs due to

1. Continual change in the orbital paths of the electrons in the atomic structure
2. A small conduction current through the dielectric
3. Eddy currents

Which of the above statements are correct?

(a) 1, 2 and 3 (b) 1 and 2 only
(c) 1 and 3 only (d) 2 and 3 only

ESE 2018

Ans. (b) : In dielectric material, The dissipation of energy takes place due to following causes :–

1. Continual change in the orbital paths of electrons due to AC fields.
2. A small conduction current through the dielectric. No eddy current losses in dielectric.

153. Dielectric materials are essentially.

(a) Insulating materials
(b) Conducting materials
(c) Semi conducting materials
(d) Ferro electric materials

MPPSC AE 2017
WBPSC AE 2012

Ans. (a) : Dielectric materials are essentially insulators, which means that no current will flow through the materials when a voltage is applied across a dielectric object, it becomes polarized.

154. Consider the following statements:

1. Superconductors exhibit normal conductivity behaviour above a transition temperature T_c.
2. Superconductors lose their superconducting nature in an external magnetic field, provided the external magnetic field is above a critical value.
3. High T_c superconductors have T_c values in the range 1 to 10 K.

Which of the above statements are correct?

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

ESE 2017

Ans. (a) : High temperature, super conductor conducts electricity with zero electrical resistance at temperature above boiling point of liquid nitrozen i.e. 63.15 K so, statement 3 is incorrect.
Rest are correct.

155. Superconductivity is a material property associated with
(a) Changing shape by stretching
(b) Stretching without breaking
(c) A loss of thermal resistance
(d) A loss of electrical resistance

ESE 2017

Ans. (d) : Super conductivity is the ability of certain materials to conduct electric current with practically zero resistance.

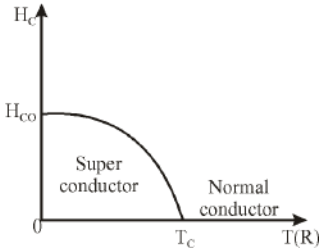
156. Consider the following statements:
1. The critical magnetic field of a superconductor is maximum at absolute zero.
2. Transition temperature of a superconductor is sensitive to its structure.
3. The critical magnetic field of a superconductor is zero at its critical temperature.
4. Superconductors show very high conductivity below the critical temperature?

Which of the above statements are correct?
(a) 1, 2 and 3 only (b) 1, 2 and 4 only
(c) 2, 3 and 4 only (d) 1, 3 and 4 only

ESE 2017

Ans. (d) : Critical magnetic field of super conductor

$$H_C = H_{C_0}\left[1-\left(\frac{T}{T_C}\right)^2\right]$$



H_C = magnetic field at T K
H_{C_0} = magnetic field at 0 K
T_C = Critical temperature.
From above equation we may conclude
(i) at absolute zero, H_C = maximum = H_{C_0}
(ii) at $T = T_C$, $H_C = 0$
(iii) at $T < T_C$, material exhibits superconductivity
Hence, statements 1, 3, 4 are correct.

157. Super conductors are becoming popular for use in.
(a) Manufacturing of memories.
(b) Generating a very strong magnetic field.
(c) Generating a very strong electrostatic field.
(d) Generating regions free from magnetic field.

MPPSC AE 2017
ESE 2011

Ans. (a) : Super conductors are becoming popular for use in manufacturing of memories. Super conductors magnets used in magnetic resonance imaging (MRI) and nuclear magnetic resonance (NMR) machines, and beam-steering and focusing magnets used in particle accelerators.

158. A superconductor may be used for generating
(a) Voltage (b) Pressure
(c) Temperature (d) Magnetic Field

HPSSSB JE 2018 (Post code 663)
ESE-2011

Ans. (d) : A superconductor may be used for generating magnetic field. In superconducting materials, an electric current will flow without any resistance and therefore can conduct much larger electric current than ordinary wire, creating intense magnetic fields. Superconducting magnets can produce greater magnetic fields than all.

159. Which of the following materials has the highest resistivity?
(a) Polystyrene (b) Aluminium
(c) Silicon (d) Carbon

APGCL JM 2021
ESE-2003

Ans : (a) The order of resistivity in descending order is given as-
Polystyrene>Carbon>Silicon>Aluminium

160. Silver metal is a _____ of electricity.
(a) good conductor (b) superconductor
(c) semiconductor (d) bad conductor

PSPCL JE 2019, Shift-I

Ans. (a) : Silver is a metal with the symbol 'Ag' and atomic number 47. Silver is lustrous, soft, very good conductor of electricity but it is not used widely for electrical purposed due to expensive.

161. The electric breakdown strength of insulating materials depends on-
(a) Nature of applied voltage
(b) Imperfection of dielectric material
(c) Pressure, temperature and humidity
(d) All of these

PGVCL JE 2015

Ans. (d) : Dielectric strength or breakdown voltage–
It can be expressed in minimum electrical stress that will result in breakdown of material under some conditions.
It can be reduced by aging, high temperature, moisture pressure, Imperfection of dielectric material, humidity and nature of applied voltage etc.

Dielectric strength/breakdown voltage = $\boxed{\frac{V}{t}kV/mm}$

V = Breakdown potential
t = thickness of material
kV/mm = S.I. unit of breakdown voltage

162. With the rise of temperature, dielectric strength of material
(a) increase (b) remain constant
(c) decreases (d) becomes zero

MIZORAM PSC (PHED) 2019, Paper-I

Ans. (c) : The dielectric strength of a material is a measure of the electrical strength of an insulation it is defined as the maximum voltage required to produce a dielectric breakdown through the material and is expressed in terms of volt per unit thickness. The higher the dielectric strength of a material the better an electrical insulator it makes.

- When temperature increases, dielectric strength of material decreases.

163. Quartz and $BaTiO_3$ exhibit which of the following properties?

(a) Magnetostriction (b) Ferromagnetism
(c) Piezoelectricity (d) Ferroelectricity

ESE-2009

Ans. (c) : Quartz and $BaTiO_3$ both are piezoelectric material so exhibits piezoelectricity property.
Piezoelectric materials:-
Quartz, Ba Ti O_3, Pb Ti O_3, Pb Zr O_3, KH_2PO_4

164. The following material is not used for making a piezoelectric transducer

(a) Rochelle salt (b) Barium titanate
(c) Chromium sulphide (d) Quartz

ESE-2012

Ans. (c) : Common Piezo-electric materials are Rochelle salt, ammonium dihydrogen phosphate, lithium sulphate Barium titanate, quartz and ceramics so, the given option chromium sulphide is not used for making a piezoelectric transducer.

165. Dielectric strength of rubber is around

(a) 3 kV/mm (b) 10 kV/mm
(c) 30 kV/mm (d) 300 kV/mm

SSC JE 22.01.2018, Shift-II

Ans : (c) Dielectric strength of rubber is around 30kV/mm. rubber is an insulating material, which is used in cable for insulation. Rubber, PVC, XLPE etc. are used for voltage below than 1kV, whereas paper is used for voltage above 1kV.

166. The resistance of an aluminium conductor is ----.

(a) less than the resistance of silver
(b) less than the resistance of copper
(c) less than the resistance of iron
(d) more than the resistance of iron

Vizag Steel JET 27.10.2018

Ans. (c) : Resistivity of silver $\Rightarrow 1.59 \times 10^{-8}\Omega.m$
Resistivity of Copper $\Rightarrow 1.68 \times 10^{-8}\Omega.m$
Resistivity of Aluminum $\Rightarrow 2.65 \times 10^{-8}\Omega.m$
Resistivity of Iron $\Rightarrow 9.70 \times 10^{-8}\Omega.m$
So, the resistance of an Al is Less than resistance of iron.

167. Which is the best conductor of electricity?

(a) Copper (b) Aluminium
(c) Gold (d) Silver

Vizag Steel 25.10.2018 Shift-I

Ans. (d) : Silver is the best conductive material but it is more costly so normally in transmission line we use aluminium conductor and for windings we use copper conductor.

168. Dielectric constant of air is _____.

(a) Less than 1 (b) Equal to 1
(c) Can't be determined (d) Zero

UPPCL JE 2018, Shift-II
KPTCL JE 2015

Ans. (b) : Dielectric constant or relative permittivity (ε_r)

Material	Dielectric constant
Air	1
Asbestos	2
Mica	4-8
Glass	5-12

169. Which of the following materials has the highest value of dielectric constant?

(a) ceramics (b) oil
(c) glass (d) vacuum

PGCIL NR-III, 22.08.2021
UPSSSC JE 31.07.2016

Ans : (a) Ceramic materials has the highest value of dielectric constant.

Material	Dielectric Constant
Ceramic	38
glass	5-12
mica	4-8
oil	3
vaccum	1
impregnated paper	5

170. The unit of dielectric strength is given by

(a) V/m (b) V^2/m
(c) m/V (d) m/V^2

UPSSSC JE 31.07.2016

Ans : (a) The property of a substance that opposes dielectric break is called a dielectric strength. In other words, that is the highest kV/mm force in which the medium remains fine without dissolving is called dielectric strength. It is expressed in volt/meter.

171. In super conductivity, the electrical resistance of material becomes

(a) zero (b) negative
(c) infinite (d) finite

RSMSSB JEN (PHED)Degree 26.12.2020

Ans. (a) : In super conductivity the electrical resistance of material becomes zero and conductivity is infinite. When super conducting material is cooled below its critical temperature its resistance reduces suddenly to zero.

172. What is the thermal conductivity of nichrome?

(a) 15.5 $Wm^{-1}K^{-1}$ (b) 11.3 $Wm^{-1}K^{-1}$
(c) 25 $Wm^{-1}K^{-1}$ (d) 20.7 $Wm^{-1}K^{-1}$

RRB JE 30.08.2019 Shift-II

Ans. (b) : The thermal conductivity of nichrome is 11.3 $Wm^{-1}K^{-1}$.

Property	Value	Units
Melting point	1400	^0C
Electrical resistivity at room temperature	1.0×10^{-6} to 1.5×10^{-6}	Ωm
Specific heat	450	$Jkg^{-1}K^{-1}$
Thermal conductivity	11.3	$Wm^{-1}K^{-1}$

173. _____ is an example of a high-resistivity material.

(a) silver (b) Nichrome
(c) Copper (d) Gold

UPPCL JE 27.08.2018, Shift-II

Ans. (b) : Nichrome is a highly resistive material. It is used for heating element.
Composition:-
Ni (55-78)%+Cr (15-23)%+1.5% Mn+Remaining %Fe.

174. Dielectric strength of insulting oil is:

(a) 40 kV (b) 4 kV
(c) 400 V (d) 40 V

UJVNL JE 2016

Ans. (a) : Dielectric strength of insulating oil is 40 kV.

175. Superconductivity is a material property associated with

(a) Changing shape by stretching
(b) Stretching without breaking
(c) A loss of thermal resistance
(d) A loss of electrical resistance

ESE 2017

Ans. (d) : Super conductivity is the ability of certain materials to conduct electric current with practically zero resistance.

176. Super conducting materials can be used for

(a) ore refining.
(b) magnetic levitation in high speed trains.
(c) medical resonance imaging.
(d) All of the above

UKPSC JE 2013, PAPER-I

Ans. (d) : Super conducting materials can be used -
(i) ore Refining
(ii) magnetic levitation in High speed trains.
(iii) medical resonance imaging.

177. For an ideal current source, the internal resistance is:

(a) infinite and connected in parallel
(b) zero and connected in parallel
(c) infinite and connected in series
(d) zero and connected in series

HPSSC JE 08.08.2021
GPSC AAE, CLASS-3, 25.07.2021
UPPSC AE 13.12.2020, Paper-I
MPMKVVCL (Bhopal) JE 2018
RPSC Lect. (Tech. Edu. Dept.) 09.01.2016

Ans. (a) : For an ideal current source the internal resistance is infinite and connected in parallel, such that ideal current source provide constant current irrespective of load.

178. The reactance of 1 farad capacitance when connected to DC circuit is:

(a) Infinite (b) 1Ω
(c) 0.5Ω (d) 0Ω

NPCIL ST 2019 (Kakrapar)

Ans. (a) : At steady state, capacitor behaves as an open circuit for D.C.
Hence in open circuit condition reactance will be infinite or current on capacitor will be zero.
Also f = 0 for D.C.

$$X_c = \frac{1}{2\pi fC} = \frac{1}{2\pi \times 0 \times 1} = \infty$$

179. Capacitance of a capacitor is given by:

(a) $C = \frac{\varepsilon_0 \varepsilon_r d}{A}$ (b) $C = \frac{\mu A}{d}$
(c) $C = \frac{A}{d}$ (d) $C = \frac{\varepsilon_0 \varepsilon_r A}{d}$

Vizag Steel MT 13.12.2020
DMRC JE 2018, Shift III

Ans. (d) : The capacitance of a parallel plates capacitor can be given by-

$$C = \frac{\varepsilon_0 \varepsilon_r A}{d}$$

Where, ε_0 = Absolute permittivity
ε_r = Relative permittivity
A = Area of each plate
d = Distance between plates
Capacitance is measure in Farad.

180. Which type of resistor is used for over voltage protection:

(a) Sensistors (b) Thermistors
(c) Varistors (d) Inductor

FCI JE 2015

Ans. (c) : Varistors also called variable resistors is used to over voltage protection. A varistor is an electronic component with an electrical resistance that varies with the applies voltage, Also known as voltage dependent resistor (VDR). Varistors are a type of resistor with a non-linear, non-ohmic current voltage characteristics and are a reliable and economical means of providing protection against over voltage transient and surges.
Metal oxide varistor, are typically made from a small disk-shaped metal zinc oxide material.

181. The hot resistance of the filament of a bulb is higher than the cold resistance because the temperature coefficient of the filament is

(a) Negative (b) Infinite
(c) Zero (d) Positive

HPSSSB JE 2018 (Post code 663)

Ans. (d) : The hot resistance of the filament of a bulb is higher than the cold resistance because the temperature coefficient of the filament is positive.

182. Which of the following does not effect the capacitance of a capacitor?

(a) Distance between the plates
(b) Area of the plates
(c) Type of dielectric medium
(d) Thickness of the plates

KPTCL JE 2015

Ans. (d) : Capacitance $(C) = \frac{\varepsilon A}{d}$
ε = dielectric medium, A = Area,
d = Distance between plate
Capacitance (C) does not depends on thickness of plate.

183. An electrical short circuit is characterized by:

(a) High resistance (b) Medium resistance
(c) Zero resistance (d) Infinite resistance

DMRC JE 18.02.2017

Ans : (c) In an electric circuit the value of resistance in short circuit is zero.

184. The capacitance of a capacitor is the ratio

(a) Charge to potential difference between plates
(b) Potential difference between plates to plate spacing
(c) Potential deference between plates to thickness of dielectric
(d) Potential difference between plates to charge

Karnataka PSC JE-2016

Ans. (a) : The capacitance of a capacitor is the ratio of charge to potential difference between plates.

$$q \propto V$$

$$q = CV$$

$$C = \frac{q}{V}$$

• The unit of capacitance is 1 C/V which is also called 1 Farad.

185. The capacitor in circuit opposes the sudden change of:

(a) Voltage (b) temperature
(c) Energy (d) current

PSPCL JE 2019, Shift-I
SSC JE 26.09.2019, Shift-I
HPSSC JE 2017(Code 579)
DMRC JE 03.08.2014
SSC JE 2008

Ans. (a) : The capacitor in circuit opposes the sudden change of voltage. Because a capacitor is storing element that stored the energy in electric field. Current in a capacitor is given by -

$$\boxed{i_c(t) = C\frac{dV_c}{dt}}$$

Since current in a capacitor does not goes to zero abruptly therefore capacitor oppose the rate of change of voltage.

186. The property of a substance that opposes the flow of electric current is known as:

(a) resilience (b) conductance
(c) resistance (d) immittance

PSPCL JE 2019, Shift-I

Ans. (c) : The property of a substance that opposes the flow of current is known as resistance. It is denoted by 'R' and measure in ohm. The resistance 'R' can be given in a electric circuit is.

$$R = \frac{V}{I}\Omega$$

187. If a capacitor is charged by a square wave current source, the voltage across the capacitor is

(a) A square wave (b) triangular wave
(c) step function (d) zero

MIZORAM PSC (PHED) 2019, Paper-I

Ans. (b) :. If a capacitor is charged by a square wave current source, then voltage across the capacitor is triangular wave.

$$V_c(t) = \frac{1}{C}\int i_c(t)dt$$

Integration of square wave = triangular wave.

188. Which of the following is the correct expression for the capacitance?

(a) $C = \frac{Q}{V}$ (b) $C = Q - V$

(c) $C = QV$ (d) $C = \frac{V}{Q}$

SSC JE 24.01.2018, Shift-I

Ans : (a) Correct expression for the capacitance-

$$C = \frac{Q}{V}$$

$$C = \frac{Q}{V} = \frac{\text{Coulomb}}{\text{Volt}} \text{ or Farad}$$

189. Which of the following is NOT a type of capacitor?

(a) Ceramic (b) Electrolytic
(c) Film (d) Wire wound

SSC JE 27.01.2018, Shift-I

Ans. (d) : Ceramic, Film and electrolytic are different types of a capacitor, through wire wound is a type of resistor. Wire wound resistance is an electrically inactive element. Manganin or nichrome wire is used to wound over core material of ceramic or glass to construct wire wound resistors. It's power rating is high. It is often used in high power resistor application.

190. Which one of the following has the ability to store energy in the form of electric charge?

(a) Superconductor (b) Resistor
(c) Capacitor (d) Inductor

SSC JE 22.01.2018, Shift-II

Ans : (c) Capacitor has the ability to store energy in the form of electric charge. It is a passive electronic component with two terminals. It stores energy in electric field. The effect of a capacitor is known as capacitance

Capacitor, $C = \frac{Q}{V}$

Where Q = positive or negative charge
V = Voltage

191. A capacitor consists of two:

(a) conductors separated by an insulator
(b) silver-coated insulators
(c) ceramic plates and one mica disc
(d) insulators separated by a dielectric

UPPCL JE 25.11.2019, Shift-I

Ans : (a) A capacitor consists of two conductors separated by an insulator. It has the ability to collect charge, which is called capacitance. The unit of capacitance is farad.

$$\boxed{C = \frac{q}{V}}\ F$$

192. When two capacitors are connected in series, there total value of capacitance-

(a) Remains same (b) Reduces
(c) Increases (d) None of these

UPSSSC JE-2015

Ans. : (b) When two capacitors are connected in series the equivalent capacitance decreases–

$$C_{eq} = \frac{C_1 C_2}{C_1 + C_2}$$

When two capacitors are connected in parallel the equivalent capacitance increases.

$$C_{eq} = C_1 + C_2$$

193. The rate of flow of charge in any element is known as:

(a) current (b) net charge
(c) conductance (d) potential

SSC JE 10.12.2020, Shift-II

Ans (a) : The rate of flow of charge in any element is known as - current

$$\boxed{i = \frac{dq}{dt}}$$

The SI unit of electric current is ampere.

194. A capacitor acts as an infinite resistance for _____.

(a) AC (b) DC as well as AC
(c) neither AC nor DC (d) DC

KPTCL JE 2017

Ans. (d) : Capacitors contain at least two electrical conductors separated by a dielectric/insulator and is used to store energy electrostatically between the conductors. It acts like an open circuit and hence acts like an infinite resistance for DC current.

195. What is the permittivity of free space (vacuum permittivity)?

(a) 8.854×10^{9} (b) 8.854×10^{-12}
(c) 8.854×10^{6} (d) 8.854×10^{15}

GESCOM AE 2011

Ans. (b) : Permittivity of free space = $\varepsilon_0 \varepsilon_r$

$\varepsilon_r = 1$ for air

$\varepsilon = \varepsilon_0 \varepsilon_r$

$= 8.85 \times 10^{-12} \times 1$ f/m

$= \boxed{8.85 \times 10^{-12} \text{ farad/meter}}$

196. Dielectric strength of air is _____ kV/mm

(a) 2.5 (b) 25
(c) 3.2 (d) 16

BWSSB Code 222, 26.05.2017
Kerala PSC Draftman 2016, Grade II

Ans. (c) : The dielectric strength of air is approximately 3 kV/mm. Its exact value varies with the shape and size of the electrodes and increases with the pressure of the air. The dielectric strength of air is 3.2 kV/mm.

197. Which of the following is not true with respect to dielectric strength?

(a) It decreases with increase in frequency
(b) It increases with increase in frequency
(c) It decreases with increases in operating temperature
(d) It decreases with increase in humidity

MPPKVVCL (Jabalpur) JE -2018

Ans. (b) : Dielectric strength of an insulator or dielectric medium is given by the maximum potential difference which a unit thickness of the medium can withstand without break down. With increase in frequency dielectric strength decreases.
Its unit is volt/meter or kV/mm.
Its value depends on the thickness of the insulator temperature, moisture, content, shape and several other factors.

198. According to the Einstein relation, for any semiconductor the ratio of diffusion constant to mobility of carries

(a) Depends upon the type of the semiconductor
(b) Varies with lifetime of the semiconductor
(c) Depends upon the temperature of the semiconductor
(d) Is a universal constant

UPPSC AE 29.05.2022, P-I (ECE)

Ans. (c) : According to the Einstein relation for any semiconductor the ratio of diffusion constant to mobility of carrier depends upon the temperature of the semiconductor.
Einstein relation,

$$\frac{D_n}{\mu_n} = \frac{D_p}{\mu_p} = V_T = \frac{kT}{q}$$

Where,
V_T = Temperature equivalent
K = Boltzmann's constant
T = Temperature in Kelvin

199. The impurity commonly used for realizing the base region of a silicon n-p-n transistor is

(a) Indium (b) Phosphorus
(c) Gallium (d) Boron

UPPSC AE 29.05.2022, P-I (ECE)

Ans. (d) : The impurity commonly used for realizing the base region of a silicon n-p-n transistor is boron.

200. Which of the following is an insulator?

(a) Silicon (b) Silver
(c) Rubber (d) Germanium

UPPSC ITI Principal 09.01.2022 (ECE)

Ans. (c) : Insulator are those materials which do not allow electric current to flow because of lack of free electron.
Rubber has a very high resistance and does not have free electrons to conduct electricity this makes rubber is an insulator.

201. The concentration of minority carriers in an extrinsic semiconductor under equilibrium is

(a) directly proportional to the doping concentration
(b) inversely proportional to the doping concentrations
(c) directly proportional to the intrinsic concentration
(d) inversely proportional to the intrinsic concentration

UPPSC ITI Principal 09.01.2022 (ECE)

Ans. (b) : The concentration of minority carriers in a extrinsic semiconductor under equilibrium is inversely proportional to the doping concentrations.
The concentration of minority carrier given by law of mass action,

$$n.p = n_i^2$$

Where,
n – Concentration of electrons in the conduction band.
P – Concentration of holes in the valence band.
n_i – Intrinsic carrier concentration.

202. Doping of Boron in Silicon results in
(a) An intrinsic Si semiconductor
(b) A p-type extrinsic semiconductor
(c) An n-type extrinsic semiconductor
(d) An intrinsic B semiconductor

UPPSC ITI Principal 09.01.2022 (ECE)

Ans. (b) : Doping of Boron in silicon results in a p-type extrinsic semiconductor because it has more holes than electrons.

203. Resistance strain gauge is NOT used to measure which one of the following?
(a) Pressure (b) Temperature
(c) Torque (d) Displacement

UPPSC ITI Principal 09.01.2022 (ECE)

Ans. (b) : Resistance strain gauge is used to measure following:
- Pressure
- Torque
- Displacement

It does not used to measure temperature, but it can be used to monitor temperature.

204. Zener diodes allow a current to flow in the reverse direction, when the
(a) Voltage reached above a certain value
(b) Temperature reached above a certain value
(c) Current always flows in the reverse direction only
(d) Current cannot flow in the reverse direction

UPPSC Poly. Lect. 22.12.2021, P-II (EE)

Ans. (a) : Zener diode has voltage regulating property. When voltage reaches above a certain value (zener voltage), current starts to flow in the reverse direction.

205. A zener diode is used as a
(a) Current regulator (b) Voltage booster
(c) Voltage regulator (d) Power regulator

UPPSC Poly. Lect. 22.12.2021, P-II (EE)

Ans. (c) : A zener diode is used as a voltage regulator in reverse biased mode. A small leakage current is generated until a constant voltage is obtained.

206. The forbidden energy gap in silicon at 300°K is
(a) 0.72 eV (b) 0.785 eV
(c) 1.1 eV (d) 1.41 eV

UPPSC Poly. Lect. 22.12.2021, P-II (EE)

Ans. (c) : The forbidden energy gap, or bandgap, in silicon at 300 K is approximately 1.1 eV.

207. The temperature at which a conductor becomes superconductor is called
(a) Superconducting temperature
(b) Curie temperature
(c) Meel temperature
(d) Transition temperature

UPPSC Poly. Lect. 22.12.2021, P-II (EE)

Ans. (d) : The temperature at which a conductor becomes superconductor is called transition temperature.

208. Which of the following metal has the lowest temperature coefficient of resistance?
(a) Gold (b) Kanthal
(c) Aluminium (d) Copper

UPPSC AE 29.05.2022, P-II (EE)

Ans. (a) : The temperature coefficient of resistance is generally defined as the change in electrical resistance of a substance with respect to per degree change in temperature. Gold had the lowest temperature coefficient of resistance.

209. The electrically controlled magnetic materials used in machines should have
(a) low permeability and high saturation flux density
(b) low permeability and low saturation flux density
(c) high permeability and high saturation flux density
(d) high permeability and low saturation flux density

UPPSC Poly. Lect. 22.12.2021, P-II (EE)

Ans. (c) : The electrically controlled magnetic materials have high permeability and high saturation flux density reduce the induction size as it allows for a lower number of turns therefore reduces copper loss and capacitance, thus improving filter performance at high frequency.

210. A metal-semiconductor junction where semiconductor is highly doped behaves like
(a) Rectifying junction
(b) Ohmic junction
(c) LED
(d) Laser diode

UPPSC Poly. Lect. 22.12.2021, P-II (EE)

Ans. (b) : A metal-semiconductor junction where semiconductor is highly doped behaves like ohmic junction.

211. The forbidden energy gap in silicon at 300°K is
(a) 1.41 eV (b) 0.72 eV
(c) 1.1 eV (d) 0.785 eV

UPPSC AE 29.05.2022, P-I (EE)

Ans. (c) : The forbidden energy gap is the minimum amount of energy required to excite an electron from the valence band to the conduction band. The forbidden energy gap in silicon at 300° K is 1.1 eV.
- The energy gap in germanium at 300° K is 0.67 eV.

212. Superconductor are becoming popular for use in
(a) generating a very strong magnetic field
(b) generating regions free from magnetic field
(c) generating electrostatic field
(d) manufacture of bubble memories

UPPSC AE 29.05.2022, P-II (EE)

Ans. (a) : Superconductor are becoming popular for use in generating a very strong magnetic field.

213. The structure sensitive property of a super conductor is

(a) Critical magnetic field
(b) Transition temperature
(c) Critical current density
(d) None of the above

UPPSC AE-13.12.2020, P-II (EE)
UPPSC AE 29.05.2022, P-II (EE)

Ans. (c) : The structure sensitive property of a super conductor is critical current density.

214. If temperature increases then conductivity of semiconductor is

(a) Decreases (b) Constant
(c) Increases (d) None of the above

UPPSC Poly. Lect. 22.12.2021, P-I (EE)

Ans. (c) : If temperature increase then conductivity of semiconductor increases because due to increase in the temperature more electron-hole pair are generated and hence, conductivity of semiconductor increases.

215. If the bias voltage applied across the p-n junction increases the potential barrier, the applies voltage is known as

(a) Forward bias voltage (b) Reverse bias voltage
(c) Transition voltage (d) None of the above

UPPSC AE-13.12.2020, P-I (EE)

Ans. (b) : The process by which a p-n junction diode blocks the electric current in the presence of reverse applied voltage is called reverse biased p-n junction diode.

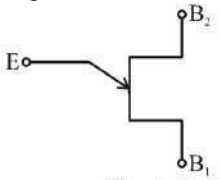
- If the reverse biased voltage applied on the p-n junction diode is further increased, then even more number of free electrons and holes are pulled away from the p-n junction. This increases the width of depletion region (potential barrier). Hence, the width of the depletion region increases with increase in reverse bias.

216. UJT is known as

(a) Voltage-controlled device
(b) Current-controlled device
(c) Relaxation oscillator
(d) A transistor

UPPSC AE-13.12.2020, P-II (EE)

Ans. (a) : The UJT is a highly efficient for switch its switching time is in the range of nano seconds. Since UJT exhibits negative resistance characteristics, it can be known as voltage-controlled device.



"Symbol of UJT"

217. A modern power semi-conductor device that combines the characteristics of both BJT and MOSFET

(a) GTO (b) FCT
(c) IGBT (d) MCT

UPPSC AE-13.12.2020, P-II (EE)

Ans. (c) : A modern power semi-conductor device that combines the characteristics of both BJT and MOSFET is known as IGBT. Thus IGBT possesses high input impedance like a MOSFET and has low ON state power loss as in a BJT.

218. An SCR is made up of silicon because

(a) Silicon has larger leakage current than germanium
(b) Silicon has small leakage current than germanium
(c) Silicon has small leakage voltage than germanium
(d) Silicon has large leakage voltage than germanium

UPPSC AE-13.12.2020, P-II (EE)

Ans. (b) : An SCR is a three terminal namely anode, cathod and gate, four layer P-N-P-N and three junction J_1, J_2 and J_3 semi-controlled device. It is made up of silicon because silicon has small leakage current than germanium.

219. Super conduction in metals is observed in the following temperature range:

(a) below 10 ºK (b) around 10 ºC
(c) above 100 ºK (d) around 100 ºC

UPPSC AE-2007 (Special) P-I

Ans. (a) : Super conductivity in metals is observed at very low temperatures, typically below 10° K.

220. Highest electrical resistivity exists is

(a) platinum wire (b) nichrome wire
(c) silver wire (d) kanthal wire

UPPSC AE-2007 (Special) P-I

Ans. (d) : Kanthal wire is an alloy composed vainly of iron, chromium, and aluminum. It has a very high electrical resistivity, which makes it suitable for use in heating elements.

221. When a dielectric is introduced into an air capacitor which of the following quantity changes?

(a) potential difference
(b) Electric field intensity
(c) Temperature of the capacitor
(d) Electric charge

UPPSC AE-2004 P-I

Ans. (a) : When a dielectric is introduced into an air capacitor the electric field intensity and potential difference are the primary quantities that change, but the electric charge would only change if the capacitor is connected to a voltage source.

222. The total current through a semi-conductor is given by

(a) sum of currents due to electrons and holes
(b) difference of currents due to electrons and holes
(c) product of currents due to electrons and holes
(d) ratio of currents due to electrons and holes

UPPSC AE-2004 P-I

Ans. (a) : In semi-conductors electrons and holes both are responsible for conducting current in it.
Thus, Total current through a semiconductor is the sum of currents due to electrons and holes.

$$I = I_{hole} + I_{electron.}$$

223. Super-conductivity is

(a) complete disappearance of electrical resistivity at very low temperatures
(b) comparative value of different electrical conductors
(c) transition of an electrical conductor to an electrical insulator
(d) superheating of a conductor

UPPSC AE-2004 P-I

Ans. (a) : Superconductivity is complete disappearance of electrical resistivity at very low temperatures (below a specific critical temperature).

224. The purpose of oil in a transformer is to?

(a) protect the transformer from rusting
(b) avoid wear and tear of the transformer
(c) transfer heat from winding and core to cooling surface of the transformer
(d) avoid noise in a transformer

ESE (PRE) 2021

Ans. (c) : The purpose of oil in a transformer is to transfer heat from the core and windings to the cooling surface of the transformes.

Purpose of transformer oil:

Transfer of heat by connection from winding and core to the cooling surfaces.

It maintains the insulation of winding and extinguishes fire that occurs due to faults occurring in the windings.

225. For a semiconductor to be called as p-type semiconductor, which one of the following element impurities are added to pure semiconductor?

(a) Phosphorus (b) Arsenic
(c) Antimony (d) Boron

ESE (PRE) 2021

Ans. (d) : The material which is not a good conductor or a good insulator is called a semiconductor The pure form of semiconductor is called as intrinsic Semiconductor.

There are two types of semiconductor.

P type semiconductor : The Semiconductor having holes as majority charge carriers and electrons as a minority charge carrier is called a p-type semiconductor.

When a trivalent impurity is doped in intrinsic semiconductors than we got p-type semiconductor for examples : Boron, gallium, indium.

N type Semiconductor : The Semiconductor having electrons as majority charge carriers and holes as a minority charge carrier are called N-type semiconductors.

When a Pentavalent impurity is doped in intrinsic Semiconductor then we got N-type semiconductor for example Arsenic.

226. Impure semiconductor

(a) has more conductivity in contrast to pure semiconductor
(b) has less conductivity in contrast to pure semiconductor
(c) has electrons and holes in equal numbers
(d) has a fermi level which is in the centre of conduction and valence bands

ESE (PRE) 2021

Ans. (a) : Impure (or extrinsic) semiconductor : We add a small amount of impurity to the pure semiconductor.

This increases the conductivity of the semiconductor by mane fold.

This impure Semiconductor is called an extrinsic Semiconductor.

Pure (or intrinsic) Semiconductor : The intrinsic Semiconductor is a pure semiconductor since they are pure semiconductor they have the same number of holes and electrons.

The conductivity of an intrinsic semiconductor is very low at room temperature.

227. Which one of the following is the disadvantage of ion-implantation over diffusion doping?

(a) It is a low temperature process
(b) Point imperfections are not produced
(c) Shallow doping is possible
(d) Gettering is possible

ESE (PRE) 2021

Ans. (b) : The disadvantage of ion implantation over diffusion doping is that point imperfection are not produced.

Diffusion doping, also known as thermal diffusion, involves heating a material with a dopant source to create point defects and allow the dopants to diffuse into the material

228. Consider the following characteristics with respect to Alpha particles :

1. They have large specific ionization values.
2. They dissipate their energy rather slowly.
3. They can penetrate the outer layer of human skin.
4. Their emitters are heavy elements.

Which of the above statements are correct ?

(a) 1 and 4 only (b) 1 and 3 only
(c) 2 and 4 only (d) 2 and 3 only

ESE (Pre) 2018

Ans. (a) : Alpha particles cannot penetrate human skin. Emitters of α-particles are heavy elements. Alpha Particles are heavily ionized matter and they quickly loose their kinetic energy.

229. An FET is a semiconductor device with the output current controlled by an electric field and its current is carried predominantly by one type of carriers. It is known as :

(a) junction transistor (b) unipolar transistor
(c) MOSFET (d) IGBT

ESE (Pre) 2020

Ans. (b)

- The field-effect transistor (FET) is a semiconductor device with the output current controlled by the electric field. Since the current is carried predominantly by one type of carriers, the FET is known as unipolar transistor. The FET is thus different from the bipolar transistor (BJT) which involves two types of carriers, i.e., electrons and holes.
- Metal-Oxide-Semiconductor FET (MOSFET) is also referred to as the IGFET and MISFET.
  The MOSFET is also an important power device.

230. The photoelectric current depends on which of the following factors ?

1. **The frequency of the incident light.**
2. **The intensity of the incident light.**
3. **The potential difference between the electrodes**
4. **The photosensitivity of the non-metal**

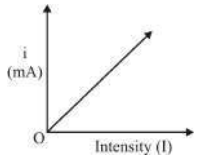
(a) 1, 2 and 4 (b) 1, 2 and 3
(c) 1, 3 and 4 (d) 2, 3 and 4

ESE (Pre) 2020

Ans. (b) : The emission of electrons from a metallic surface when irradiated by electromagnetic radiation is called the phenomenon of photoelectric effect.

Photoelectric current depends on following factors–

- Intensity of incident radiation



- The potential difference between two electrodes.
- The frequency of incident radiations.
- The photometal used.

231. The forward voltage drop of green colour LED is

(a) 1.2 Volt (b) 2.0 Volt
(c) 2.2 Volt (d) 1.8 Volt

UP JAL Nigam JE (E &M) 16.12.2016

Ans. (c) : Light emitting diode (LED) are specially dropped PN junction diodes, which emit light when a proper forward bias is applied across the diodes.

Various LED and their colours & Forward voltage drop are shown -

Semi conductor material	Colour	Forward voltage drop
Algap	Infrared	2.2V
GaAs	Red	>1.9V
GaAsρ	Green	1.8V
Sic	Blue	2.6V

232. In transmission electron microscopy, the electron gun filament is made of?

(a) Silver wire (b) Lead Wire
(c) Gold wire (d) Tungsten wire

MP Vyapam Sub Engineer 10.11.2022, Shift-I

Ans. (d) : The TEM is capable of recoding magnified images of a thin specimen, typically with a magnification in the range 10^3-10^6. The instrument can be used to produce electron diffraction pattern, useful for analyzing the properties of crystalline specimens. The electron gun filament is made of tungsten wire. The electron gun produces a beam of electrons whose kinetic energy is high enough to allow them to pass through thin area of the TEM specimen.

Exam Points

- Depletion region of a p-n junction is formed– **During forward bias**
- Doping in a semiconductor increases ..... quantity– **Conductance**
- Donors to a semiconductor material is– **Pentavalant**
- Example of donor atom is– **Antimony**
- Acceptor impurities are added to form which of the following material– **p-type**

2.4 Magnetic Properties of Materials

233. Unit of permeability is–

(a) Henry/meter (b) Henry
(c) Henry/meter^2 (d) it is dimensionless

UPPCL AE 2013

Ans. (a) : The magnetic permeability is defined as the property of the material to allow the magnetic line of force to pass through it.

The SI unit = Henry per meter (H/m)

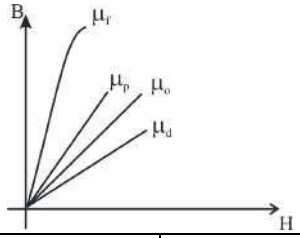
Permeability is the measure of the resistance of a material against the formation of a magnetic field.

234. If the permeability of a material is 0.999991 it can be classified as

(a) diamagnetic material
(b) paramagnetic material
(c) ferro-magnetic material
(d) ferrite

Vizag Steel MT 2012

Ans. (a) : Permeability of diamagnetic material is less than 1.



Paramagnetic	Diamagnetic
When placed in external magnetic field, total magnetic inside the material decreases	When placed in external magnetic field, magnetic field inside the material decreases.
Magnetic susceptibility (x) is +ve	Magnetic susceptibility (x) is -ve
Relative permeability (μ_r) is +ve and greater than one. Example- Aluminium, Platinum, Chromium	μ_r is +ve but less than one. Example- Copper, Gold, Bismuth.

235. For paramagnetic materials, permeability is:

(a) zero
(b) 1
(c) slightly greater than zero
(d) infinite

UPPCL AE 30-12-2016

Ans. (c) : For paramagnetic materials permeability is slightly greater than zero.
For diamagnetic materials permeability is less than zero or negative.

236. Susceptibility of ferromagnetic materials is _____.
(a) small and positive (b) large and positive
(c) zero (d) negative
UPPCL AE 30-12-2016

Ans. (b) : Ferromagnetic materials have large and positive value of susceptibility.
ex : Fe, Cu, Ni
$\mu_r = 1 + \chi_m$
χ_m = susceptibility

237. In diamagnetic materials:
(a) Susceptibility is independent of temperature
(b) Susceptibility increases with temperature
(c) Susceptibility decreases with temperature
(d) Susceptibility reaches infinity
UPPCL AE 30-12-2016

Ans. (a) : Diamagnetic materials are characterized by constant, small negative susceptibilities only slightly affected by temperature so it is independent of temperature.

238. Which of the following is diamagnetic?
(a) MgO (b) BaTiO
(c) Cobalt (d) Copper
UPPCL AE 30-12-2016

Ans. (d) : Copper is diamagnetic. Zinc, Bismuth, copper, silver, gold antimony, marble, water, gold, Nacl etc are also diamagnetic.
Ferro magnetic material $\mu_r >>> 1$
for paramagnetic material μ_r slightly greater than 1
for diamagnetic material $\mu_r < 1$
Copper is a diamagnetic material.

239. Consider the following statements regarding water:
1. Water is a polar molecule
2. Water molecules align themselves in an electric field.
3. Water molecules vary their alignment if the applied electric polarity changes with time.
4. Water molecules align themselves in a magnetic field.

Which of the above statements are correct?
(a) 1, 2 and 3 only (b) 1, 2 and 4 only
(c) 3 and 4 only (d) 1, 2, 3 and 4
ESE (PRE) 2017

Ans. (d) :
- Polar molecule is molecule in which one end of the molecule is slightly positive, while the other end is slightly negative.
  Water is classified as a polar molecule because of its polar covalent bonds and its bent shape.
- In an applied electric field, polar molecules tend to align themselves with the field.
- On reversing the polarity the molecules also change their orientation.
- Magnetic field has no effect on water molecule.

240. Reciprocal of magnetic permeability is
(a) Conductance (b) Susceptance
(c) Reluctivity (d) Permittivity
(RRB SSE Bilaspur Yellow paper, 21.12.2014)

Ans : (c) Reciprocal of magnetic permeability is reluctivity.

$$\text{Magnetic permeability} = \frac{\text{Henry}}{\text{meter}} \qquad \mu = \frac{B}{H}$$

$$\text{and reluctance} = \frac{\text{ampere turn}}{\text{weber}} \qquad R = \frac{Ni}{\phi}$$

241. The magnetic pressure on a piece of magnetic material is well defined by the relation
(a) $2B^2/\mu_0$ (b) $\mu_0/2B^2$
(c) $B^2/2\mu_0$ (d) $2\mu_0/B^2$
Rajasthan Nagar Nigam AE 2016, Shift-I

Ans. (c) : The magnetic pressure is an energy density associated with a magnetic field. Any magnetic field has an associated magnetic pressure contained by the boundary condition on the field.
Magnetic pressure on piece of magnetic material

$$P_B = \frac{B^2}{2\mu_o}$$

B = magnetic flux density (in Tesla)
μ_o = permeability (in H/m)

242. According to Curie law, the magnetic susceptibility of a paramagnetic substance is
(a) directly proportional to the square of absolute temperature
(b) inversely proportional to absolute temperature
(c) directly proportional to absolute temperature
(d) not varied with absolute temperature
JUVNL AE 2017, Shift-II

Ans. (b) : Curie law for paramagnetic substance

$$\chi = \frac{C}{T - T_c} \qquad T > T_c \qquad \chi \propto \frac{1}{T}$$

T_c = curie temperature
χ = magnetic susceptibility.
According to Curie law materials become more magnetic at lower temperature.

243. In a magnetic circuit, the relative permeability of vacuum is
(a) $4\pi \times 10^{-7}$ (b) 100
(c) 0 (d) 1
JUVNL AE 2017, Shift-II

Ans. (d) : Relative permeability (μ_r), ($\mu_o \mu_r = \mu$)
It is unitless-
For vacuum $\mu_r = 1$
for Air $\mu_r = 1.0000004$
for cobalt $\mu_r = 170$
for silicon steel $\mu_r = 5000$ to 10,000

244. All ferrous materials are suitable for construction of core of electrical machines because they are having
(a) Very high permittivity
(b) Very low permeability
(c) Very low permittivity
(d) Very high permeability
Rajasthan Nagar Nigam AE 2016, Shift-II

Ans. (d) : All ferrous metals are having iron as common element. All ferrous materials are having very high permeability which makes these materials suitable for construction of core of electrical machines.
Due to high permeability, less excitation current is needed for the establishment of working fluxes.

245. Hysteresis is commonly found in _____
(a) ferromagnetic materials
(b) ferroelectric materials
(c) both A and B
(d) none of these

KPTCL AE 2015

Ans. (c) : Hysteresis is commonly found in ferromagnetic and ferroelectric materials.

246. A neodymium magnet is a permanent magnet made from an alloy of _____
(a) Neodymium and iron
(b) Neodymium, iron and iodine
(c) Neodymium and boron
(d) Neodymium, iron and boron

KPTCL AE 2015

Ans. (d) : A neodymium magnet is a permanent magnet made from an alloy of Neodymium, iron and boron.

247. The process of removing the unwanted magnetism is called _____
(a) Unmagnetization (b) Degaussing
(c) Diamagnetization (d) Depoling

KPTCL AE 2015

Ans. (b) : The process of removing the unwanted magnetism is called degaussing.

248. The iron alloy, ALNICO is mainly used to make _____
(a) Temporary magnets (b) Permanent magnets
(c) Transmission lines (d) None of these

UPPCL AE 2015
KPTCL AE 2015

Ans. (b) : The iron alloy ALNICO is mainly used to make permanent magnets.
ALNICO is a family of iron alloys which in addition to iron are composed primarily of Aluminium (Al), Nickel (Ni) and Cobalt (Co) hence acronym Al-Ni-Co. ALNICO alloys are ferromagnetic are used to make permanent magnets.

249. The magnetic permeability of a diamagnet is _____
(a) More than that of vacuum
(b) Same as that of vacuum
(c) Less than that of vacuum
(d) 3.14 times that of vacuum

HPPSC AE 23 June 2019
KPTCL AE 2015

Ans. (c) : The magnetic permeability of a diamagnet is less than that of vacuum.
- Diamagnetic materials are those materials that are freely magnetized when placed in the magnetic field. However, the magnetization is in the direction opposite to that of the magnetic field.
- Magnetic susceptibility is small and negative.
- The relative permeability is slightly less than unity.

250. Which of the following is a ferroelectric material?
(a) Stainless steel (b) Barium nitrate
(c) Wrought iron (d) Brass

UPPCL AE 2015

Ans. (b) Barium nitrate is a ferroelectric material.

251. Area of hysteresis loop represents:
(a) Iron losses (b) Hysteresis losses
(c) Eddy current losses (d) Copper losses

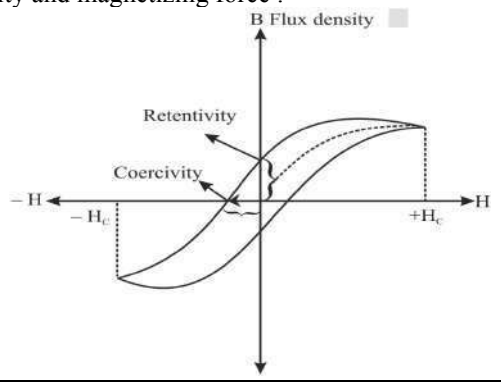
UPPCL AE 2015

Ans. (b) Area of hysteresis loop represents hysteresis loss.

252. Which two values are plotted on a B-H curve graph-
(a) reluctance and flux density
(b) permeability and reluctance
(c) magnetizing force and permeability
(d) flux density and magnetizing force

PS PCL AE 2012

Ans. (d) : B-H curve graph are plotted between flux density and magnetizing force .



253. Match List-I with List-II and select the correct answer using the codes given the lists:

List-I (Type of magnetic material)	List-II (Orientation of individual dipole moment)
A. Ferromagnetic	1. ↓↓
B. Antiferro-magnetic	2. ↑↓↑↓
C. Ferrimagnetic	3. ↑
	4. ↑↑↑↑

Codes:

	A	B	C
(a)	4	2	1
(b)	1	2	4
(c)	2	1	3
(d)	4	2	3

JPSC AE 2013 Paper-V

Ans. (a) : The orientation of industrial dipole moments:
Ferromagnetic → ↑↑↑↑
Antiferromagnetic → ↑↓↑↓
Ferrimagnetic → ↓↓

254. The materials used for permanent magnets are
(a) soft magnetic materials
(b) magnetic materials
(c) non-magnetic materials
(d) hard magnetic materials

BPSC AE 2012 Paper-V

Ans. (d) : The materials used for permanent magnets are hard magnetic materials.
Permanent magnets are made from special alloys (ferromagnetic material) such as iron, nickel, and cobalt.

255. In ferromagnetic materials, the spin moments associated with two sets of atoms are aligned
(a) anti-parallel to each other
(b) parallel to each other
(c) random to each other
(d) anti-parallel but of unequal magnitude

BPSC AE 2012 Paper-V

Ans. (b) : In ferromagnetic materials, the spin moments associated with two sets of atoms are aligned parallel to each other.

256. The conductivity of ferrite is
(a) less than that of ferromagnetic materials
(b) equal to that of ferromagnetic materials
(c) greater than that of ferromagnetic materials
(d) None of the above

BPSC AE 2012 Paper-V

Ans. (a) : The conductivity of ferrite is less than that of ferromagnetic material. Thus they are useful in high-frequency devices because of the absence of significant eddy current losses.

257. When a Ferromagnetic material is magnetized by alternating source voltage. The phenomenon of magnetostriction causes :
(a) Increase in the body temperature
(b) Change in permeability of the material
(c) Small changes in its dimension
(d) Decrease in the saturation flux density

UJVNL AE 2016

Ans. (c). When a Ferromagnetic material is magnetized by alternating source voltage. The phenomenon of magnetostriction causes small changes in its dimension.

258. Ferro magnetic substances are those which when placed in a magnetic field
(a) are weakly magnetized in opposition to the applied field.
(b) are weakly magnetized in direction of the applied field.
(c) are strongly magnetized in opposition to the applied field.
(d) are strongly magnetized in direction of the applied field.

UPRVUNL (UPJVNL) AE 2016

Ans. (d) : Ferromagnetic material have a large, positive susceptibility to an external magnetic field. When magnetization force is applied, the domain become aligned to produce a strong magnetic field.
In ferromagnetic material
$\mu_r >> 1$
susceptibility
$\chi_m = \mu_r - 1$

259. Unit of retentivity is :
(a) Ampere turn (b) Ampere turn/meter
(c) Weber (d) Wb/m^2

HPPSC AE 23 June 2019

Ans. (d) : Retentivity– The amount of flux retained per unit area.
unit $\rightarrow$ weber/m^2

260. A material produces a magnetic field which opposes the applied magnetic field, then it is :
(a) Diamagnetic (b) Paramagnetic
(c) Electromagnetic (d) Ferromagnetic

HPPSC AE 22 June 2019

Ans. (a) : Diamagnetic material are those materials that are freely magnetized when placed in the magnetic field. The magnetic field produced by diamagnetic material opposes the applied magnetic field. The relative permeability of diamagnetic material is less than 1 $\boxed{\mu_r < 1}$.

261. Which of the following materials is having less than unity relative permeability μ_r and negative magnetic susceptibility?
(a) Ferromagnetic (b) Paramagnetic
(c) Diamagnetic (d) Antiferromagnetic

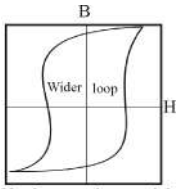
UPSC JWM 2017

Ans. (c) Diamagnetic materials relative permeability (μ_r) is less than unity. Ferromagnetic> Paramagnetic>Antiferomagnetic> Diamagnetic. So diamagnetic have least relative permeability (μ_r) and -ve susceptibility.
For diamagnetic, $\mu_r \le 1, \chi_m = \mu_r - 1$

262. Hard magnetic materials are utilized in permanent magnets. In terms of hysteresis behaviour, a hard magnetic material does not possess.
(a) Low energy loss when subjected to alternating magnetic field.
(b) High remanence and coercivity
(c) Saturation flux density
(d) Low initial permeability

UPSC JWM 2017

Ans. (a) :



Hard magnetic material
B-H curve

In term of hysteresis behaviour, a hard magnetic material does not posses low energy loss when subjected to alternating magnetic field because the hysteresis loop of hard magnetic material is large and hysteresis loss = area under the curve.

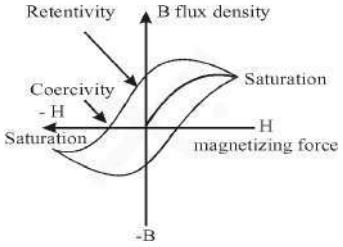
Characteristics of hard magnetic materials:-
- Low initial permeability.
- High coercivity & high remanence
- High saturation flux density.
- Reduces to saturation magnetization with a high applied magnetic field.
- It can not be easily magnetized and demagnetized.
- High hysteresis loss.
- Used as permanent magnets.

263. The materials used for permanent magnets should have:

(a) low retentivity, high coercivity
(b) high retentivity, low coercivity
(c) high retentivity, high coercivity
(d) low retentivity, low coercivity

CIL MT 2017

Ans. (c) : It should have high retentivity so that it remains magnetized in the absence of the magnetizing field.



It should have high coercivity so that it does not get demagnetised easily.

264. The phenomenon of magnetostriction occurs when a ferromagnetic substance is magnetized resulting in:

(a) Heating
(b) Small changes in its dimensions
(c) Small changes in its crystal structure
(d) Some changes in its mechanical properties

ESE 2017

Ans. (b) : Magnetostriction is a property of ferromagnetic materials that causes them to change their shape or dimension during the process of magnetization.

265. Susceptibility of a diamagnetic material is

1. Negative
2. Positive
3. Dependent on the temperature
4. Independent of the temperature

Select the correct answer using the codes given below:

(a) 1 and 3 only (b) 2 and 3 only
(c) 1 and 4 only (d) 2 and 4 only

ESE 2017, 2003

Ans. (c) : For magnetic material (other than diamagnetic) susceptibility is a function of temperature but diagmagnetic material have negative susceptibiliy and independent of temperature.

266. Consider the following statements?

1. The susceptibility χ of diamagnetic materials is small and negative.
2. The susceptibility of para and anti ferromagnetic materials is small but positive.
3. The susceptibility has a finite value for free space or air.

Which of the above statements are correct?

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

ESE 2017

Ans. (a) : susceptibility of free space or air is zero.

$\chi_m = \mu_r - 1$

$\chi_m = 1 - 1 \quad [\because \text{ for air } \mu_r = 1]$

$\chi_m = 0$

So, only statements 1 and 2 are correct.

267. The total magnetic moment

1. is called saturation magnetization.
2. depends on the number of magnetic dipoles per unit volumes, the instant electric current and the area of the current loop.

Which of the above statements is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

ESE 2017

Ans. (b) : Magnetic moment = $\mu_m = IA\mu_n$

where, I = electric current
A = Area enclosed by current/loop
μ_n = number of magnetic dipole

Thus, magnetic moment depends on above factors.

268. For high speed reading and storing of information in a computer, the core shall be of:

(a) Ferrite
(b) Piezoelectric
(c) Pyroelectric
(d) Ferromagnetic above 768^oC

ESE 2017, 2015

Ans. (a) : Due to high magnetic permeability and high electrical resistance ferrites are employed for construction of core for high speed reading and storing.

269. Soft magnetic materials should have:

(a) Large saturation magnetization and large permeability
(b) Low saturation magnetization and large permeability
(c) Large saturation magnetization and low permeability
(d) Low saturation magnetization and low permeability

ESE 2017

Ans. (a) : A soft magnetic material should be easily magnetized and demagnetized and should have high saturation magnetization, which means larger permeability and saturation respectively.

270. The temperature at which iron ceases to be ferromagnetic and becomes paramagnetic is

(a) Curie-Weiss point
(b) Thermo-magnetic point
(c) Ferro-paramagnetic point
(d) Curie point

ESE 2019

Ans. (d) : The temperature at which iron ceases to be ferromagnetic and becomes paramagnetic is curie-temperature.

Paramagnetism : Curie law, $\chi_m = \frac{C}{T}$

Ferromagnetism : Curie-Weiss law,

$$\chi_m = \frac{C}{T - \theta}(T > \theta)$$

Where θ is curie temperature.

Antiferromagnetism:

Curie- Weiss law,

$$\chi_m = \frac{C}{T+\theta_N};\ \text{at}\ \ T > T_N$$

Where T_N = Neel temperature.

271. The magnetizing force at the centre of a circular coil varies

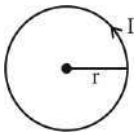
1. Directly as the number of its turns.
2. Directly as the current.
3. Directly as its radius.
4. Inversely as its radius

Which of the above statements are correct?

(a) 1, 2 and 3 only (b) 1 and 4 only
(c) 1, 2 and 4 only (d) 2 and 3 only

ESE 2020

Ans. (c) : We know that magnetising force at the center of coil is proportional to flux density at center.



From ampere's law

$$H.\int dl = NI$$

$$H.2\pi r = NI$$

$$H = \frac{NI}{2\pi r}$$

$$\text{Force} \propto H$$

$$H \propto \frac{NI}{r}$$

where N = No. of turns
I = Current in loop
r = radius of loop.

272. An analogous of magnetic circuit 'permeability' in electrical circuit is

(a) Reluctivity (b) Conductance
(c) Conductivity (d) Resistivity

ESE 2020

Ans. (c) : Since permeability is measure of easiness for magnetic field path.

$$\vec{B} = \mu\vec{H}$$

So, it is analogous to conductivity in electric circuit as it is measure of easiness of electric current in circuit

$$\vec{J} = \sigma\vec{E}$$

273. For which of the following materials, the relative permeability is much greater than unity?

(a) Diamagnetic materials
(b) Paramagnetic materials
(c) Ferromagnetic materials
(d) None of the above

MPPSC AE 2017

Ans. (c) : Material can be classified into 3 groups with regard to their relative permeability.

(i) Diamagnetic materials $0 \le \mu_r < 1$

(ii) Paramagnetic materials $\mu_r > 1$

(iii) Ferromagnetic materials $\mu_r >> 1$

So ferromagnetic materials, the relative permeability is much greater than unity.

274. When the relative permeability of a material is slightly less than 1, it is called a

(a) diamagnetic material
(b) paramagnetic material
(c) ferromagnetic material
(d) none

UPPCL JE 07.09.2021, Shift-II
RRB JE 01.09.2019 Shift-I
UPPCL JE 25.11.2019, Shift-II
SSC JE 23, 24, 27.01.2018, Shift-II
HPSSSB JE 2018 (Post code 663)
BWSSB 09.04.2017
HPSSC JE 2017 (Code-579)
HPSSSB JE-2017 (Post code- 579)
SSC JE 01.03.2017, Shift-II
BWSSB Code 127, 13.11.2016
Karnataka PSC JE-2016
BSNL TTA 28, 29.09.2016, 10 AM
UKPSC JE 2013, PAPER-I

Ans : (a)

Material	μ_r	Example
• Non-magnetic materials	$\mu_r = 1$	glass, air, plastic, wood
• Diamagnetic	$\mu_r < 1$	Copper, silver, Bismuth, pyrolitic, carbon
• paramagnetic	$\mu_r \ge 1$ (Slightly greater than 1)	Aluminium, magnesium, molybdenum, Lithium
• Ferromagnetic	$\mu_r \ge 100$	Fe, Ni, steel

275. Which of the following materials is a diamagnetic material?

(a) Copper (b) Tungsten
(c) Potassium (d) Oxygen

DMRC JE, 26.02.2020
UPPSC AE 13.12.2020, Paper-II

Ans. (a) : Diamagnetic materials are repelled by the external magnetic field an applied magnetic field creates an induced magnetic field in opposite direction, causing repulsive force.

Diamagnetic material- permeability (μ) is less than 1.

eg: Diamond , Copper , Silicon, Germanium etc.

276. Which of the following is NOT an example of diamagnetic material?

(a) Antimony (b) Nickel
(c) Bismuth (d) Copper

ESIC JE 2019

Ans. (b) : Diamagnetic material:- Diamagnetic material are a non magnetic material like wood glass and some metal such as copper, Antimony etc. particularly the heavy ones with many core electron such as mercury, gold and bismuth. Thus Nickel is not a diamagnetic material.

277. Which of the following is NOT an example of a ferromagnetic material?

(a) Lithium (b) Iron
(c) Nickel (d) Cobalt

ESIC JE 2019, 2016

Ans. (a) : Ferromagnetic Material:- The ferromagnetic materials are those substance which exhibit strong magnetism in the same direction of the field when a magnetic field is applied to it. Iron, Nickel and cobalt etc are the ferromagnetic materials. But Lithium is a paramagnetic material.

278. Which of the following is NOT an example of paramagnetic material?

(a) Lithium (b) Copper
(c) Molybdenum (d) Tantalum

ESIC JE 2019

Ans. (b) : Paramagnetic material:- The material in which magnetic dipole are present due to spin unpaired electrons and it is randomly oriented but when magnetic field is applied such dipole align parallel to magnetic field is called paramagnetic materials Here lithium, molybdenum and tantalum are paramagnetic material where copper is not paramagnetic material Because copper does not have above properties.

279. Which of the following is the strongest diamagnetic material?

(a) Iron (b) Steel
(c) Bismuth (d) Aluminium

Kerala PSC Asst: Gr. II Electrical Inspectorate 2015

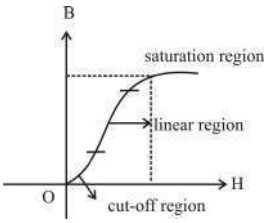
Ans. (c) : Bismuth is the strongest diamagnetic material.
Example of Diamagnetic material-Copper, Zinc, Bismuth, Silver, Gold, Antimony, Marble, Water, Glass, NaC*l* etc.

280. A ferromagnetic material, such as iron, does not have a constant relative permeability. As the magnetizing field increases, the relative permeability_____.

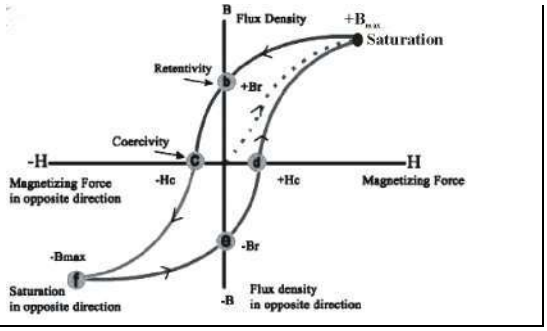
(a) Decreases (b) Increases
(c) One (d) Zero

NPCIL ST 2019 (Kakrapar)

Ans. (b) : The B-H curve of ferromagnetic material is shown below



Basically It has three parts
→ cut-off region
→ Linear region
→ saturation region
A ferromagnetic material such as iron does not have a constant relative permeability. The permeability of ferromagnetic materials varies greatly with field strength. As the magnetizing field increases, the relative permeability increases, reaches a maximum and then decreases.



281. Which one of the below is a paramagnetic material?

(a) Soft iron (b) Nickel
(c) Hard iron (d) Magnesium

PGCIL Diploma Trainee 14.11.2018
MPMKVVCL (Bhopal) JE 2018

Ans : (d) A paramagnetic material is one whose relative permeability is slightly more than one i.e. $\mu_r > 1$

- On the other hand a ferromagnetic material have very much high relative permeability i.e. $\mu_r >>> 1$.
- A diamagnetic material has a constant relative permeability slightly less than 1.
- In the given option, nickel, soft iron and hard iron are ferromagnetic materials. Similarly magnesium is a paramagnetic material.

282. Ferromagnetism is:

(a) The phenomenon in which an application of a magnetising force, the domains become aligned to produce a strong magnetic field within the part.
(b) The phenomenon of being repelled by a magnetic field; an applied magnetic field creates an induced magnetic field in them in the opposite direction, causing a repulsive force
(c) a form of magnetism whereby certain materials are weakly attracted by an externally applied magnetic field, and form internal, induced magnetic fields in the direction of the applied magnetic field
(d) the phenomenon of getting attracted towards a non-magnet

MPMKVVCL (Bhopal) JE 2018

Ans. (a) : Ferromagnetism is the phenomenon in which an application of a magnetising force, the domains become aligned to produce a strong magnetic field within the part.

283. A large value of the exchange interaction energy in a ferromagnetic material implies

(a) Large saturation magnetization
(b) High Curie temperature
(c) High melting point
(d) Large diamagnetic susceptibility

ESE-2001

Ans. (a) : The parallel alignment of dipoles is due to creation of energy known as exchange interaction energy.
Higher the exchange interaction energy, higher will be area under B-H curve i.e. high saturation magnetization (because value of B at saturation will be very high).

284. ALNICO is an alloy of?
(a) iron, aluminium
(b) aluminium, nickel
(c) iron, cobalt, nickel
(d) aluminium, nickel, iron and cobalt

Mizoram PSC Jr. Grade (Power & Electricity Dept.) 2015

Ans. (d) : ALNICO is a family of iron alloys which in addition to iron are composed primarily of aluminium (Al), nickel (Ni) and cobalt (Co), hence acronym AL-NI-CO.
ALNICO magnet alloys have the highest energy per unit of cost or volume of any permanent magnet material commercially available. They are usually characterised by a higher coercivity, a higher energy, and a lower retentivity than the magnet steel type.

285. A material with unequal anti-parallel atomic magnetic moments is
(a) an anti-ferromagnet (b) ferrimagnetic
(c) a ferrite (d) non-magnetic

Mizoram PSC Jr. Grade (PWD) 2018 Paper-I

Ans. (b) : An anti-ferromagnet is a material with equal anti-parallel atomic magnets. Ferrimagnetic material is like anti-ferromagnet but with unequal anti-parallel atomic magnetic moments. The oldest known magnetic substance, magnetite (Iron Oxide), is a ferrimagnetic material.

Ferromagnetic ↑ ↑ ↑ ↑ ↑ ↑	Below T_C, spins are aligned parallel in magnetic domains.
Anti feromagnetic ↑ ↓ ↑ ↓ ↑ ↓	Below T_N, spins are aligned antiparallel in magnetic domains.
Ferrimagnetic ↑ ↓ ↑ ↓ ↑ ↓	Below T_C, spins are aligned antiparallel but do not cancelled.
Paramagnetic ↑ ↓ ↑↑ ↓ ↑ ↓↑↑	Spins are randomly oriented (any of the others above T_C or T_N)

286. Which one of the following pairs is NOT correctly matched?
(a) Copper : Diamagnetic
(b) Sodium : Anti ferromagnetic
(c) Iron : Ferromagnetic
(d) Ferrite : Ferromagnetic

ESE-2001

Ans. (b) : Sodium is a paramagnetic material so it is not an anti-ferromagnetic material.
Copper - Cu is a diamagnetic material
Iron - Ferromagnetic material
Ferrite - Ferromagnetic material
Na - Is not a anti ferromagnetic material.

287. All magnetic material lose their magnetic properties when
(a) Kept in Aluminium box
(b) Kept in Vacuum
(c) Cooled to low temperature
(d) Heated with high temperature

RSMSSB JEN (PHED) Degree 26.12.2020
Mizoram PSC Jr. Grade (PWD) 2018 Paper-I
Mizoram PSC Jr. Grade (PHED) 2014 Paper-I
ESE-2005

Ans. (d) : All magnetic material lose their magnetic properties when heated with high temperature. Because magnetic susceptibility decreases with increases temperature above to curie temperature. If magnetic susceptibility decreases then permeability also decreases.

$$(\mu_r) = \chi_m + 1$$

Where, χ_m = magnetic susceptibility

288. Ferromagnetic behavior is shown by those transition metals where the ratio of the atomic diameter to 3d orbital diameter is
(a) in the range of 0.5 to 1
(b) in the range of 1 to 1.5
(c) in the range of 1.5 to 2
(d) greater than 2

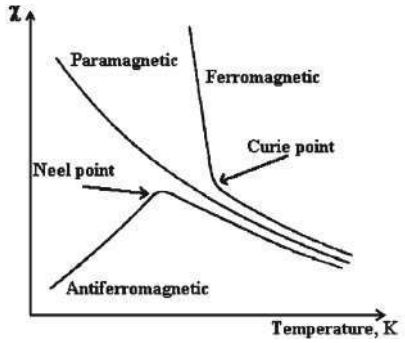
ESE-2001

Ans. (c) : The ratio of the atomic diameter to 3d orbital diameter is in the range of 1.5 to 2 of a ferromagnetic material.

289. Above the Curie temperature, ferro-magnetic materials behave like
(a) Paramagnetic (b) Diamagnetic
(c) Anti-ferromagnetic (d) Ferrimagnetic

ESE 2017, 2010, 2006, 2005
ISRO TA 2016
Mizoram PSC Jr. Grade (Power & Electricity Dept.) 2015
Mizoram PSC Jr. Grade (PHED) 2014 Paper-I
UKPSC JE 2013, PAPER-I
BPSC AE 2012 Paper-V
MPPSC AE 2016
UPPCL AE 12-11-2016

Ans. (a) : Above the Curie temperature, ferro-magnetic materials behave like paramagnetic because above curie temperature ferromagnetic material loses their property of ferro-magnetism.



$$\left(\chi_m \downarrow \propto \frac{1}{T \uparrow}\right)$$

χ_m = magnetic susceptibility
t = temperature

290. The hysteresis loop for the material of the core of a transformer should be
(a) Short and narrow (b) Tall and narrow
(c) Short and wide (d) Tall and wide

ESE-2005

Ans. (b) : The hysteresis loop for the material of the core of a transformer should be tall and narrow because the material used in transformer core should have high saturation level and low coercive force. Transformer core is of soft iron material.

291. Which one of the following materials can not be used for permanent magnets?

(a) Alnico (b) Barium ferrite
(c) Carbon steel (d) Iron – cobalt alloy

JPSC AE 10.04.2021, Paper-II
HPSSSB JE 2018 (Post code 663)
Mizoram PSC Jr. Grade(Power & Electricity Dept.) 2015
Mizoram PSC Jr. Grade (PHED) 2014 Paper-I
ESE-2002

Ans. (b) : Materials can not be used for permanent magnets barium ferrite.

292. Which one of the following is not a permanent magnetic material?

(a) Chromium steel (b) Silicon iron
(c) Cobalt steel (d) Alnico

RSMSSB JEN (PHED)Degree 26.12.2020
UPPCL AE 04-11-2019 Shift II
ESE-2004, 2005

Ans. (b) : Silicon iron is not a permanent magnetic material. Silicon iron is soft magnetic material.
4% Si-Fe is a soft magnetic material having coercive field H_c= 40 amp-m^{-1}.

293. With increase in temperature, magnetic susceptibility of a ferromagnetic material will

(a) Increase
(b) Decrease
(c) Increase initially and then decrease
(d) Remain constant

JPSC AE 10.04.2021, Paper-II
Mizoram PSC Jr. Grade (PHED) 2014 Paper-I
ESE-2006

Ans. (b) : With increase in temperature, magnetic susceptibility of ferromagnetic material will decreases.

Magnetic susceptibility $\downarrow \chi = \frac{C}{\uparrow (T-\theta)}$

Where T = Temperature
θ = curie temperature

294. Which law is synonymous to the occurrence of diamagnetism?

(a) Coulomb's law (b) Lenz's law
(c) Ampere's law (d) Maxwell's law

RSMSSB JEN (PHED)Degree 26.12.2020
OPPSC AE 2021, Paper-I

Ans. (b) : Since when a diamagnetic material subjected to an external field then it gets magnetization in the opposite to applied field. This phenomena is called diamagnetism. It behaves same as Lenz's law. The Lenz's law is synonymous to the occurrence of diamagnetism.

295. What are the materials which exhibit electric polarization even in the absence of an applied electric field called?

(a) Ferromagnetic (b) Paramagnetic
(c) Ferroelectric (d) Anti-ferroelectric

ESE-2005

Ans. (c) : Ferroelectric materials exhibit hysteresis effects similar to those observed in ferromagnetic materials.
The materials which exhibit electric polarization even in the absence of an applied electric field is called ferroelectric material.

296. The conductivity of ferrites is :

(a) Less than that of ferromagnetic materials
(b) Equal to that of ferromagnetic materials
(c) Greater than that of ferromagnetic materials
(d) Very high than that of ferromagnetic materials

MIZORAM PSC (PHED) 2019, Paper-I

Ans. (a) : As resistance of ferrite material is quite high so that the conductivity of ferrites is less than ferromagnetic materials.

297. The property/characteristic of ferroelectric materials is

(a) Dielectric relaxation
(b) Dielectric breakdown
(c) Spontaneous polarization
(d) Spontaneous magnetization

JPSC AE 10.04.2021, Paper-II
ESE-2010

Ans. (c) : The property/characteristic of ferroelectric materials is Spontaneous polarization.

298. Which of the following is a diamagnetic material?

(a) Aluminium (b) Oxygen
(c) Lead (d) Nickel

SSC JE 27.01.2018, Shift-I

Ans. (c) : Lead is a chemical element with its symbol Pb. It's atomic number is 82. It is a heavy metal that is denser than most of the common materials. The relative permeability of paramagnetic material is greater than 1 and less than 1000. Lead is a diamagnetic material diamagnetic materials have μ_r less than 1.
{μ_r = relative permeability}

299. Which of the following material shows paramagnetism?

(a) Copper (b) Iron
(c) Titanium (d) Silver

SSC JE 27.01.2018, Shift-I

Ans. (c) : Titanium is a paramagnetic material gets attract in the direction of magnetic field. the susceptibility of paramagnetic material is positive and very little. Their relative permeability is slightly greater than one (μ_r>1).

300. The magnetic materials that are used to prepare permanent magnets should have

(a) steeply rising magnetisation curve
(b) small hysteresis loop
(c) high retentivity
(d) low coercive force

SSC JE 2012

Ans:(c) Properties of the material of a permanent magnet-

- It should have high retentivity so, that it remains magnetised in the absence of the magnetising field.
- It should have high saturation magnetisation.
- It should have high coercivity so that it does not get demagnetised easily.

301. Ferro-electric materials have a

(a) high dielectric constant which varies non-linearly.
(b) low dielectric constant and is non-linear.

(c) high dielectric constant which varies linearly.
(d) low dielectric constant but linear.

ESE-2013

Ans. (a) : Ferro-electric materials have a high dielectric constant which varies non-linearly.

302. Oxygen is a/an……gas?
(a) ferromagnetic (b) diamagnetic
(c) paramagnetic (d) inert

SSC JE 26.09.2019, Shift-II

Ans. (c) : Paramagnetic- Gaseous oxygen is paramagnetic also but it is moving too fast to be affected by the magnets. The reason that it is paramagnetic is because the oxygen molecule has two unpaired electrons. Unpaired electron, spin in the same direction as each other which increased the magnetic field effect.

303. Which one of the following material does not have a constant relative permeability?
(a) Diamagnetic (b) Paramagnetic
(c) Ferromagnetic (d) Free space

SSC JE 29.01.2018, Shift-I

Ans. (c) : The relative permeability of ferromagnetic material is much greater than 1. It does not have constant relative permeability. Permeability is the measure of the resistance of a material against the formation of a magnetic field. otherwise known as distributed inductance in transmission line theory. It is denoted by μ.

304. An example for a para-magnetic material is---
(a) Copper (b) Bismuth
(c) Steel (d) Nickel

Vizag Steel JET 27.10.2018

Ans. (c) : Paramagnetic Materials: These are metals that are weakly attracted to magnet. They include aluminum, oxygen and platinum. The atoms of these substances contain electrons most of which spin in same direction but not all. They are only weakly influenced by a magnetic field.

♦ A paramagnetic material has a constant relative permeability (μ_r) slightly more than 1.

$$\mu_r > 1$$

305. Which is the natural magnet?
(a) Lodestone (b) Silicon steel
(c) Cobalt (d) Alnico

Vizag Steel 25.10.2018 Shift-I

Ans. (a) : Lodestone is the natural magnet. It is used in the permanent magnet where retentivity and coercivity are high.

306. Which of the following materials has susceptibility independent of temperature?
(a) Ferromagnetic (b) Ferrimagnetic
(c) Paramagnetic (d) Diamagnetic

UPPCL JE 2018, Shift-II

Ans. (d) : Diamagnetic materials has susceptibility independent of temperature-
- No intrinsic magnetic moment
- Independent of temperature
- Dipole induced by the external magnetic field.

307. Which of the following materials follow magnetic anisotropy?
(a) Ferromagnetic (b) Ferrimagnetic
(c) Paramagnetic (d) Diamagnetic

UPPCL JE 2018, Shift-II

Ans. (a) : In materials like iron, the magnetic properties depend on the direction in which they measured. This is magnetic anisotropy. The material iron is a ferromagnetic material type.

308. Which of the following is a ferroelectric material?
(a) Barium titanate
(b) Potassium dihydrogen phosphate
(c) All of these
(d) Rochelle salt

UPPCL JE 2018, Shift-II

Ans. (c) : A ferroelectric material is one which exhibits an electric dipole moment and is said to be spontaneously polarized even in the absence of an electric field. e.g. Rochelle salt, Barium titanate, (Potassium dihydrogen phosphate), Sodium nitrite.

309. In ferromagnetic, antiferromagnetic and ferrimagnetic materials, the atomic thermal motions counteract the coupling forces between the adjacent atomic dipole moments, thereby causing.
(a) some dipole misalignment regardless of whether an external field is present
(b) increase in dipole alignment regardless of whether an external field is present
(c) no effect on dipole alignment
(d) atoms tend to de-randomize the direction of moments

ESE-2014

Ans. (b) : In ferromagnetic, antiferromagnetic and ferrimagnetic materials, the atomic thermal motions counteract the coupling forces between the adjacent atomic dipole moments, thereby causing increase in dipole alignment regardless of whether an external field is present.

310. What is the equivalent of ferromagnetic curie temperature for iron in terms of Kelvin?
(a) 1418 (b) 1095
(c) 995 (d) 770

UPPCL JE 2018, Shift-II

Ans. (b) :

Material	Curie temperature in (K)
Iron	1043
Ni	627
Cobalt	1400
Fe_2O_3	948

311. Magnetic materials which may be readily magnetized in either direction are
(a) soft magnetic materials
(b) hard magnetic materials
(c) high eddy current loss materials
(d) high hysteresis loss materials

ESE-2015

Ans. (a) : Magnetic materials which may be readily magnetized in either direction are soft magnetic materials also used in electromagnets. Soft magnetic material can be easily magnetised in any direction and it may be easily demagnetised also.

312. An example for a ferro-magnetic material is ..... .

(a) Manganese (b) Nickel
(c) Aluminium (d) Copper

RSMSSB JEN (Diploma) 26.12.2020
Vizag Steel JET 25.10.2018, Shift-II

Ans. (b) : The ferro-magnetic materials are those substances which exhibit strong magnetism in the same direction of the field. When a magnetic field is applied to it

Permeability of these materials (μ_r) much greater than one. . $(\mu_r >>> 1)$

Example of ferro-magnetic materials–Nickel, cobalt, iron

313. The unit of relative permeability is

(a) henry/meter (b) henry
(c) henry/sq.m. (d) it is dimensionless

TSTRANSCO AE 2018
UPSSSC JE 31.07.2016

Ans : (d) The unit of relative permeability is dimension less. The relative magnetism of a substance is the ratio of the flux density produced in the substance and the flux density produced in zero or air by the same magnetic field. It is expressed by μ_r. For air its value (μ_r) is one. It is dimension less quantity.

$$\mu_r = \frac{\mu}{\mu_0}$$

μ_r = relative permeability
μ = permeability of material
μ_0 = permeability of free space

314. Which of the following exhibit electric hysteresis?

(a) Ferromagnetic materials only
(b) Ferroelectric materials only
(c) Ferrielectric materials only
(d) Both ferroelectric and ferrielectric materials

ESE-2007

Ans. (b) : Ferroelectric materials exhibit electrical hysteresis like Ferro-magnetic materials exhibits magnetic hysteresis.

315. Which of the following materials are diamagnetic?

(a) copper (b) silver-copper
(c) silver (d) iron

UPSSSC JE 31.07.2016

Ans : (b) Silver-copper materials are diamagnetic. Diamagnetic material creates an induced magnetic field in a direction opposite to an externally applied magnetic field. They are repelled by the applied magnetic field. The permanent dipoles are absent in diamagnetic material.

316. Susceptibilities of diamagnetic material is-

(a) Unity (b) Zero
(c) Negative (d) Positive

RRB JE 01.09.2019 Shift-I

Ans. (c) : Diamagnetic substance are those which repel magnetic field and hence its susceptibility is negative.

- For paramagnetic which are weaker than ferromagnetic but still attracting the magnetic field lines into it have positive value of magnetic susceptibility.

317. Which among the following magnetic materials has the highest energy-product to make it a permanent magnet?

(a) Alnico (b) Ferrite
(c) Samarium Cobalt (d) Cobalt-Iron alloy

ESE-2005

Ans. (a) : Alnico magnetic materials has the highest energy-product to make it a permanent magnet.

318. What are the materials which exhibit electric polarization even in the absence of an applied electrical field ?

(a) Anti-ferroelectric (b) Ferromagnetic
(c) Paramagnetic (d) Ferroelectric

RSMSSB JEN (Degree) 29.11.2020

Ans. (d) : Ferroelectric Materials:- Materials which exhibit electric polarization even in the absence of the applied electric field are called ferroelectric materials. They have permanent dipole moment in each atom or molecule. They have a high dielectric constant.

Examples:-
(1) Barium Titanate ($BaTiO_3$)
(2) Potassium dihydrogen phosphate (KH_2PO_4)
(3) Ammonium dihydrogen phosphate ($NH_4H_2PO_4$)
(4) Lithium Niobate ($LiNbO_3$)

319. What is a material with equal, anti-parallel atomic magnetic moments, known as?

(a) Ferrimagnetic (b) Ferrite
(c) Ferromagnetic (d) Anti-ferromagnetic

ESE-2007

Ans. (d) : Anti-ferromagnetic materials have equal but anti-parallel atomic magnetic moments.

320. Materials which lack permanent magnetic dipoles are known as:

(a) Paramagnetic (b) Diamagnetic
(c) Ferromagnetic (d) Ferrimagnetic

UPPCL JE 07.09.2021, Shift-I
ESE-2008

Ans. (b) : Material which lack permanent magnetic dipoles are called diamagnetic. Unlike a ferromagnet, a diamagnet is not a permanent magnet. Its magnetic permeability is less than the μ_o.

Where,

μ_o = Permeability of free space

321. Diamagnetic materials possess

(a) Permanent dipoles
(b) Induced dipoles
(c) Both permanent and induced dipoles
(d) No dipoles

ESE-2011

Ans. (b) : Diamagnetic materials are substances that are usually repelled by a magnetic field. Diamagnetic materials possess only induced dipole, in absence of magnetic field there is no dipoles and dipole moment is zero.

322. Paramagnetic susceptibility of a material

(a) Increase linearly with temperature
(b) Decreases linearly with temperature
(c) Increases linearly with (1/T)
(d) Decrease linearly with (1/T)

ESE-2011

Ans.(c):For paramagnetic material, magnetic susceptibility

$$\chi_m = \frac{C}{T-\theta}$$

(θ is curie temperature)

$$\chi_m \propto \frac{1}{T}$$

Where, $\chi_m \rightarrow$ susceptibility

$T \rightarrow$ Temperature

So, increase with $\frac{1}{T}$.

323. The property for magnetic material to minimize the hysteresis loss is……..?

(a) Conductivity
(b) High permittivity
(c) High resistivity
(d) Low hysteresis coefficient

NMRC JE 2019

Ans. (d) : The properties for magnetic material to minimize the hysteresis loss is low hysteresis coefficient

$$W_h = \eta B_{max}^{1.6} f.V$$

Where, η = hysteresis coefficient
B_{max}= maximum flux density
f = supply frequency
V = Volume of core

324. Soft iron is used to manufacture electro - magnets because it has

(a) High retentivity (b) High coercive field
(c) Low retentivity (d) Low coercive field

ESE-2011

Ans. (d) : Soft iron is used to manufacture electromagnets because it has low coercive field so they can response easily to alternating field. This property is important in applications where magnetic field is required to be switched repeatedly.

325. Susceptibility for paramagnetic materials is :

(a) Positive and small (b) Negative and small
(c) Positive and large (d) Negative and large

UPPCL JE 11.11.2016
ESE-2014

Ans : (a) Susceptibility for paramagnetic materials is "Positive and small" .
These materials are slightly attracted by a magnetic field and the material does not retain the magnetic properties when the external field is removed.

326. Which of the following is a magnetic material in which a permanent atomic magnetic dipole has a parallel orientation.

(a) Ferromagnetic (b) Ferrimagnetic
(c) Paramagnetic (d) Diamagnetic

UPPCL JE 27.08.2018, Shift-II

Ans. (a) : Ferromagnetic is a magnetic material in which a permanent atomic magnetic dipole has a parallel orientation.

327. The critical temperature at which high ferromagnetic materials lose their magnetism is called _____.

(a) Standard temperature
(b) Transition temperature
(c) Hysteresis
(d) Curie point

UPPCL JE 27.08.2018, Shift-II

Ans. (d) : High ferromagnetic material loses their magnetism at curie temperature and behaves like as paramagnetic material.

328. The presence of carbon as an impurity in ferromagnetic material decreases:

(a) retentivity (b) permeability
(c) coercive force (d) resistivity

UPPCL JE 27.11.2019, Shift-I

Ans : (b) By adding impurities of carbon to ferromagnetic material or increasing the amount of carbon, the magnetization decreases.

329. Copper, Silver, Diamond are examples of :

(a) Diamagnetic substance
(b) Paramagnetic substances
(c) Ferromagnetic substance
(d) Ferromagnetic substances

HPSSC JE 08.08.2021
UPPCL JE 11.11.2016

Ans : (a) Copper, silver, Diamond are examples of diamagnetic substance.
Diamagnetic materials have a weak, negative susceptibility to magnetic fields. Diamagnetic materials are slightly repelled by a magnetic field and the material does not retain the magnetic properties when the external field is removed.

330. Susceptibility of a diamagnetic material is

1. Negative
2. Positive
3. Dependent on the temperature
4. Independent of the temperature

Select the correct answer using the codes given below:

(a) 1 and 3 only (b) 2 and 3 only
(c) 1 and 4 only (d) 2 and 4 only

ESE 2017

Ans. (c) : For magnetic material (other than diamagnetic) susceptibility is a function of temperature but diagmagnetic material have negative susceptibiliy and independent of temperature.

331. The relative permeability of ferromagnetic material is–

(a) Not equal to unity (b) Greater than unity
(c) Equal to unity (d) Less than unity

HPSSC JE 08.08.2021

Ans. (b) : The relative permeability of ferromagnetic material are much greater than unity (more than 100 or 1000) they attract the line of force strongly. eg. (iron, cobalt, nickel) etc.

- Paramagnetic material relative permeability slightly more than one.
- Diamagnetic material relative permeability slightly less than one.

332. Value of relative permeability for ferromagnetic material is:-

(a) More than one (b) More than 100 or 1000
(c) Less than one (d) None of these

UPPCL JE 25.11.2019, Shift-II
UPPCL JE 2018, Shift-II

Ans. (b) : The relative permeability of ferromagnetic materials are much greater than unity (more than 100 or 1000).

- A paramagnetic material is one whose relative permeability is slightly more than one $(\mu_r > 1)$.
- A diamagnetic materials has a constant relative permeability slightly less than 1.
- They attract the lines of force strongly.
  e.g. iron, cobalt, nickel etc.

333. Metallic copper is a:

(a) Paramagnetic substance
(b) Diamagnetic substance
(c) Ferromagnetic substance
(d) Ferromagnetic substance

JKSSB JE 2014
ESE-2005

Ans. (b) : Metallic copper is a diamagnetic material or substance. Diamagnetic is a weak form of magnetism which arises only when an external field is applied. There is no magnetic dipoles in the absence of a magnetic field and when a magnetic field applied the dipole moment are aligned opposites to field direction.

334. Water is a _____ substance.

(a) nonmagnetic (b) ferromagnetic
(c) paramagnetic (d) diamagnetic

JUVNL JE-2017

Ans. (d) : Diamagnetic materials– The relative permeability of these materials is slightly less than unity they repel the lines of force slightly.
e.g. - Copper, hydrogen, silver, water etc.

335. Magnetic flux intensity is a

(a) scalar quantity (b) vector quantity
(c) phasor (d) None of these

BSNL TTA 29.09.2016, 10 AM

Ans : (b) Time and temperature has only magnitude so they are scalar. Flux density is the dot product of field and area vector so it is called scale. The magnetic field intensity (H) has both direction and magnitude so it is a vector quantity.

336. Diamagnetic materials are:

(a) Attracted by both poles
(b) Attracted by North pole
(c) Repelled by North pole
(d) Repelled by Both poles

BSNL TTA 27.09.2016, 3 PM

Ans : (d) Diamagnetic materials are substances that are usually repelled by both poles. The resultant magnetic momentum in an atom of the diamagnetic material is zero. Diamagnetic materials are such as wood, water, mercury, gold and bismuth, some plastics and few metals as well.

337. Ferromagnetic can be diamagnetic by-

(a) Heating to Curie temperature
(b) Keeping magnet in alternating fields
(c) Exposure to cyclic fields
(d) All of these

BSNL TTA 27.09.2016, 3 PM

Ans : (d) Ferromagnetic materials can be demagnetized by the following three methods-

- Heating to Curie temperature.
- Keeping magnet in alternating fields.
- Exposure to cyclic field.

338. Relative permeability is less than 1.0 in case of:

(a) Dia-magnet material
(b) Non-ferrous material
(c) Ferro-magnet material
(d) ferrites

DSSSB JE 05.11.2019

Ans. (a) : Relative permeability is less than 1 in case of dia-magnet material.

$$\begin{bmatrix} \mu_r < 1 \Rightarrow \text{Diamagnet} \\ \mu_r > 1 \Rightarrow \text{Paramagnet} \\ \mu_r >> 1 \Rightarrow \text{Ferromagnet} \end{bmatrix}$$

339. The retentivity of a material is useful for the construction of

(a) electromagnet
(b) permanent magnet
(c) non-magnetic substances
(d) transformer

ESIC JE-2016

Ans. (b) : The retentivity of a material is useful for the construction of permanent magnet.

340. Materials subjected to rapid reversal of magnetism should have

(a) high permeability and low hysteresis loss
(b) high coercivity and high retentivity
(c) high coercivity and low density
(d) large area of B-H loop

ESIC JE-2016

Ans. (a) : Material subjected to rapid reversal of magnetism should have high permeability and low hysteresis loss .

341. Relative permeability of non-magnetic material is

(a) Zero
(b) Greater than unity
(c) Unity
(d) Less than unity but not zero

PSTCL AE 06.08.2021

Ans. (c) : Relative permeability of non-magnetic material is unity.

342. The material used for formation of salient poles of variable reluctance stepper motor is

(a) Paramagnetic material
(b) Ferrimagnetic material
(c) Ferromagnetic material
(d) Diamagnetic material

UPPSC Poly. Lect. 22.12.2021, P-II (EE)

Ans. (b) : The material used for formation of salient poles of variable reluctance stepper motor is ferromagnetic material.

343. Dielectric heating is not used for

(a) preheating plastic performs
(b) heating of glass for glass working

(c) sterilizing surgical instruments
(d) wood gluing and glue line heating

UPPSC AE 2011, P-I (EE)

Ans. (c) : Dielectric heating- Dielectric heating is a non conducting material which can be polarized in the presence of electric field. They have ability to store energy when external electric field applied. A dielectric is always an insulator. Therefore dielectric heating is not used for sterilizing surgical instruments.

344. Which one of the following statements is not correct related to dielectric loss in dielectric heating? Dielectric loss is
(a) proportional to the supply voltage
(b) proportional to the supply frequency
(c) proportional to loss factor
(d) proportional to area of the plate

UPPSC AE 2011, P-I (EE)

Ans. (a) : Dielectric heating is heating caused due to dielectric loss in insulating material. Dielectric loss is power loss occurring in dielectric material (Insulating material) when it is subjected to electric field.
Note:-This loss increases with frequency of applied alternating voltage or frequency and area of plate.

345. When temperature exceeds the transition temperature, a ferromagnetic material becomes similar to
(a) Anti-ferromagnetic material
(b) Diamagnetic material
(c) Paramagnetic material
(d) None of the above

UPPSC Poly. Lect. 22.12.2021, P-II (EE)

Ans. (c) : Magnetic properties of ferromagnetic material get affected when heated therefore when temperature exceeds the transition temperature, a ferromagnetic material becomes similar to paramagnetic material.

346. Which of the following materials has the highest dielectric strength?
(a) Marble (b) Polystyrene
(c) Transformer oil (d) Cotton

UPPSC Poly. Lect. 22.12.2021, P-II (EE)

Ans. (a) : The dielectric strength is the ratio of the permittivity of a substance to the permittivity of free space.
Polystyrene has the highest value of dielectric strength (2.4×10^7).

347. Which of the following materials has permanent magnetic dipoles?
(a) Ferromagnetic material
(b) Anti-ferromagnetic material
(c) Diamagnetic material
(d) Paramagnetic material

UPPSC Poly. Lect. 22.12.2021, P-II (EE)

Ans. (a) : Ferromagnetic materials are those which exhibit strong magnetism in the same direction of the field when a magnetic field is applied to it therefore ferromagnetic materials has permanent magnetic diploes.

348. When the temperature of a magnetic material is raised above the Curie point, it becomes
(a) Diamagnetic (b) Ferrimagnetic
(c) Ferromagnetic (d) Paramagnetic

UPPSC AE 29.05.2022, P-II (EE)

Ans. (d) : When the temperature of a magnetic material is raised above the curie point becomes paramagnetic materials.
• Curie temperature is the temperature at which the magnetic properties of a material change.

349. Which one of the following materials is a diamagnetic material?
(a) Copper (b) Nickel
(c) Iron (d) Aluminium

UPPSC AE-13.12.2020, P-II (EE)

Ans. (a) : In a diamagnetic material no magnetism and no any dipole present due to absence of magnetic field. When magnetic field presence dipole are induced. Copper is diamagnetic material whenever iron, nickel are ferromagnetic material. Aluminium is paramagnetic material.

350. At room temperature iron is:
(a) paramagnetic (b) ferromagnetic
(c) ferroelectric (d) dielectric

UPPSC AE-2007 (General) P-I

Ans. (b) : At room temperature iron exhibits ferromagnetic properties, meaning it has a strong attraction to magnets and can retain magnetization.

351. Dielectric strength is:
(a) the magnitude of electric field necessary to cause significant current passage through a dielectric material
(b) shock load which a dielectric material can bear
(c) maximum temperature upto which a dielectric material does not melt
(d) maximum current which can pass through a dielectric

UPPSC AE-2007 (General) P-I

Ans. (a) : : Dielectric strength is the magnitude of electric field necessary to cause significant current passage through a dielectric material.

352. Dielectric strength of material is
(a) capacity to bear two stresses
(b) magnetic property
(c) capacity to withstand high voltage
(d) capacity to resist creep deformation

UPPSC AE-2011 P-I

Ans. (c) : Dielectric strength is the maximum electric field that a material can with stand without breaking down or becoming electrically conductive. It is a measure of a material's ability to act as an insulator under high voltage conditions.

353. The residual magnetic flux density is more in
(a) metallic magnets (b) ceramic magnets
(c) graphite (d) iron oxide

UPPSC AE-2007 (Special) P-I

Ans. (a) : Explanation:– Metallic magnets have strong magnetic properties and high residual flux density due to their ferromagnetic nature.

354. At room temperature iron is

(a) para magnetic (b) ferromagnetic
(c) ferro electric (d) dielectric

UPPSC AE-2004 P-I

Ans. (b) : Explanation:– At room temperature iron is ferromagnetic this means that it has a spontaneous magnetic moment even in the absence of an external magnetic field due to the alignment of its magnetic domains.

355. Hard magnetic materials

(a) have large hysteresis loop area
(b) have higher hardness physically
(c) have large coercive force
(d) all the above

UPPSC AE-2004 P-I

Ans. (d) : Explanation:– Hard magnetic materials are characterized by their ability to retain magnetization and resist demagnetization.

(A) Large hysteresis loop area:– Hard magnetic materials typically have a large hysteresis loop, indicating that they require significant energy to magnetic and demagnetize, which is a key property of permanent magnetic.

(B) Higher hardness physically:– while many hard magnetic materials are physically hard (due to their ability to retain magnetization)

(C) Large coercive force:– Hard magnetic materials have a large coercive force, meaning they require a strong opposing magnetic field to demagnetize.

356. Magnetic susceptibility of a material is equal to (– 1). It belongs to the kind of solid known as

(a) anti-ferromagnetic
(b) superconductor, type I
(c) ferrite
(d) garnet

UPPSC AE 31.07.2010 P-I

Ans. (b) : Magnetic susceptibility of a material is equal to (–1). It belongs to the kind of solid known as superconductor type I.

357. The critical temperature above which ferromagnetic materials lose their magnetic property is called

(a) Kelvin point
(b) Curie point
(c) Recrystallization point
(d) Celsius point

ESE (Pre) 2018

Ans. (b) : Curie point is a particular temperature at which any material's magnetic properties disappear. Ferromagnetic or diamagnetic converted into paramagnetic.

■ The antiferromagnetic curie point is called the neel point.

358. The Hall Effect may be used to

1. Determine whether the semiconductor is p-type or n-type.
2. Determine the carrier concentration.
3. Calculate the mobility.

Which of the above statements are correct ?

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

ESE (Pre) 2018

Ans. (d) : Hall Effect–The production of a potential difference across an electrical conductor when magnetic field is applied in direction perpendicular to that of the flow of current.

It is Applied–

(a) Find P-type or n-type
(b) To calculate carrier concentration
(c) To calculate mobility
(d) To calculate drift velocity
(e) To calculate conductivity of specimen
(f) To calculate magnetic field B.

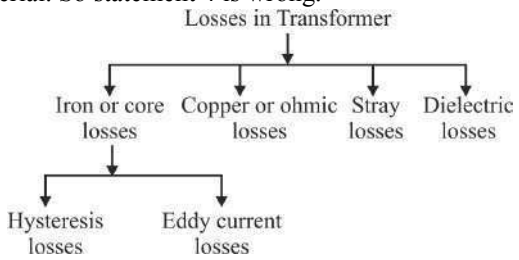
359. On which of the following factors does hysteresis loss depend ?

1. Magnetic filed intensity
2. Frequency of the filed
3. Volume of material
4. Neel temperature

(a) 1, 2 and 4 only (b) 1, 3 and 4 only
(c) 2, 3 and 4 only (d) 1, 2 and 3 only

ESE (Pre) 2018

Ans. (d) : Neel temperature is the temperature at which antiferromagnetic material changes into paramagnetic material. So statement 4 is wrong.



Iron losses are caused by the alternating flux in core of the transformer as this loss occurs in core.

Hysteresis loss–It is caused by the magnetization and demagnitization of the core as current flow in the forward and backward direction.

$$\text{Loss} = \eta\ B_{max}^{1.6} \times f \times v$$

B = magnetic field
f = frequency of the field
v = volume of material

360. Which one of the following types of materials is having high remanence, coercivity and saturation flux density as well as low permeability and high hysteresis energy losses?

(a) Soft magnetic materials
(b) Hard magnetic materials
(c) Hard electrical materials
(d) Soft electrical materials

ESE (Pre) 2020

Ans. (b) : Hard Magnetic Materials– It is used in permanent magnets, which must have a high resistance to demagnetization.

In terms of hysteresis behaviour, a hard magnetic material has–

- High remanence

- Coercivity and saturation flux density as well as low initial permeability and high hystersis energy losses.
- Low permeability.
- Low susceptibility.

Soft Magnetic Material– It is the material that are easily magnetised and demagnetised. They typically have intrinsic coercivity less than 1000 AM.

Exam Points

- Super conduction by metals is observed in the temperature range of– **below 60K**
- Which alloying element increases residual magnetism and coercive magnetic force in steel for magnets is– **Cobalt**
- Intensity of magnetization of a body is defined as– **Magnetic moment/volume**
- Ferromagnetic material is a material in which– **The atomic magnetic moments are parallel**
- The intensity of magnetization of a ferromagnetic solid material– **Decreases with increase in temperature**
- Intensity of magnetization of a ferromagnetic solid material dependent on temperature is caused by– **Variations in the directions of the atomic magnetic moments**
- The least desired property in magnetic materials for electrical engineering applications is– **Large hysteresis loop**

2.5 Ceramics

361. Gauged cement mortar consists of
(a) Cement and sand
(b) Cement, surkhi and sand
(c) Cement, lime and sand
(d) Cement, cinder and sand

BPSC AE (GEN. ENGG.) 15.09.2018

Ans. (c) : Gauged cement mortar–Mortar is produced by mixing a binding material (cement and lime) with fine aggregate (sand, surkhi etc.) with water.
• **Types of mortar are follows–**

	Binding materials	Fine aggregate
1. Cement mortar	Cement	Sand
2. Lime mortar	Lime	Sand
3. Gauged mortar	Cement+Lime	Sand
4. Surkhi mortar	Lime	Surkhi
5. Mud mortar	Mud	Saw dust + rice husk + cow dung

362. Quoins in brick masonry are
(a) Bricks cut a corners in a triangular fashion
(b) Half-brick with length same but width halved
(c) Squint junction of walls
(d) Corner junction of walls

BPSC AE (GEN. ENGG.) 15.09.2018

Ans. (d) : Quoins–
• It is the outer of exterior angle on the face side of wall.
• It is generally kept 90º
• In brick masonry, quoins refer to the corner stones or brick that are positioned at the external corners of a building or structure. They provide both functional strength and aesthetic appeal, contributing to the overall durability and visual impact of the construction.

363. The bonding in ceramics is
(a) Ionic
(b) Metallic
(c) Covalent
(d) Partially ionic and partially covalent

UPPSC Poly. Lect. 22.12.2021, P-II (EE)

Ans. (d) : The bonding in ceramic materials is partially ionic and partially covalent.

364. Which of the following is the characteristics of ceramic material?
(a) Porosity and Flexibility
(b) Elasticity and Plasticity
(c) Hardness and Brittleness
(d) Malleability and Ductility

UPPSC PCS Pre-2009

Ans. (c) : Ceramic materials are known for their high hardness and brittleness, They are strong in compression but tend to fracture or break under tensile stress or impact.

365. Consider the following statements:
1. Asphalt is a naturally occurring product having non-crystalline structure.
2. Rock Asphalt occurs in lime stones or sandstones.
3. Tar is a residue left after distillation of crude oil.
4. Resins in Asphalt provide the stickiness to the product.

Which of the above statements are correct?
(a) 1, 2 and 3 only (b) 3 and 4 only
(c) 1, 2 and 4 only (d) 1, 2, 3 and 4

ESE (Pre) 2017

Ans. (c) : Non-crystalline structure is
- Irregular pattern of ions, molecules, or atoms in a solid.
- Asphalt is a naturally occurring product having non-crystalline structure.
- Rock Asphalt occurs in lime stones or sandstones.
- Resins in Asphalt provide the stickiness to the product.

366. ***Statement (I):*** Abrasive ceramics are used to wear, grind, or cut away other material, which necessarily is softer.
Statement (II): The prime requisite for abrasive ceramic group of materials is hardness or wear resistance and a high degree of toughness is essential to ensure that the abrasive particles do not easily fracture.
Codes:
(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
(b) Both Statement (I) ad Statement (II) are individually true but Statement (II) is **not** the correct explanation of Statement (I)