National Testing Agency [NTA]

National Eligibility cum Entrance Test

NEET - 2025

Chemistry

BAISED ON NMC

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In the event of any dispute, the judicial area will be Prayagraj.

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NEET Exam Pattern & Syllabus

As per the NEET exam pattern, the questions in the medical entrance examination will be divided into two sections: Section A and B. Section A will contain 35 questions while Section B will have 15 questions. Of these 15 questions in Section B, candidates will have to answer 10 questions.

NTA will conduct the NEET exam in pen and paper-based mode for a 3 hours 20 minutes duration, where candidates must answer Multiple Choice Questions (MCQs) from Physics, Chemistry, and Biology subjects as per the given NEET syllabus. Aspirants seeking more information regarding the NEET exam pattern can check the article below to know the level of the exam, types, and the number of questions, marking schemes, and all other relevant information.

Factors in Exam Pattern	Details
Mode of NEET Question Paper	Pen and Paper-based. Candidates will be given an OMR sheet to mark the answers with a black or blue ballpoint pen
Duration of the NEET exam	3 hours and 20 minutes
Language/Medium	English, Hindi, Assamese, Bengali, Gujarati, Marathi, Tamil, Telugu, Oriya, Malayalam, Kannada, Punjabi and Urdu
Question Type	Multiple Choice Questions (MCQs)
Total Number of Questions	A total of 200 questions will be asked out of which candidates will have to answer 180 questions
Total marks in NEET	720 Marks
NEET 2023 Marking Scheme	4 marks will be awarded for each correct answer & 1 mark will be deducted for each wrong attempt

■ NEET Exam Sections and Total Marks

Subjects	Sections	Number of Questions	Section-wise Marks
Physics	Section A	35	140
	Section B	15	40
Chemistry	Section A	35	140
	Section B	15	40
Botany	Section A	35	140
	Section B	15	40
Zoology	Section A	35	140
	Section B	15	40
Total Marks			**720**

CHEMISTRY

■ Some Basic Concepts of Chemistry

- General Introduction: Important and scope of chemistry.
- Laws of chemical combination, Dalton's atomic theory: concept of elements, atoms and molecules.
- Atomic and molecular masses. Mole concept and molar mass; percentage composition and empirical and molecular formula; chemical reactions, stoichiometry and calculations based on stoichiometry.

■ Structure of Atom

- Atomic number, isotopes and isobars. Concept of shells and subshells, dual nature of matter and light, de Broglie's relationship, Heisenberg uncertainty principle, concept of orbital, quantum numbers, shapes of s,p and d orbitals, rules for filling electrons in orbitals- Aufbau principle, Pauli exclusion principles and Hund's rule, electronic configuration of atoms, stability of half filled and completely filled orbitals.

■ Classification of Elements and Periodicity in Properties

- Modern periodic law and long form of periodic table, periodic trends in properties of elements-atomic radii, ionic radii, ionization enthalpy, electron gain enthalpy, electronegativity, valence.

■ Chemical Bonding and Molecular Structure

- Valence electrons, ionic bond, covalent bond, bond parameters, Lewis structure, polar character of covalent bond, valence bond theory, resonance, geometry of molecules, VSEPR theory, concept of hybridization involving s, p and d orbitals and shapes of some simple molecules, molecular orbital theory of homonuclear diatomic molecules (qualitative idea only). Hydrogen bond.

■ States of Matter: Gases and Liquids

- Three states of matter, intermolecular interactions, types of bonding, melting and boiling points, role of gas laws of elucidating the concept of the molecule, Boyle's law, Charle's law, Gay Lussac's law, Avogadro's law, ideal behaviour of gases, empirical derivation of gas equation. Avogadro number, ideal gas equation. Kinetic energy and molecular speeds (elementary idea), deviation from ideal behaviour, liquefaction of gases, critical temperature.
- Liquid State- Vapour pressure, viscosity and surface tension (qualitative idea only, no mathematical derivations).

■ Thermodynamics

- First law of thermodynamics-internal energy and enthalpy, heat capacity and specific heat, measurement of ΔU and ΔH, Hess's law of constant heat summation, enthalpy of : bond dissociation, combustion, formation, atomization, sublimation, phase transition, ionization, solution and dilution.
- Introduction of entropy as state function, Second law of thermodynamics, Gibbs energy change for spontaneous and non-spontaneous process, criteria for equilibrium and spontaneity.
- Third law of thermodynamics- Brief introduction.

■ Equilibrium

- Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of chemical equilibrium, equilibrium constant, factors affecting equilibrium- Le Chatelier's principle; ionic equilibrium- ionization of acids and bases, strong and weak electrolytes, degree of ionization, ionization of polybasic acids, acid strength, concept of pH., Hydrolysis of salts (elementary idea)., buffer solutions, Henderson equation, solubility product, common ion effect (with illustrative examples).

■ Redox Reactions

- Concept of oxidation and oxidation and reduction, redox reactions oxidation number, balancing redox reactions in terms of loss and gain of electron and change in oxidation numbers.

■ Hydrogen

- Occurrence, isotopes, preparation, properties and uses of hydrogen; hydridesionic, covalent and interstitial; physical and chemical properties of water, heavy water; hydrogen peroxide-preparation, reactions, uses and structure;

■ s-Block Elements (Alkali and Alkaline earth metals)

- Group I and group 2 elements:

  General introduction, electronic configuration, occurrence, anomalous properties of the first element of each group, diagonal relationship, trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii), trends in chemical reactivity with oxygen, water, hydrogen and halogens; uses.
- Preparation and Properties of Some important Compounds:
- Sodium carbonate, sodium chloride, sodium hydroxide and sodium hydrogencarbonate, biological importance of sodium and potassium.
- Industrial use of lime and limestone, biological importance of Mg and Ca.

■ Some p-Block Elements

- General Introduction to p-Block Elements.
- Group 13 elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous properties of first element of the group; Boron, some important compounds: borax, boric acids, boron hydrides. Aluminium: uses, reactions with acids and alkalies.
- General 14 elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first element. Carbon, allotropic forms, physical and chemical properties: uses of some important compounds: oxides.
- Important compounds of silicon and a few uses: silicon tetrachloride, silicones, silicates and zeolites, their uses.

■ Organic Chemistry- Some Basic Principles and Techniques

- General introduction, methods of purification qualitative and quantitative analysis, classification and IUPAC nomenclature of organic compounds.
- Electronic displacements in a covalent bond: inductive effect, electromeric effect, resonance and hyper conjugation.
- Homolytic and heterolytic fission of a covalent bond: free radials, carbocations, carbanions; electrophiles and nucleophiles, types of organic reactions.

■ Hydrocarbons

- Alkanes- Nomenclature, isomerism, conformations (ethane only), physical properties, chemical reactions including free radical mechanism of halogenation, combustion and pyrolysis.
- Alkanes-Nomenclature, structure of double bond (ethene), geometrical isomerism, physical properties, methods of preparation: chemical reactions: addition of hydrogen, halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect), ozonolysis, oxidation, mechanism of electrophilic addition.
- Alkynes-Nomenclature, structure of triple bond (ethyne), physical properties, methods of preparation, chemical reactions: acidic character of alkynes, addition reaction of- hydrogen, halogens, hydrogen halides and water.

- Aromatic hydrocarbons- Introduction, IUPAC nomenclature; Benzene; resonance, aromaticity; chemical properties: mechanism of electrophilic substitution- Nitration sulphonation, halogenation, Friedel Craft's alkylation and acylation; directive influence of functional group in mono-substituted benzene; carcinogenicity and toxicity.

■ Environmental Chemistry

- Environmental pollution: Air, water and soil pollution, chemical reactions in atmosphere, smogs, major atmospheric pollutants; acid rain ozone and its reactions, effects of depletion of ozone layer, greenhouse effect and global warming-pollution due to industrial wastes; green chemistry as an alternative tool for reducing pollution, strategy for control of environmental pollution.

■ Solid State

- Classification of solids based on different binding forces; molecular, ionic covalent and metallic solids, amorphous and crystalline solids (elementary idea), unit cell in two dimensional and three dimensional lattices, calculation of density of unit cell, packing in solids, packing efficiency, voids, number of atoms per unit cell in a cubic unit cell, point defects, electrical and magnetic properties, Band theory of metals, conductors, semiconductors and insulators.

■ Solutions

- Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties- relative lowering of vapour pressure, Raoult's law, elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties abnormal molecular mass. Van Hoff factor.

■ Electrochemistry

- Redox reactions, conductance in electrolytic solutions, specific and molar conductivity variation of conductivity with concentration, kohlrausch's Law, electrolysis and Laws of electrolysis (elementary idea), dry cell- electrolytic cells and Galvanic cells; lead accumulator, EMF of a cell, standard electrode potential, Relation between Gibbs energy change and EMF of a cell, fuel cells; corrosion.

■ Chemical Kinetics

- Rate of a reaction (average and instantaneous), factors affecting rates of reaction; concentration, temperature, catalyst; order and molecularity of a reaction; rate law and specific rate constant, integrated rate equations and half life (only for zero and first order reactions); concept of collision theory (elementary idea, no mathematical treatment). Activation energy, Arrhenious equation.

■ Surface Chemistry

- Adsorption-physisorption and chemisorption; factors affecting adsorption of gases on solids, catalysis homogeneous and heterogeneous, activity and selectivity: enzyme catalysis; colloidal state: distinction between true solutions, colloids and suspensions; lyophillic, lyophobic multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation; emulsions- types of emulsions.

■ General Principles and Processes of Isolation of Elements

- Principles and methods of extraction- concentration, oxidation, reduction electrolytic method and refining; occurrence and principles of extraction of aluminium, copper, zinc and iron.

■ p- Block Elements

- Group 15 elements: General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; preparation and properties of ammonia and nitric acid, oxides of nitrogen (structure only); Phosphorous- allotropic forms; compounds of phosphorous: preparation and properties of phosphine, halides (PCI_3, PCI_5) and oxoacids (elementary idea only).
- Group 16 elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; dioxygen: preparation, properties and uses; classification of oxides; ozone. Sulphur – allotropic forms; compounds of sulphur: preparation, preparation, properties and uses of sulphur dioxide; sulphuric acid: industrial process of manufacture, properties and uses, oxoacids of sulphur (structures only).
- Group 17 elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; compounds of halogens: preparation, properties and uses of chlorine and hydrochloric acid, interhalogen compounds oxoacids of halogens (structures only).

- Group 18 elements: General introduction, electronic configuration, occurrence, trends in physical and chemical properties, uses.

■ d and f Block Elements

- General introduction, electronic configuration, characteristics of transition metals, general trends in properties of the first row transition metals- metallic character, ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic properties, interstitial compounds, alloy formation. Preparation and properties of $K_2Cr_2O_7$ and $KMnO_4$.
- Lanthanoids- electronic configuration, oxidation states, chemical reactivity, and lanthanoid contraction and its consequences.
- Actinoids: Electronic configuration, oxidation states and comparison with lanthanoids.

■ Coordination Compounds

- Coordination compounds: Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds, isomerism (structural and stereo) bonding, Werner's theory VBT,CFT; importance of coordination compounds (in qualitative analysis, biological systems).

■ Haloalkanes and Haloarenes

- Haloalkanes: Nomenclature, nature of C –X bond, physical and chemical properties, mechanism of substitution reactions. Optical rotation.
- Haloarenes: Nature of C-X bond, substitution reactions (directive influence of halogen for monosubstituted compounds only).
- Uses and environment effects of – dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT.

■ Alcohols, Phenols and Ethers

- Alcohols: Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only); identification of primary, secondary and tertiary alcohols; mechanism of dehydration, uses with special reference to methanol and ethanol.
- Phenols: Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophillic substitution reactions, uses of phenols.
- Ethers: Nomenclature, methods of preparation, physical and chemical properties uses.

■ Aldehydes, Ketones and Carboxylic Acids

- Aldehydes and Ketones: Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties; and mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes; uses.
- Carboxylic Acids: Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

■ Organic Compounds Containing Nitrogen

- Amines: Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary secondary and tertiary amines.
- Cyanides and Isocyanides- will be mentioned at relevant places.
- Diazonium salts: Preparation, chemical reactions and importance in synthetic organic chemistry.

■ Biomolecules

- Carbohydrates- Classification (aldoses and ketoses), monosaccharide (glucose and fructose), D.L. configuration, oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen): importance.
- Proteins- Elementary idea of – amino acids, peptide bond, polypeptides, proteins, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins; enzymes.
- **Hormones- Elementary idea (excluding structure).**
- Vitamins- Classification and function.
- Nucleic Acids: DNA and RNA

■ Polymers

- Classification- Natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers: natural and synthetic like polyesters, bakelite; rubber, Biodegradable and non-biodegradable polymers.

■ Chemistry in Everyday Life

- Chemicals in medicines- analgesics, tranquilizers, antiseptics, disinfectants,antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.
- Chemicals in food- preservatives, artificial sweetening agents, elementary idea of antioxidants.
- Cleansing agents- soaps and detergents, cleansing action.

NEET (UG) & AIPMT EXAMINATION PAPER ANALYSIS CHART

S. No.	Examination Question Paper	Exam Date/ year	No. of Question
1.	NEET (UG)	05.05.2024	50
2.	RE-NEET- Manipur	06.06.2023	50
3.	NEET (UG)	07.05.2023	50
4.	RE-NEET	04.09.2022	50
5.	NEET (UG)	17.07.2022	50
6.	NEET (UG)	12.09.2021	50
7.	NEET (UG)	14.10.2020 Phase 2	45
8.	NEET (UG)	13.09.2020	45
9.	NEET (UG) (Odisha)	20.05.2019	45
10.	NEET (UG)	05.05.2019	45
11.	NEET (UG)	06.05.2018	45
12.	NEET (UG)	07.05.2017	45
13.	NEET (UG)	24.07.2016 Phase 2	45
14.	NEET (UG)	01.05.2016	45
15.	AIPMT	25.07.2015 Re-Exam	45
16.	AIPMT	03.05.2015	45
17.	AIPMT	06.05.2014	45
18.	NEET (UG)	05.05.2013	45
19.	NEET (UG) (Karnataka)	18.05.2013	45
20.	AIPMT	2012 Mains	30
21.	AIPMT	2012	50
22.	AIPMT	2011 Mains	30
23.	AIPMT	2011	50
24.	AIPMT	2010 Mains	30
25.	AIPMT	2010	50
26.	AIPMT	2009	50
27.	AIPMT	2008	50
28.	AIPMT	2007	50
29.	AIPMT	2006	50
30.	AIPMT	2005	50
31.	AIPMT	2004	50
32.	AIPMT	2003	50
33.	AIPMT	2002	50
34.	AIPMT	2001	50
35.	AIPMT	2000	50
36.	AIPMT	1999	50
37.	AIPMT	1998	50
38.	AIPMT	1997	50
39.	AIPMT	1996	50
40.	AIPMT	1995	50
41.	AIPMT	1994	50
42.	AIPMT	1993	50
43.	AIPMT	1992	50
44.	AIPMT	1991	50
45.	AIPMT	1990	50
46.	AIPMT	1989	50
47.	AIPMT	1988	50
48.	AIPMT	1987	50
		Total	**2275**

Note- After the analysis of the above question papers, a total of **2275** (Repeated questions + similar nature questions) questions related to Chemistry have been placed below the name of the original questions, so that the examinees can understand the nature of repetition of questions.

Topic wise Trend Analysis of NEET/AIPMT Previous Question I

CHEMISTRY

S. No.	Topic	NEET (UG) 013	AIPMT 2014	AIPMT 2015	AIPMT 2015 (Re)	NEET (UG) 2016 Phase- I	NEET (UG) 2016 Phase- II	NEET (UG) 2017	NEET (UG) 2018	NEET (UG) 2019	NEET (UG) 2019 Odisha	NEET (UG) 2020	NEET (UG) 2020 Phase-II	NEET (UG) 2021	NEET (UG) 2022
1	**s/p/d/f Blocks**	5	3	4	5	6	7	7	4	7	10	8	9	6	8
2	**Chemical Bonding**	9	3	6	4	3	4	3	5	4	3	2	3	4	2
3	**Oxygen Containing Group (Alcohol, Ether, Phenol, Aldehyde/ Ketone, Benzaldehyde, Acid & It's Acid Derivatives, Benzoic Acid**	2	3	2	3	4	1	4	4	2	3	4	2	5	5
4	**Hydrocarbon (Alkane, Alkene, Alkyne) & Halogen Derivatives**	1	3	2	3	3	4	2	3	3	3	3	4	3	2
5	**Complex Compound**	2	2	2	4	1	3	4	3	1	1	1	1	2	3
6	**Electrochemistry**	3	3	1	1	1	5	1	1	2	2	2	2	2	3
7	**Thermodynamics**	1	2	1	1	1	1	2	1	2	2	3	2	2	1
8	**Solution**	1	1	2	3	2	2	2	0	2	2	2	2	2	1
9	**Reaction Mechanism**	2	1	3	2	0	2	4	2	2	1	1	1	0	2
10	**Chemical Kinetics**	1	0	2	1	2	1	2	2	2	2	2	2	2	2
11	**Ionic Equilibrium, Acid-Base, pH/ Buffer/ Titration**	2	2	1	1	1	2	1	2	3	3	1	2	1	1

12	**Atomic Structure/Nuclear Chemistry**	3	2	2	1	1	2	1	1	1	2	1	1	1	1
13	**Biomolecules**	0	3	0	0	3	2	1	2	1	1	2	2	1	0
14	**Solid State**	2	1	1	2	2	1	1	1	1	1	1	1	2	2
15	**Mole Concept**	1	3	1	3	0	1	0	2	2	0	1	1	1	1
16	**Metallurgy**	0	0	1	1	1	0	1	1	1	1	1	1	3	1
17	**Polymers**	2	2	1	1	1	1	0	1	1	2	1	1	1	1
18	**Periodic Table**	0	1	3	2	1	0	1	1	2	1	2	1	1	1
19	**Nitrogen Containing Groups (Amines, Anilene, Nitro, Cyanides)**	2	2	1	2	1	2	1	2	0	1	1	1	2	2
20	**States of Matter (Gases & Liquids)**	1	0	1	1	1	0	0	2	1	2	1	1	2	2
21	**Surface Chemistry**	0	2	1	0	2	1	1	1	1	1	1	1	1	2
22	**Purification-Separation, Chemistry in everyday life**	1	1	2	0	1	0	1	0	1	1	2	2	1	2
23	**Isomerism**	1	0	2	2	2	2	1	0	0	0	0	0	2	0
24	**Chemical Evolution**	1	1	2	1	1	0	2	1	0	0	0	0	0	1
25	**Nomenclature (IUPAC)**	2	0	0	0	0	1	1	1	1	0	0	1	1	1
26	**Redox Reaction**	0	2	1	1	1	0	0	1	0	0	1	1	0	0
27	**Environmental Chemistry**	0	1	0	0	0	0	1	1	1	0	0	0	1	2
28	**Hydrogen & It's Compounds**	0	1	0	0	1	0	0	0	1	0	1	0	1	1
Total		**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**50**	**50**

01.

Some basic Concepts of Chemistry

1. Properties of Matter and their Measurement

1. The density of the solution is 2.15g mL^{-1}, then mass of 2.5 mL solution in correct significant figures is:
एक विलयन का घनत्व 2.15g mL^{-1} है, तब 2.5 mL विलयन का मान सही सार्थक अंकों में है:

(a) 5375×10^{-3} g (b) 5.4 g
(c) 5.38 g (d) 53.75 g

NEET (UG) Re-Exam-04.09.2022

Ans. (b) : In case of multiplication and division the final result should be reported as having the same number of significant digits as the number with least number of significant digits.

$\because$ Density = $\frac{\text{Mass}}{\text{Volume}}$

So, Mass = 2.15×2.5

$= 5.375 \approx 5.4$g

2. Number of significant number will be in following numbers
सार्थक अंकों की संख्या निम्न संख्याओं में होगी–

(a) 161 cm (b) 0.0161 (c) 1.61

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

AIPMT-1998

Ans. (a) : 1. All non zero digits are significant.
2. Non zero digits to the right of the decimal point are significant.
3. Zeroes to the left of the first non-zero digits in a number are not significant. So, the number of significant figures for the numbers 161 cm, 0.161 cm and 1.61 cm are same 3.
4. If zero will be in between the non-zero digits, then they will also be counted in the significant figure.

3. The dimensions of pressure are the same as that of/दाब के विमा समान है-

(a) force per unit volume/बल प्रति इकाई आयतन
(b) energy per unit volume/ऊर्जा प्रति इकाई आयतन
(c) force/बल
(d) energy/ऊर्जा

AIPMT-1995

Ans. (b): Pressure = $\frac{\text{Force}}{\text{Area}} = \frac{\left[MLT^{-2}\right]}{\left[L^2\right]} = \left[ML^{-1}T^{-2}\right]$

Energy per unit volume = $\frac{\left[ML^2T^{-2}\right]}{\left[L^3\right]} = \left[ML^{-1}T^{-2}\right]$

Dimension of pressure is $M^1L^{-1}T^{-2}$ which is same as the energy per unit volume.

4. The volume strength of 1.5 N H_2O_2 solution is
1.5 N H_2O_2 विलयन की आयतनिक शक्ति है-

(a) 8.8 (b) 8.4
(c) 4.8 (d) 5.2

AIPMT-1997, 1996

Ans. (b) : Strength of 1.5 H_2O_2 = Normality × equivalent weight (H_2O_2 =17).
Strength of 1.5 H_2O_2=1.5 ×17=25.5
Now, the equation of hydrogen peroxide decomposition,
$2H_2O_2 \rightarrow 2H_2O + O_2$
Here, 2 moles of H_2O_2 produce 1 mole of O_2.
1 mole of H_2O_2 has molecular weight =34 thus, mass of 2 moles of H_2O_2 = 68g/mol.
Now, 68 g/mol H_2O_2 producing 1 mole that is equal to 22.4L of oxygen gas at NTP.
So, the volume strength will be,

$\frac{\text{Volume of } O_2 \text{ at NTP}}{\text{Mass of } H_2O_2} \times \text{Strength of } H_2O_2$

Volume strength = $\frac{22.4}{68} \times 25.5 = 8.4$L

Therefore, the volume strength of 1.5 N H_2O_2 solution is 8.4L.
Note: Equivalent weight is molar mass divided by n-factor.
n-factor of any compound is the number of replaceable hydrogen atoms.
In H_2O_2, n = 2 and molar mass = 34
Thus, equivalent weight of H_2O_2= $\frac{34}{2} = 17$.

2. Laws of Chemical Combinations

5. On heating, some solid substances change from solid to vapour state without passing through liquid state. The technique used for the purification of such solid substances based on the above principle is known as
गर्म करने पर, कुछ ठोस पदार्थ से बिना द्रव अवस्था से गुजरते हुए वाष्प अवस्था में परिवर्तित हो जाते है। ऊपर दिए सिद्धांत के आधार पर ऐसे ठोस पदार्थों के शोधन के लिए प्रयुक्त तकनीक कहलाती है:

(a) Crystallization/क्रिस्टलन

(b) Sublimation/ऊर्ध्वपातन

(c) Distillation/आसवन

(d) Chromatography/वर्णलेखिकी

NEET (UG) - 05.05.2024

Ans.(b) : When solid substance changes from solid to vapour state without passing through liquid state. The technique used for the purification of such solid substances based on the above principle is known as sublimation. Thus occurs when the temperature and pressure of the substance react a specific point known as the sublimation point.

6. The molecular weight of O_2 and SO_2 are 32 and 64 respectively. At 15ºC and 150 mm Hg pressure, one litre of O_2 contains 'N' molecules. The number of molecules in two litres of SO_2 under the same conditions of temperature and pressure will be
O_2 तथा SO_2 के परमाणु द्रव्यमान क्रमशः 32 तथा 64 हैं। 15ºC ताप तथा 150 mm दाब पर O_2 के एक लीटर में 'N' अणु उपस्थित हैं। सामान्य ताप और दाब पर SO_2 के दो लीटर में अणुओं की संख्या होगी-

(a) N/2 (b) N

(c) 2N (d) 4N

AIPMT-1990

Ans. (c) : According to Avogadro's law,

$$\frac{V_1}{n_1} = \frac{V_2}{n_2}$$

No. of molecules of $O_2 = n_1 = N$

Volume of $O_2 = V_1 = 1$litre

No. of molecules of $SO_2 = n_2 = ?$

Volume of $SO_2 = V_2 = 2$ litre

Substituting the values in above formula we get,

$$\frac{1}{N} = \frac{2}{n_2}$$

$$\boxed{n_2 = 2N}$$

7. What is the weight of oxygen required for the complete combustion of 2.8 kg of ethylene?
2.8 kg इथीलीन के पूर्ण दहन के लिए कितनी ऑक्सीजन की आवश्यकता है?

(a) 2.8 kg (b) 6.4 kg

(c) 9.6 kg (d) 96 kg

AIPMT-1989

Ans. (c) : Ethylene + $O_2 \rightarrow CO_2 + 2H_2O$

$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$

Weight of C_2H_4 $= 12\times2 + 4\times1$

$= 24 + 4$

$= 28$g

Weight of oxygen for complete combustion = $3O_2$

$= 3\times32$

$= 96$g

Weight of oxygen required for the combustion of 2.8 kg ethylene $= \frac{96\times2.8}{28} = 9.6kg.$

8. The total number of valence electrons in 4.2 g of N_3^- ion is (N_A is the Avogadro's number)
N_3^- आयन के 4.2g में संयोजन इलेक्ट्रानों की कुल संख्या है- (NA आवोगाद्रो संख्या है।)

(a) 2.1 N_A (b) 4.2 N_A

(c) 2.4 N_A (d) 3.2 N_A

AIPMT-1994

Ans. (c) : No. of valence electron in N^{3-} ion =8

No. of ions in 4.2g of Nitride ion= no. of moles $\times N_A$

$$= \frac{weight}{Atomic\,weight}\times N_A$$

$$= \frac{4.2}{14}\times N_A$$

No. of valence electron in 4.2g of N^{3-} ion= $\frac{8\times4.2}{14}N_A$

$= 2.4N_A$

9. In the reaction,
$4NH_{3(g)} + 5O_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(l)}$
when 1 mole of ammonia and 1 mole of O2 are made to react to completion
निम्न अभिक्रिया में,
$4NH_{3(g)} + 5O_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(l)}$
जब एक मोल अमोनिया और एक मोल O_2 (ऑक्सीजन) पूर्णतया अभिक्रिया करते हैं, तो

(a) all the oxygen will be consumed
सारी ऑक्सीजन खर्च होगी।

(b) 1.0 mole of NO will be produced
1.0 मोल NO उत्पन्न होगा।

(c) 1.0 mole of H_2O is produced
1.0मोल H_2O उत्पन्न होता है।

(d) all the ammonia will be consumed.
सारी अमोनिया खर्च होगी।

AIPMT-1998

Ans. (a) :

$4NH_{3(g)} + 5O_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(l)}$

$1NH_{3(g)} + 1.25O_{2(g)} \rightarrow 1NO_{(g)} + 1.5H_2O_{(l)}$

In this reaction 1 mole of NH_3 react with 1.25 mole of O_2 to produce 1 mole of NO and 1.5 mole of H_2O.

Hence, all the oxygen will be consumed in the reaction.

3. Dalton's Atomic Theory

10. Select the correct statements from the following:

A. Atoms of all elements are composed of two fundamental particles.

B. The mass of the electron is 9.10939×10^{-31} kg.

C. All the isotopes of a given element show same chemical properties.

D. Protons and electrons are collectively known as nucleons.

E. Dalton's atomic theory, regarded the atom as an ultimate particle of matter.

Choose the correct answer from the options given below :

निम्नलिखित में से सही कथनों का चयन कीजिए।

A. सभी तत्वों के परमाणु दो मूल कणों द्वारा बनें होते हैं।

B. इलेक्ट्रॉन का द्रव्यमान 9.10939×10^{-31} kg होता है।

C. किसी तत्व के सभी समस्थानिक समान रासायनिक गुणधर्म प्रदर्शित करते हैं।

D. प्रोटॉनों और इलेक्ट्रॉनों को संयुक्त रूप से न्यूक्लिऑन्स कहते हैं।

E. डॉल्टन के परमाणु सिद्धांत ने परमाणु को द्रव्य के मूल कण के रूप में माना।

नीचे दिए गए विकल्पों में से सही उत्तर चुनिए :

(a) B, C and E only/ केवल B, C और E

(b) A, B and C only/ केवल A, B और C

(c) C, D and E only/ केवल C, D और E

(d) A and E only/ केवल A और E

NEET (UG)- 07.05.2023

Ans. (a) :

(A) Atoms of all elements are composed of three fundamental particles protons, electrons and neutrons.

(B) The mass of the electron is 9.10939×10^{-31}kg.

(C) All the isotopes of a given element show same chemical properties.

(D) **Nucleons-**Nucleons are equal to number of proton and neutron in the nucleus.

e.g.,if the given atom of isotope is He_2^4, He_z^A

Z = 2 Number of proton.

A = 4 Number of nucleons

A–Z = 4–2=2 Number of Neutrons.

(Hence nucleons = Number of protons + neutrons).

(E) Daltons atomic theory, regarded the atom as an ultimate particle of matter.

11. In an experiment it showed that 10 mL of 0.05 M solution of chloride required 10 mL of 0.1 M solution of $AgNO_3$, which of the following will be the formula of the chloride (X stands for the symbol of the element other than chlorine) :

(a) X_2Cl (b) X_2Cl_2

(c) XCl_2 (d) XCl_4

NEET Karnataka (UG) 18.05.2013

Ans. (c) : Millimoles of solution of chloride = $0.05 \times 10 = 0.5$

Millimoles of $AgNO_3$ solution = $10 \times 0.1 = 1$

So, the millimoles of $AgNO_3$ are double than the chloride solution

Therefore, $XCl_2 + 2AgNO_3 \longrightarrow 2AgCl + X(NO_3)_2$

Compound is XCl_2 because valency of chloride is -1.

4. Mole Concept and Molar Masses

12. 1 gram of sodium hydroxide was treated with 25 mL of 0.75 M HCl solution, the mass of sodium hydroxide left unreacted is equal to

सोडियम हाइड्रॉक्साइड के 1g को 0.75 M HCl विलयन के 25 mL के साथ उपचारित किया गया, शेष अनअभिक्रियित सोडियम हाइड्रॉक्साइड का द्रव्यमान बराबर होगा :

(a) 250 mg (b) Zero mg

(c) 200 mg (d) 750 mg

NEET (UG) - 05.05.2024

Ans.(a) : The mass of sodium hydroxide left un-reacted is equal to 250 mg.

$$M = \frac{W \times 1000}{M_2 \times V(\text{in ml})}$$

$$W = \frac{M \times M_2 \times V(\text{in ml})}{1000} = \frac{0.75 \times 36.5 \times 25}{1000}$$

$$= 0.684 \text{ g (mass of HCl)}$$

$HCl + NaOH \rightarrow HCl + NaOH$

36.5g 40g

$\therefore$ 36.5 g HCl react with NaOH = 40g

$\because$ 0.684 g HCl react with NaOH = $\frac{40}{36.5} \times 0.684$

$\simeq 0.750$g

Amount of NaOH left = 1g-0.750g = 0.250g

= 250 mg

13. The highest number of helium atoms is in

हीलियम परमाणुओं की अधिकतम संख्या है :

(a) 4 u of helium/ हीलियम के 4 u में

(b) 4 g of helium/ हीलियम के 4 g में

(c) 2.271098 L of helium at STP
एस.टी.पी. पर हीलियम के 2.271098 L में

(d) 4 mol of helium/हीलियम के 4 मोलों में

NEET (UG) - 05.05.2024

Ans.(d) : (i) 4 mole of helium = 4 N_A He atoms

(ii) 4 u of helium = $\frac{4}{4}$ = 1 He atom $\left(\because n = \frac{W}{mW}\right)$

(iii) 4 g of helium = $\frac{4}{4}$ mole = 1 N_A He atom

(iv) 2.271098 L of helium at STP = $\frac{2.271098}{22.4}$ mole

= 0.1 NA He atom

Hence, the highest number of helium atoms is in 4 mole of helium.

14. The density of 1 M solution of a compound 'X' is 1.25 g mL^{-1}. The correct option for the molality of solution is (Molar mass of compound X= 85 g).

यौगिक 'X' के M विलयन का घनत्व 1.25g mL^{-1} है। विलयन की मोललता का सही विकल्प है (यौगिक X का मोलर द्रव्यमान = 85 g)

(a) 1.165m (b) 0.858 m

(c) 0.705m (d) 1.208m

RE-NEET Manipur (UG) 06.06.2023

Ans. (b) : Given,

Volume of solution = 1000 cm^3

Density = 1.25gcm^{-3}

$$d = \frac{m}{V} \Rightarrow m = d \times V$$

So, mass of solution = 1000×1.25=1250g

Given Molar mass of compound X = 85g

mass of solvent = 1250 – 85 = 1165g

Number of mole = 1 [$\because$ Given 1M means 1 mole/L]

$$\text{molality (m)} = \frac{\text{No. of moles}}{\text{mass of solvent (in kg)}}$$

$$= \frac{1 \times 1000}{1165} = 0.858\text{m}$$

15. The right option for the mass of CO_2 produced by heating 20 g of 20% pure limestone is (Atomic mass of Ca =40)

20% शुद्ध चूना पत्थर के 20g को गरम करने से उत्पन्न CO_2 के द्रव्यमान के लिए सही विकल्प है : (Ca का परमाणु द्रव्यमान = 40 है।)

$\left[CaCO_3 \xrightarrow{1200K} CaO + CO_2\right]$

(a) 1.32 g (b) 1.12 g

(c) 1.76 g (d) 2.64 g

NEET (UG)- 07.05.2023

Ans. (c) : Sample of $CaCO_3$ = 20%

$$= 20 \times \frac{20}{100}$$

= 4 gram

$CaCO_3 \xrightarrow{1200k} CaO + CO_2$

1 mole $CaCO_3$ gives 1 mole CO_2.

100gram $CaCO_3 \longrightarrow$ 44gram CO_2

$$4\text{gram } CaCO_3 \longrightarrow \frac{44}{100} \times 4 = \frac{176}{100}$$

$$= 1.76\text{gram}$$

16. In one molal solution that contains 0.5 mole of a solute, there is

एक मोलल विलयन जिसमें किसी विलेय के 0.5 मोल उपस्थित होते हैं, में:

(a) 1000 g of solvent/विलायक के 1000 g होते हैं।

(b) 500 mL of solvent/विलायक के 500 mL होते हैं।

(c) 500 g of solvent/विलायक के 500 g होते हैं।

(d) 100 mL of solvent/विलायक के 100 mL होते हैं।

NEET (UG) 17.07.2022

Ans. (c) : Molality, $m = \frac{\text{No. of moles of solute}}{\text{mass of solvent (kg)}}$

$$1 \text{ molal} = \frac{0.5}{\text{w of solvent in (kg)}}$$

$$\text{w of solvent (kg)} = \frac{0.5}{1}$$

= 0.5 kg

= 500 gm

17. One mole of carbon atom weight 12 g, the number of atoms in it is equal to, (Mass of carbon-12 is 1.9926×10^{-23} g)

एक मोल कार्बन परमाणु का भार 12 g, इसमें परमाणुओं की संख्या किसके बराबर है,

(कार्बन -12 का द्रव्यमान 1.9926×10^{-23} g)

(a) 6.022×10^{23} (b) 1.2×10^{23}

(c) 6.022×10^{22} (d) 12×10^{22}

NEET (UG) 14.10.2020, Phase-II

Ans. (a) : One mole of carbon atom weight is 12g.

1.9926×10^{-23} g = 1 atom

$$1\text{g} \rightarrow \frac{1}{1.9926 \times 10^{-23}}$$

$$12\text{g} \rightarrow \frac{1}{1.9926 \times^{-23}} \times 12$$

$= 6.022 \times 10^{23}$

We also know 1 mole = molar mass (N_A)

$= 6.022 \times 10^{23}$

18. Which one of the followings has maximum number of atoms ?/निम्नलिखित में से किसमें परमाणु की संख्या अधिकतम होगी?

(a) 1 g of Mg(s) [Atomic mass of Mg = 24]

Mg(s) का 1 g [Mg का परमाणु द्रव्यमान = 24]

(b) 1 g of O_2(g) [Atomic mass of O = 16]

O_2(g) का 1 g [O का परमाणु द्रव्यमान = 16]

(c) 1 g of Li(s) [Atomic mass of Li = 7]

Li(s) का 1 g [Li का परमाणु द्रव्यमान = 7]

(d) 1 g of Ag(s) [Atomic mass of Ag = 108]

Ag(s) का 1 g [Ag का परमाणु द्रव्यमान = 108]

NEET (UG) 13.09.2020

Ans. (c):

Number of atoms in 1g of Mg(s) $= \frac{1}{24} \times N_A$

$= 0.25 \times 10^{23}$

Number of atoms in 1 g of $O_2(g)$ $= \frac{1}{32} \times N_A \times 2$

$= \frac{N_A}{16} = 0.37 \times 10^{23}$

Number of atoms in 1g of Li(s) $= \frac{1}{7} \times N_A$

$= 0.86 \times 10^{23}$

Number of atoms in 1g of Ag(s) $= \frac{1}{108} \times N_A$

$= 0.56 \times 10^{23}$

Formula used-

$$\text{Number of atoms} = \frac{W}{\text{molar mass}} \times N_A \times \text{atomicity}$$

19. The density of 2 M aqueous solution of NaOH is 1.28 g/cm^3. The molality of the solution is [Given that molecular mass of NaOH = 40 g mol^{-1}]

NaOH के 2 M जलीय विलयन का घनत्व 1.28 ग्रा./सेमी.^{3} है। विलयन की मोललता होगी। [दिया गया है : NaOH का मोलर द्रव्यमान = 40 g mol^{-1}]

(a) 1.32 m (b) 1.20 m

(c) 1.56 m (d) 1.67 m

NEET Odisha (UG) 20.05.2019

Ans. (d) : Density = 1.28g/cc

Conc. of solution = 2M

Molar mass of NaOH = 40g mol^{-1}

Volume of solution = 1L = 1000 mL

Mass of solution = d × V = 1.28 × 1000 = 1280 g

mass of solute = n × molar mass = 2×40 = 80 g

mass of solvent = (1280 – 80)g = 1200 g

Number of moles of solute $= \frac{80}{40} = 2$

$$\text{molality} = \frac{\text{Mole of solute}}{\text{Weight of solvent (in kg.)}}$$

$\text{molality} = \frac{2 \times 1000}{1200}$

$= \frac{5}{3} = 1.67\text{m}$

20. The number of moles of hydrogen molecules required to produce 20 moles of ammonia through Haber's process is:/हैबर प्रक्रम द्वारा अमोनिया के 20 मोल बनाने के लिए आवश्यक हाइड्रोजन अणुओं के मोलों की संख्या होगी।

(a) 20 (b) 30

(c) 40 (d) 10

NEET (UG) 05.05.2019

Ans. (b): Haber's process

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

20 moles need to be produced

2 moles of $NH_3 \rightarrow$ 3 moles of H_2

Hence 20 moles of $NH_3 = \frac{3 \times 20}{2} = 30$ moles of H_2

21. In which case is number of molecules of water maximum?

किस स्थिति में जल के अणुओं की संख्या अधिकतम है?

(a) 18 mL of water/18 mL जल के लिए

(b) 0.18 g of water/0.18 g जल के लिए

(c) 10^{-3} mol of water/10^{-3} मोल जल के लिए

(d) 0.00224 L of water vapours at 1 atm and 273 K 1 atm एवं 273 K पर 0.00224 L जल वाष्प के लिए

NEET (UG) 06.05.2018

Ans. (a) :

(a) Mass of water = v × d = 18 × 1 = 18g [∵ density of water is 1 g/cc]

Molecules of water = mole × $N_A = \frac{18}{18} N_A = N_A$

(b) Molecules of water = mole × N_A

$= \frac{0.18}{18} N_A$

$= 10^{-2} N_A$

(c) Molecules of water = mole × $N_A = 10^{-3} N_A$

(d) Moles of water $= \frac{0.00224}{22.4} = 10^{-4}$

Molecules of water = mole × $N_A = 10^{-4} N_A$

From the above calculations, it is clear that 18 mL of water has maximum molecules.

22. Suppose the elements X and Y combine to from two compounds XY_2 and X_3Y_2.When 0.1 mole of XY_2 weight 10 g and 0.05 mole of X_3Y_2 weights 9g, the atomic weights of X and Y are

मान लें कि दो तत्व X और Y मिलकर दो यौगिक XY_2 एवं X_3Y_2 देते है । जब 0.1 मोल XY_2 का भार 10 g तथा 0.05 मोल X_3Y_2 का भार 9g, है, तो X और Y भार है

(a) 40, 30 (b) 60, 40

(c) 20, 30 (d) 30, 20

NEET (UG) 24.07.2016, Phase-II

Ans. (a) : Assuming x and y be the atomic weights of X and Y respectively.

Given, 0.1 mole of XY_2 weighs 10g

So, $x + 2y = \frac{10}{0.1} = 100$ ...(i)

0.05 mole of X_3Y_3 weighs 9 gram

So, $3x + 2y = \frac{9}{0.05} = 180$ ...(ii)

From eq(i) and (ii)

$x + 2y = 100$

$3x + 2y = 180$

$-2x = -80$

$x = \frac{80}{2} = 40$

Putting x = 40 in eq (i)

y = 30 so, option (a) is correct.

23. The number of water molecules is maximum in/जल अणुओं की अधिकतम संख्या है :

(a) 18 gram of water/18 ग्राम पानी में

(b) 18 moles of water/18 मोल पानी में

(c) 18 molecules of water/पानी के 18 अणुओं में

(d) 1.8 gram of water/1.8 ग्राम पानी में

RE-AIPMT 25.07.2015

Ans. (b) :

- 1.8 gram of water = $\frac{6.023\times10^{23}}{18}\times1.8$
  $= 6.023 \times 10^{22}$ molecules
- 18 gram of water = 6.023×10^{23} molecules.
- 18 mole of water = $18 \times 6.023 \times 10^{23}$ molecules.
- 18 molecules of water and hence no. of water molecules is 18.

From the above discussion, it is clear that the no. of water molecules is maximum in 18 moles of water.

24. If Avogadro number N_A, is changed from 6.022×10^{23} mol^{-1} to 6.022×10^{20} mol^{-1}, this would change
यदि आवोगाद्रो संख्या N_A, 6.022×10^{23} mol^{-1} से परिवर्तित होकर 6.022×10^{20} mol^{-1} होता है, तो इससे परिवर्तन होगा :

(a) The ratio of chemical species to each other in a balanced equation/संतुलित समीकरण में परस्पर रासायनिक स्पीशीज का अनुपात।

(b) The ratio of elements to each other in a compound/यौगिक में परस्पर तत्वों का अनुपात।

(c) The definition of mass in units of grams
द्रव्यमान की परिभाषा g यूनिट में।

(d) The mass of one mole of carbon
एक मोल कार्बन का द्रव्यमान।

RE-AIPMT 25.07.2015

Ans. (d) : Mass of 1 mole (6.022×10^{23} atoms) of carbon = 12g.

If Avogadro number is changed to 6.022×10^{23} atom then ,

mass of 1 mole of carbon $= \frac{12\times6.022\times10^{20}}{6.022\times10^{23}}$

$= 12\times10^{-3}$ g

25. A mixture of gases contains H_2 and O_2 gases in the ratio of 1 : 4 (w/w). What is the molar ratio of the two gases in the mixture ?
एक गैस के मिश्रण में H_2 एवं O_2 गैस का अनुपात 1 : 4 (w/w) है। मिश्रण में इन दोनों गैसों का मोलर अनुपात है:

(a) 4 : 1 (b) 16 : 1

(c) 2 : 1 (d) 1 : 4

AIPMT- 03.05.2015

Ans. (a) : H_2 and O_2 gases in the ratio 1 : 4

1 gm H_2 = 4 gm O_2

No. of moles $= \frac{\text{weight}}{\text{Molecular weight}}$

So, $\frac{\text{lg}}{2\text{g/mol}} : \frac{4\text{g}}{(2\times16)\text{g/mol}}$

molar ratio $= \frac{\frac{1}{2}}{\frac{1}{8}} = \frac{8}{2} = 4:1$

26. 1.0 g of magnesium is burnt with 0.56 g O_2 in a closed vessel. Which reactant is left in excess and how much?
(At. wt. Mg = 24 ; O=16)
1.0 g मैग्नींशियम को 0.56 g O_2 के साथ बंद पात्र में जलाया जाता है। कौन सा अभिकारक शेष बचा रहेगा और कितना?
(Mg का प. भा. = 24 एव O का प. भा. = 16)

(a) Mg. 0.16g (b) O_2. 0.16g

(c) Mg, 0.44 g (d) O_2, 0.28 g

AIPMT-06.05.2014

Ans. (a) : 1 mole of Mg reacts with 0.56g O_2

$\frac{1}{2}$ mole of O_2 and 1 mole of Mg form one mole of MgO.

$Mg(s) + 1/2\ O_2(g) \rightarrow MgO$		
1 Mole	1/2 mole	1 mole
24 gram	16 gram	40 gram

$\because$ 16 g O_2 reacts with 24 g of Mg

$\therefore$ 0.56 g O_2 will react with $= \frac{0.56\times24}{16}$

$= 0.14\times6$

$= 0.84$g of Mg

0.84 g Mg will react with 0.56 g O_2. So, 0.16g Mg will be left.

27. How many grams of concentrated nitric acid solution should be used to prepare 250 mL of 2.0 M HNO_3? (70% by mass)
2.0 M HNO_3 (भार अनुसार 70%) के 250 mL बनाने में कितने ग्राम सांद्रित नाइट्रिक अम्ल का घोल प्रयोग में लायेंगे?

(a) 54.0 g (b) 45.0 g

(c) 90.0 g (d) 70.0 g

NEET (UG) 05.05.2013

Ans. (b) : No. of moles of $HNO_3 = \frac{\text{Weight in gram}}{\text{molecular wt}}$

So, weight (g) = No. of moles × molecular wt.

No. of moles = Molarity × Volume of solution (V in L)

$$= \frac{2.0 \times 250}{1000} = 0.5 \text{ mole}$$

Weight (in gram) = 0.5 × 63 = 31.5

70% by mass means 70 gram HNO_3 is present in 100 g of solution

Mass of HNO_3 required = $\frac{100}{70} \times 31.5$

= 45 gram

So, 45 gram conc. HNO_3 is required to prepare 250ml of 2.0 Molar HNO_3 solution.

28. An excess of $AgNO_3$ is added to 100 mL of a 0.01 M solution of dichlorotetraaquachromium (III) chloride. The number of moles of AgCl precipitated would be :-

0.01 मोलर डाईक्लोरोटेट्राएक्वाक्रोमियम (III) क्लोराइड के 100 mL विलयन में $AgNO_3$ की अधिकतम मात्रा मिलाई गई। AgCl के अवक्षेपित होने वाले मोलों की संख्या होगी।

(a) 0.01 (b) 0.001

(c) 0.002 (d) 0.003

NEET (UG) 05.05.2013

Ans. (b) $\left[Cr(H_2O)_4Cl_2\right]^+ Cl^-$ reacts with excess $AgNO_3$

$$\left[Cr(H_2O)_4Cl_2\right]^+ Cl^- + Ag^+NO_3^- \rightarrow$$

0.01M, 100m*l*

$$\left[Cr(H_2O)_4Cl_2\right]NO_3 + AgCl\downarrow$$

No. of moles = Molarity× Volume (L)

$$= \frac{0.01 \times 100 \text{ m}l}{1000}$$

= 0.001 mole

- According to chemical equation 1 mole complex reacts with 1 mole of $AgNO_3$ and one mole AgCl precipitated. Therefore, 0.001 mole complex will produce 0.001 mole of AgCl.

29. 6.02×10^{20} molecules of urea are present in 100mL of its solution. The concentration of solution is :-

यूरिया के 100 mL विलयन में इसके 6.02×10^{20} अणु उपस्थित है, इस विलयन की सांद्रता होगी

(a) 0.1 M (b) 0.02 M

(c) 0.01 M (d) 0.001 M

NEET (UG) 05.05.2013

Ans. (c): We know that 1 mole of any substance contains 6.022×10^{23} no of particles of that substance.

Given number of particles = 6.022×10^{20}

Volume = 100 m*l* = 0.1 litre

$\because 6.022 \times 10^{23} = 1$ mole

$\therefore$ 6.022×10^{20} particles $= \frac{1 \times 6.022 \times 10^{20}}{6.022 \times 10^{23}}$

$= 1 \times 10^{-3}$ mole

= 0.001 mole

Concentration (molarity)

$$= \frac{\text{No of moles of solute (urea)}}{\text{Volume of solution}}$$

$$= \frac{0.001}{0.1}$$

= 0.01 M

30. Which has the maximum number of molecules among the following?/निम्न में से किसमें अणुओं की संख्या अधिकतम होगी?

(a) 64 g SO_2 (b) 44 g CO_2

(c) 48 g O_3 (d) 8 g H_2

AIPMT (Mains)-2011

Ans. (d) : The number of moles can be calculated from the ratio of the mass to the molar mass

→ Maximum number of moles will be corresponds to maximum number of molecules as-

Number of molecules = Number of moles $\times N_A$

$$\text{Moles of } CO_2 = \frac{44}{44} = 1 \text{ mole}$$

$$\text{Moles of } O_3 = \frac{48}{48} = 1 \text{ moles}$$

$$\text{Moles of } H_2 = \frac{8}{2} = 4 \text{ moles}$$

$$\text{Moles of } SO_2 = \frac{64}{64} = 1 \text{ moles}$$

Hence, 8 g H_2 has maximum number of molecules.

31. Mole fraction of the solute in a 1.00 molal aqueous solution is :/1.00 मोलल जलीय विलयन में घुलित का मोल प्रभाज है :

(a) 1.7700 (b) 0.1770

(c) 0.0177 (d) 0.0344

AIPMT (Screening)-2011

Ans. (c) : 1 molal aqueous solution means 1 mole of solute is present in 1000 g of water

$$1 \text{ kg of } H_2O = \frac{1000}{18} = 55.56$$

$$X_{solute} = \frac{1}{1 + \frac{1000}{18}} = \frac{1}{56.5} = \underline{0.0177}$$

32. 10 g of hydrogen and 64 g of oxygen were filled in a steel vessel and exploded. Amount of water produced in this reaction will be -

10 g हाइड्रोजन तथा 64 g ऑक्सीजन की एक स्टील पात्र में भरकर विस्फोटित किया गया। इस अभिक्रिया में बनने वाले पानी की मात्रा होगी -

(a) 1 mol/ 1 मोल (b) 2 mol / 2मोल

(c) 3 mol/ 3 मोल (d) 4 mol/ 4 मोल

AIPMT-2009

Ans. (d) :

$H_2 + ½\ O_2 \longrightarrow H_2O$

2g 16 g 18g

1 mol 0.5mol 1 mol

10g of H_2 = 5 mole and 64 g of O_2 = 2 mol

$\therefore$ In this reaction, oxygen is the limiting reagent so amount of H_2O produced depends on that of O_2. Since 0.5 mol of O_2 gives 1 mole of H_2O

$\therefore$ 2 mol of O_2 will give 4 mole of H_2O

33. What volume of oxygen gas (O_2) measured at 0ºC and 1 atm pressure, is needed to burn completely one litre, of propane gas (C_3H_8) completely measured under the same conditions?

1 L प्रोपेन गैस (C_3H_8) (जिसका आयतन 0ºC तथा 1 atm पर लिया गया है) के दहन के लिए इसी परिस्थित में (अर्थात् 0ºC तथा 1 atm पर), आक्सीजन गैस का कितना आयतन आवश्यक होगा ?

(a) 5 L (b) 10 L

(c) 7 L (d) 6 L

AIPMT-2008

Ans. (a) : In a balanced chemical reaction for the combustion of propane, volume of oxygen and propane required is

$$C_3H_8(g) + 5O_2(g) \longrightarrow 3CO_2(g) + 4H_2O(g)$$

1 vol 5vol 3 vol 4 vol

1L 5L 3L 4L

Hence volume of oxygen gas measured at 0°C and 1 atm, needed to burn completely 1L of propane gas (C_3H_8) under the same condition is 5L.

34. How many moles of lead (II) chloride will be formed from a reaction between 6.5 g of PbO and 3.2 g of HCl ?

6.5 g of PbO एवं 3.2 g की प्रतिक्रिया द्वारा लेड (II) क्लोराइड के कितने मोल बनेंगे?

(a) 0.011 (b) 0.029

(c) 0.044 (d) 0.333

AIPMT-2008

Ans. (b) : As given,

$$\text{nPbO} = \frac{6.5}{223} = 0.029\left(\text{atomic mass of PbO} = 223\right)$$

$$\text{nHCl} = \frac{3.2}{36.5} = 0.877\left(\text{atomic mass of HCl} = 36.5\right)$$

The reaction is

$$PbO + 2HCl \longrightarrow PbCl_2 + H_2O$$

In the given reaction PbO will be limiting reagent because it is completely consumed and produced 0.029 mol of $PbCl_2$.

35. Volume occupied by one molecule of water (density = 1g cm^{-3}) is :

जल (घनत्व 1g cm^{-3}) के अणु का आयतन है :

(a) 3.0×10^{-23} cm^3

(b) 5.5×10^{-23} cm^3

(c) 9.0×10^{-23} cm^3

(d) 6.023×10^{-23} cm^3

AIPMT-2008

Ans. (a) : 1 mole = 6.023×10^{23} molecule.

18g = 6.02×10^{23} molecule

18g = mass of 6.02×10^{23} water molecule

Mass of water molecule = $\frac{18}{6.023\times10^{23}}$ g.

Density = 1g cm^{-3}

$$\text{Volume} = \frac{\text{Mass of one water molecule}}{\text{Density}}$$

$$= \frac{18}{6.23\times10^{23}\times1}\text{cm}^3 = 2.88\times10^{-23}$$

$$= 3.0 \times 10^{-23}\ \text{cm}^3$$

36. The maximum number of molecules is present in:- /अधिकतम अणुओं की संख्या पायी जाती है:-

(a) 5L of N_2 gas at STP/ STP पर N_2 गैस के 5L में

(b) 0.5 g of H_2 gas/ H_2 गैस के 0.5 g में

(c) 10g of O_2 gas/ O_2 गैस के 10g में

(d) 15 L of H_2 gas at STP
STP पर H_2 गैस के 15 L में

AIPMT-2004

Ans. (d) : 1 mole of any gas = N_A molecules
[$N_A = 6.022 \times 10^{23}$]

We can normalise all to one unit, in terms of moles from which we can say that whichever has greater number of moles will contain greater number of molecules in it.

(i) No. of moles in 15L of H_2 gas at STP = $\frac{15L}{22.4L}$
= 0.67 moles

(ii) 0.5 g of H_2 gas = $\frac{0.5g}{2gm\ mol^{-1}} = 0.25$ moles

(iii) Number of moles in 10g of O_2 gas = $\frac{10g}{32g\ mol^{-1}}$
= 0.312 moles

(iv) Number of moles in 5L of N_2 gas at STP
= $\frac{5L}{22.4L} = 0.22$ moles

Thus, 15L of H_2 gas at STP has the maximum number of molecules.

37. Which has maximum molecules:
किसमें अधिकतम अणु हैं -

(a) 7 gm N_2 (b) 2 gm H_2

(c) 16 gm NO_2 (d) 16 gm O_2

AIPMT-2002

Ans. (b) : Different gases with the same number of moles have the same no. of molecules which is equal to the Avogadro's number i.e., 6.022×10^{23}

Number of moles,

(a) The number of moles of $7g N_2$,

Molar mass of $N_2 = 28g/mol$

Number of moles =

$$\frac{\text{Weight of } N_2}{\text{Molecular weight of } N_2} = \frac{7}{28} = 0.25 \text{ moles.}$$

(b) The number of moles $2g\ H_2$,

Molar mass of $H_2 = 2$ g/mol

Number of moles =

$$\frac{\text{Weight of } H_2}{\text{Molecular Weight of } H_2} = \frac{2}{2} = 1 \text{ mole.}$$

(c) The number of moles of $16g\ NO_2$,

Molar mass of $NO_2 = 14 + 2\times16 = 46g/mol$

Number of moles =

$$\frac{\text{Weight of } NO_2}{\text{Molecular weight of } NO_2} = \frac{16}{46} = 0.347\text{moles}$$

(d) The number of moles of $7g\ O_2$,

Molar mass of $O_2 = 2\times16 = 32g/mol$

Number of moles =

$$\frac{\text{Weight of } O_2}{\text{Molecular weight of } O_2} = \frac{16}{32} = 0.5\text{moles}$$

Thus, H_2 has the maximum number of moles. Hence, it has maximum number of molecules.

38. Molarity of liquid HCl if density of liq. HCl is 1.17 gm/cc : -
द्रवित HCl के विलियन की मोलरता क्या होगी यदि इसका घनत्व 1.17 gm/cc है-

(a) 36.5 (b) 18.25
(c) 32.05 (d) 42.10

AIPMT-2001

Ans. (c) : Density = 1.17 g/cc = 1170 g/L

The molar mass of HCl = 36.5

$$\text{Molarity of Solution} = \frac{m}{V}\times\frac{1}{M} = \frac{\text{Density in g/L}}{\text{Molecular Weight}}$$

$$= \frac{1170}{36.5}M = 32.05M$$

39. Sp. vol. of cylinderical virus particle is 6.02×10^{-2} cc/gm. Whose radius and length are 7 Å & 10Å respectively. If $N_A = 6.02\times10^{23}$. Find mol. wt. of virus : -
एक बेलनाकार वायरस कण जिसकी त्रिज्या 7Aº तथा लम्बाई 10Aº है, इसका विशिष्ट आयतन 6.02×10^{-2} cc/gm है यदि आवोगाद्रो संख्या 6.02×10^{23} मोल है, तो वायरस का आणिवक द्रव्यमान ज्ञात कीजिए

(a) 15.4 kg/mol. (b) 1.54×10^4 kg/mol.
(c) 3.08×10^4 kg/mol. (d) 3.08×10^3 kg/mol.

AIPMT-2001

Ans. (a) : Specific volume (Volume of 1g) cylindrical virus particle = 6.02×10^{-2} cc/g

Radius of Virus (r) = 7×10^{-8} cm

Length of Virus (l) = 10×10^{-8} cm

Volume of Virus = $\pi r^2 l = \frac{22}{7}\times(7\times10^{-8})^2\times10\times10^{-8}$

$= 154\times10^{-23}$ cc

Weight of one virus particle

$$= \frac{\text{Volume}}{\text{Specific volume}} = \frac{1.54\times10^{-23}}{6.02\times10^{-2}}$$

$\therefore$ Molecular weight of virus = weight of N_A particle

$$= \frac{154\times10^{-23}}{6.02\times10^{-2}}\times6.023\times10^{23}$$

$= 15400$ g/mol $= 15.4$ kg/mol

40. Volume of CO_2 obtained by the complete decomposition of 9.85 gm. $BaCO_3$ is:
9.85 gm. $BaCO_3$ के पूर्ण विघटन से प्राप्त CO_2 का आयतन है –

(a) 2.24 lit. (b) 1.12 lit.
(c) 0.84 lit. (d) 0.56 lit.

AIPMT-2000

Ans. (b) : Volume of 1 mole of CO_2 at STP = 22.4 liter

Volume of CO_2 obtained after complete decomposition of 9.85 gm of $BaCO_3$ is:

$BaCO_3 \longrightarrow BaO + CO_2$

No. of moles of $BaCO_3$ obtained = $\frac{9.85}{197}$ = 0.05 mole

As 1 mole of $BaCO_3$ gives 1 mole of CO_2,

So, number of moles of CO_2 obtained = 0.05 mole

$\therefore$ Volume of CO_2 obtained at STP = 22.4×0.05

$= 1.12$ liter

41. Mole ratio of H_2 and O_2 gas is 8 : 1 what will be the ratio of wt.
हाइड्रोजन तथा ऑक्सीजन गैस का का मोल अनुपात 8 : 1 है, तो भार का अनुपात क्या होगा :-

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

AIPMT-1999

Ans. (d): Mole ratio of H_2 and O_2 = 8 : 1

We know that –

$$\text{Moles} = \left[\frac{\text{Mass of element}}{\text{Molar mass}}\right]$$

$$\frac{n_{H_2}}{n_{O_2}} = \frac{8}{1} = \frac{\frac{W_{H_2}}{2}}{\frac{W_{O_2}}{32}}$$

$$\Rightarrow \frac{W_{H_2}}{W_{O_2}}\times\frac{32}{2} = 8 \Rightarrow \left[\frac{W_{H_2}}{W_{O_2}} = \frac{1}{2}\right]$$

$\therefore H_2 : O_2 = 1:2$

42. What is false for mole fraction
मोल भिन्न के विषय में असत्य कथन है-

(a) $x < 1$
(b) $-2 \le x \le 2$
(c) $0 \le x \le 1$
(d) Always non-negative

AIPMT-1999

Ans. (b) : As per the mole fraction definition the total number of moles present in the solution or the mixture will always be 1, so naturally, the fraction will always be less than 1.
Hence, $-2 < X < 2$ is false.

43. $4NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$
When one mole ammonia and one mole oxygen taken:/1 मोल अमोनिया तथा 1 मोल ऑक्सीजन लेने पर–
(a) Oxygen is completely consumed
ऑक्सीजन पूर्णतया खत्म हो जाएगी
(b) Ammonia is completely consumed
अमोनिया पूर्णतया खत्म हो जाएगी
(c) Both (1) and (2) are correct
दोनों (1) व (2) सही
(d) No one is correct/कोई भी सही नहीं

AIPMT-1998

Ans. (a) : $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$
$1NH_3 + 1.25O_2 \rightarrow +1NO + 1.5H_2O$
Hence, 1 mole of NH_3 reacts with 1.25 mole of O_2 to produce 1 mole of NO and 1.5 moles of H_2O. Hence, when one mole of ammonia and one mole of oxygen are made to react to completion, then all the oxygen are made to react to completion, then all the oxygen is consumed.

44. **0.24g of a volatile gas, upon vaporisation, given 45 mL vapour at NTP. What will be the vapour density of the substance? (Density of H_2 =0.089 g/L)**
वाष्पीकरण पर, 0.24g वाष्पशील गैस NTP पर 45 mL वाष्प देता है, तो पदार्थ का वाष्प घनत्व क्या होगा। (H_2 का घनत्व =0.089 g/L)
(a) 95.93 (b) 59.93
(c) 95.39 (d) 5.993

AIPMT-1996

Ans. (b): Weight of the gas = 0.24g
Volume of the gas = 45ml
Converting it into liter = 0.045 liter
Density of H_2= 0.089
Weight of 45ml of H_2 = Density × Volume
$= 0.089 \times 0.045$
$= 4.005 \times 10^{-3}$g

$$\text{Vapour density} = \frac{\text{weight of certain volume of substance}}{\text{weight of same volume of hydrogen}}$$

$$= \frac{0.24}{4.005 \times 10^{-3}} = 59.93$$

45. **The number of atoms in 4.25 g of NH_3 is approximately**
NH_3 के 4.25g में परमाणुओं की संख्या लगभग है-
(a) 4×10^{23} (b) 2×10^{23}
(c) 1×10^{23} (d) 6×10^{23}

AIPMT-1999

Ans. (d) : Molecular mass of $NH_3 = 14+3\times1=17$

$$\text{No. of moles} = \frac{4.25}{17} = 0.25$$

$\because$ 1 mole ammonia molecule has 4 atoms (3 H-atom and 1 N-atom). So,
1 mole of $NH_3 = 4 \times 6.022 \times 10^{23}$ atoms
0.25 mole $= 0.25 \times 4 \times 6.022 \times 10^{23} = 6 \times 10^{23}$

46. **The number of gram molecules of oxygen in 6.02×10^{24} CO molecules is**
कार्बन मोनोक्साइड (CO) के 6.02×10^{24} अणुओं में ऑक्सीजन के ग्राम अणुओं की संख्या कितनी है?
(a) 10 g molecules/10 ग्राम अणु
(b) 5 g molecules/ 5 ग्राम अणु
(c) 1 g molecule/1 ग्राम अणु
(d) 0.5 g molecules./0.5 ग्राम अणु

AIPMT-1990

Ans. (b) : 1 mole CO equivalent contains. 6.023×10^{24} molecules of CO.
6.023×10^{24} molecules of CO contain 6.023×10^{23} atoms of O.

$$\text{No. of gram atoms of CO} = \frac{6.02 \times 10^{24}}{6.02 \times 10^{23}} = 10gm$$

In oxygen molecules there are 2 atoms.
No. of gm molecules of oxygen

$$= \frac{10\,\text{gm}}{2\,\text{atom}} = 5\,\text{gm molecules}$$

47. **Ratio of C_P and C_v of a gas 'X' is 1.4. The number of atoms of the gas 'X' present in 11.2 litres of it at NTP will be**
किसी गैस 'X' के लिए C_P तथा C_v का अनुपात 1.4 है। सामान्य ताप और दाब (NTP) पर 11.2 लीटर 'X' गैस में उपस्थित इसके परमाणुओं की संख्या कितनी होगी?
(a) 6.02×10^{23} (b) 1.2×10^{23}
(c) 3.01×10^{23} (d) 12×10^{23}

AIPMT-1989

Ans. (a) : $\frac{C_P}{C_V} = \gamma = 1.4$

If, $\gamma = 1.4$ then gas is diatomic.
At NTP, 1 mole of gas occupies = 22.4L

$$\text{So, 11.2 L of gas} = \frac{1}{22.4} \times 11.2 \text{ mole}$$

1 mole of gas contains = 6.022×10^{23} molecules

$$\text{So, } \frac{11.2}{22.4} \text{ mole of gas contain} = 6.022 \times 10^{23} \times \frac{11.2}{22.4}$$

$= 3.01 \times 10^{23}$ molecules
As given gas 'X' is diatomic, so one molecule of gas has two atoms. Then,
No. of atoms in 11.2L gas
= no. of atom in a molecule × 3.01×10^{23}atoms
$= 2 \times 3.01 \times 10^{23} = 6.023 \times 10^{23}$.

48. **The number of oxygen atoms in 4.4 g of CO_2 is**
4.4 g कार्बन डाइऑक्साइड (CO_2) में ऑक्सीजन के परमाणुओं की संख्या है-
(a) 1.2×10^{23} (b) 6×10^{22}
(c) 6×10^{23} (d) 12×10^{23}

AIPMT-1989

Ans. (a) : Molecular weight of $CO_2 = 12+16\times2 = 44$

No. of moles $= \frac{4.4}{44} = 0.1 moles$

In a molecule of CO_2, there is two oxygen atom.

No. of oxygen atom $= 2\times0.1\times6.022\times10^{23}$
$= 0.2\times6.022\times10^{23}$
$= 1.2\times10^{23}$

49. 1cc N_2O at NTP contains
सामान्य ताप और दाब (NTP) पर 1cc N_2O में होते हैं-

(a) $\frac{1.8}{224}\times10^{22} atoms$ / $\frac{1.8}{224}\times10^{22}$ परमाणु

(b) $\frac{6.02}{22400}\times10^{23} molecules$ / $\frac{6.02}{22400}\times10^{23}$ अणु

(c) $\frac{1.32}{224}\times10^{23} electrons$ / $\frac{1.32}{224}\times10^{23}$ इलेक्ट्रान

(d) all of the above/उपरोक्त के सभी

AIPMT-1988

Ans. (d) : 1 mole N_2O = 22400 cc N_2O

$[\because 1 \text{ mole} = 22.4L]$

1 cc $N_2O = \frac{6.02\times10^{23}}{22400} molecules$

$[\because 1 \text{ mole} = 6.022\times10^{23} \text{ constituent}]$

Every N_2O molecules contains 3 atoms.

1cc of $N_2O = \frac{3\times6.02\times10^{23}}{22400} = \frac{1.8\times10^{24}}{22400}$

In a N_2O molecule, there is 22 electron

1cc $N_2O = \frac{6.02\times10^{23}}{22400}\times22 = \frac{1.32}{224}\times10^{23} electron$

50. The amount of zinc required to produce 224 ml of H_2 at STP on treatment with dilute H_2SO_4 will be
तनु H_2SO_4 के साथ STP पर 224 mL H_2 का उत्पादन करने के लिए आवश्यक जिंक की मात्रा होगी-

(a) 65g (b) 0.065 g
(c) 0.65 g (d) 6.5 g

AIPMT-1996

Ans. (c) : $Zn+H_2SO_4 \rightarrow ZnSO_4+H_2$

One mole of Zn react with 1 mole of H_2SO_4 to produce 1 mole of H_2.

Volume of 1 mole of hydrogen at STP is 22400 ml.

1 mole of Zn contains 65 gm.

Hence , 0.65g of Zn react with H_2SO_4 to produce 224 ml of Hydrogen.

51. At STP the density of CCl_4 vapour in g/L will be nearest to
मानक ताप और दाब (STP) पर वाष्पीय CCl_4 का घनत्व g/L में, निम्नलिखित में से किसके निकट होगा?

(a) 6.87 (b) 3.42
(c) 10.26 (d) 4.57

AIPMT-1988

Ans. (a) : Density $= \frac{\text{mass}}{\text{Volume}}$

Mass of CCl_4 = 154 g

Volume occupied by STP = 22.4litre

Density $= \frac{154}{22.4} = 6.87 g/litre$

5. Percentage Composition

52. A compound X contains 32% of A 20% of B and remaining percentage of C. Then, the empirical formula of X is :
(Given atomic masses of A = 64; B = 40; C = 32 u)
एक यौगिक X में A के 32%, B के 20% और शेष प्रतिशत C के हैं। तब X का मूलानुपाती सूत्र है:
(दिया गया है: आण्विक द्रव्यमान A = 64; B = 40; C = 32 u)

(a) ABC_3 (b) AB_2C_2
(c) ABC_4 (d) A_2BC_2

NEET (UG) - 05.05.2024

Ans.(a) :

Element	Mass percentage	No. of moles	No. of moles in smallest number	Simplification whole number
A	32%	$\frac{32}{64} = \frac{1}{2}$	$\frac{1}{2}\times2$	1
B	20%	$\frac{20}{40} = \frac{1}{2}$	$\frac{1}{2}\times2$	1
C	48%	$\frac{48}{32} = \frac{3}{2}$	$\frac{3}{2}\times2$	3

So, impirical formula of
2 = A:B:C
1:1:3
The correct impirical formula of compounds ABC_3

53. The number of moles of oxygen in one litre of air containing 21% oxygen by volume, under standard conditions, is
सामान्य स्थिति में एक लीटर हवा (जिसका 21% आयतन O_2 गैस होती है।) में मौजूद ऑक्सीजन के मोलों की संख्या है-

(a) 0.0093 mol (b) 2.10 mol
(c) 0.186 mol (d) 0.21 mol

AIPMT-1995

Ans. (a) : Given, one litre of air containing 21% of oxygen.

1 litre = 1000 ml

Volume of oxygen in 1 litre of air $= \frac{21}{100}\times1000$
$= 210 ml$

At STP, 1 mole of oxygen is 22400 ml.

No. of moles of oxygen $= \frac{210}{22400} = 0.0093$moles

54. Concentrated aqueous sulphuric acid is 98% H_2SO_4 by mass and has a density of 1.80 gmL^{-1}. Volume of acid required to make 1 litre of 0.1 M H_2SO_4 solution is:
सान्द्र जलीय सल्फ्यूरिक एसिड मात्रा की दृष्टि 98% H_2SO_4 है तथा उसका घनत्व 1.80 gmL^{-1} है। 0.1 M H_2SO_4 के 1 लीटर विलयन तैयार करने के लिए ऐसिड का आयतन आवश्यक है:-

(a) 5.55 mL (b) 11.10 mL
(c) 16.65 mL (d) 22.20 mL

AIPMT-2007

Ans. (a) : 98% by weight $H_2SO_4 = \frac{98g\ H_2SO_4}{100g\ solution}$

Volume of 100g solution $= \frac{mass}{density} = \frac{100}{1.8} = 55.5\ ml$

For, 0.1 M we needed 9.8 g H_2SO_4

55.55 ml solution = 98g acid

5.55 ml solution = 9.8 g acid = 0.1 molar acid

55. What mass of 95% pure $CaCO_3$ will be required to neutralise 50 ml of 0.5 M HCl solution according to the following reaction?
निम्नलिखित अभिक्रिया के अनुसार 0.5 M HCl विलयन के 50 mL को उदासीन करने के लिए 95% शुद्ध $CaCO_3$ के कितने द्रव्यमान की आवश्यकता होगी?

$$CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + CO_{2(g)} + 2H_2O_{(l)}$$

[Calculate up to second place of decimal point]
(दशमलव बिन्दु के दूसरे स्थान तक परिकलित कीजिए)

(a) 9.50 g (b) 1.25 g
(c) 1.32 g (d) 3.65 g

NEET (UG) 17.07.2022

Ans. (c) : $nHCl = \frac{0.5 \times 50}{1000} = 0.025\ mole$

$W_{HCl} = 0.025 \times 36.5 = 0.9125 g$

$M_{CaCO_3} = 100 g/mol$

From the given reaction-

$2 \times 36.5 g\ HCl$ requires $CaCO_3 = 100 g$

0.9125 g HCl requires $CaCO_3 = \frac{100}{2 \times 36.5} \times 0.9125 = 1.25 g$

Mass of 95% pure $CaCO_3 = \frac{1.25 \times 100}{95} = 1.32 g$

56. 20.0 g of a magnesium carbonate sample decomposes on heating to give carbon dioxide and 8.0 g magnesium oxide. What will be the percentage purity of magnesium carbonate in the sample? (At. wt. : Mg = 24)
20.0 g मैग्नीशियम कार्बोनेट के नमूने को गर्म करने पर अपघटित होकर कार्बन डाई ऑक्साइड एवं 8.0 g मैग्नीशियम ऑक्साइड देता है। नमूने में मैग्नीशियम कार्बोनेट की शुद्धता का प्रतिशत क्या होगा?

(a) 60 (b) 84
(c) 75 (d) 96
(प. भार : Mg = 24)

RE-AIPMT 25.07.2015

Ans. (b) : $MgCO_{3(s)} \xrightarrow{\Delta} MgO_{(S)} + CO_2(g)$
84g 40g

84g of $MgCO_3$ gives 40g of MgO

$\therefore$ 20g of $MgCO_3$ gives $\frac{40}{84} \times 20 = 9.52g$ of MgO

Actual yield = 8g of MgO

$\therefore$ % Purity $= \frac{8}{9.52} \times 100 = 84\%$

57. An organic compound contains carbon, hydrogen and oxygen. Its elemental analysis gave C, 38.71% and H, 9.67%. The empirical formula of the compound would be :
एक कार्बनिक यौगिक में कार्बन, हाइड्रोजन तथा ऑक्सीजन उपस्थित हैं। इसका तात्विक विश्लेषण C, 38.71% तथा H, 9.67% देता है। यौगिक का मूलानूपाती सूत्र होगा :-

(a) CHO (b) CH_4O
(c) CH_3O (d) CH_2O

AIPMT-2008

Ans. (c) :

Element	%	Atomic Mass	Mole	Simple ratio
C	38.71	12	$\frac{38.71}{12} = 3.22$	$\frac{3.22}{3.22} = 1$
H	9.67	1	$\frac{9.67}{1} = 9.67$	$\frac{9.67}{3.22} = 3$
O	51.62	16	$\frac{51.62}{16} = 3.22$	$\frac{3.22}{3.22} = 1$

Hence empirical formula of the compound would be CH_3O

58. An element, X has the following isotopic composition;
एक तत्व, X का समस्थानिक संघटन निम्न है:
^{200}X : 90%
^{199}X : 8.0%
^{202}X : 2.0%
The weighted average atomic mass of the naturally-occurring element X is closest to:
भार की दृष्टि से, प्राकृतिक रूप से प्राप्त X तत्व की औसत परमाणु संहति निम्न में से किसके निकटतम होगी?

(a) 199 amu (b) 200 amu
(c) 201 amu (d) 202 amu

AIPMT-2007

Ans. : (b) Given data :

Element	Abundance	Atomic mass
X^{200}	90%	200
X^{199}	8.0%	199
X^{202}	2.0%	202

Formula :
Average atomic mass = (Atomic mass of X^{200} × abundance + atomic mass of X^{199} × abundance +

atomic mass of X^{202}×abundance)/100

$$= \frac{200\times 90 + 199\times 8.0 + 202\times 2.0}{100}$$

$$= \frac{18000 + 1592 + 404}{100}$$

$$= 199.96 \approx 200 \text{ amu}$$

59. In Haber process 30 litres of dihydrogen and 30 litres of dinitrogen were taken for reaction which yielded only 50% of the expected product. What will be the composition of gaseous mixture under the above condition in the end:
हैबर प्रक्रम में अभिक्रिया के लिए 30 लीटर डाइहाइड्रोजन एवं 30 लीटर डाइनाइट्रोजन ली गई जिसमें अपेक्षित उत्पाद की केवल 50% प्राप्ति हुई। उपरोक्त परिस्थिति में अंततः गैसीय मिश्रण का क्या संघटन होगाः

(a) 20 litres ammonia, 20 litres nitrogen, 20 litres hydrogen /20 लीटर अमोनिया, 20 लीटर नाइट्रोजन 20 लीटर हाइड्रोजन

(b) 10 litres ammonia, 25 litres nitrogen, 15 litres hydrogen/10 लीटर अमोनिया, 25 लीटर नाइट्रोजन 15 लीटर हाइड्रोजन

(c) 20 litres ammonia, 10 litres nitrogen, 30 litres hydrogen/20 लीटर अमोनिया, 10 लीटर नाइट्रोजन 30 लीटर हाइड्रोजन

(d) 20 litres ammonia, 25 litres nitrogen, 15 litres hydrogen/20 लीटर अमोनिया, 25 लीटर नाइट्रोजन 15 लीटर हाइड्रोजन

AIPMT-2003

Ans. (b): In Haber process-

	N_2	+ $3H_2$	$\rightarrow$ $2NH_3$
Initially	30L	30L	0
at equilibrium	(30-x)	(30-3x)	2x
	10L	30L	20L

Given expected product = 50% of expected product

Then , yield of $NH_3 = \frac{50}{100}\times 20 = 10\,\text{L}$

So, $2x = 10 \Rightarrow \boxed{x = 5}$

$NH_3 \rightarrow 10\text{L}$

$N_2 \rightarrow (30 - x) = 30 - 5 = 25\text{L}$

$H_2 \rightarrow (30 - 3x) = 30 - 15 = 15\text{L}$

60. The percentage of C, H and N in an organic compound are 40%, 13.3% and 46.7% respectively then empirical formula is:
एक कार्बनिक यौगिक में C, H तथा N की प्रतिशतता क्रमशः 40%, 13.3% तथा 46.7% है, तो यौगिक का मूलानुपाती सूत्र है -

(a) $C_3H_{13}N_3$ (b) CH_2N
(c) CH_4N (d) CH_6N

AIPMT-2002

Ans. (c) : Table for empirical Formula

Element	%	At wt.	Relative Number	Ratio elements
C	40%	12	$\frac{40}{12} = 3.33$	$\frac{3.33}{3.33} = 1$
H	13.3%	1	$\frac{13.3}{1} = 13.3$	$\frac{13.3}{3.33} = 4$
N	46.7%	14	$\frac{46.7}{14} = 3.33$	$\frac{3.33}{3.33} = 1$

Hence, empirical formula of compound is CH_4N.

61. Percentage of Se in peroxidase anhydrous enzyme is 0.5% by weight (at. wt = 78.4) then the minimum molecular weight of peroxidase anhydrous enzymes is : -
परॉक्सीडेस एनहाइड्रस एन्जाइम में Se की भार से 0.5% मात्रा है (प. भार = 78.4 है) परॉक्सीडेस एनहाइड्रस का न्यूनतम अणुभार है -

(a) 1.568×10^4 (b) 1.568×10^3
(c) 15.68 (d) 2.136×10^4

AIPMT-2001

Ans. (a) : In peroxidase anhydrous enzyme, 0.5 gm Se is present in 100 gm of the enzyme.
In a molecule of enzyme, one Se atom must be present.
Hence 78.4g Se will be present in $\frac{100}{0.5}\times 78.4$

$= 1.568\times 10^4$

62. Oxidation numbers of A, B and C are + 2, +5 and – 2 respectively possible formula of compound is:
A, B और C के ऑक्सीकरण अंक क्रमशः +2, +5 और –2 है। यौगिक का संभावित सूत्र है –

(a) $A_2(BC_2)_2$ (b) $A_3(BC_4)_2$
(c) $A_2(BC_3)_2$ (d) $A_3(B_2C)_2$

AIPMT-2000

Ans. (b) : Using trial and error method,
$A_3 (BC_4)_2$
Overall compound should be neutral, let's check charge on
A = 3 × 2 = +6
Charge on $(BC_4)_2$ = 5 + (–8) × 2 = –6
Hence $A_3(BC_4)_2$ = +6–6 = 0

63. A compound contain C, H and O. If C = 40% and H = 6.67% then empirical formula of compound will be/ एक यौगिक में शामिल कार्बन, हाइड्रोजन व ऑक्सीजन है। यदि C = 40% H = 6.67% तो यौगिक का मूलानूपाती सूत्र क्या होगा :- :

(a) CH_2O (b) CH_4O
(c) CH_4O_2 (d) CHO

AIPMT-1999

Ans. (a) : 100 g of the compound will contain 40g C 6.67g H and 53.3 gm O.

number of moles of C = $\frac{40}{12} = 3.33$ mol

number of moles of O = $\frac{53.3}{16} = 3.33$ mol

number of moles of H = $\frac{6.67}{1} = 6.67 \approx 6.7$

The mole ratio C : H : O = $\frac{3.33}{3.33} : \frac{6.7}{3.33} : \frac{3.33}{3.33}$

= 1 : 2 : 1

The empirical formula = CH_2O

64. Percentage of C, H & N are given as follows: C = 40% H = 13.33% N = 46.67% The empirical formula will be:
C, H व N की प्रतिशतता दी गई है, यौगिक का मूलानुपाती सूत्र क्या होगा– C = 40% H = 13.33% N = 46.67%

(a) CH_2N (b) C_2H_4N
(c) CH_4N (d) CH_3N

AIPMT-1998

Ans. (c) : Consider their compound to be made of 100 g. Convert percentage to weight in grams. Then, convert wt. in grams to moles.

Moles of C = $\frac{40}{12} = 3.33$

Moles of H = $\frac{13.33}{1} = 13.33$

Moles of N = $\frac{46.6}{14} = 3.33$

Now divide each mole value by lowest value of n as:

$C = \frac{3.33}{3.33} = 1$

$H = \frac{13.33}{3.33} = 4.00$

$N = \frac{3.33}{3.33} = 1$

The empirical formula is CH_4N

65. Boron has two stable isotopes, ^{10}B (19%) and ^{11}B (81%). Calculate average at. wt. of boron in the periodic table.
बोरॉन के दो स्थायी समस्थानिक हैं, ^{10}B (19%) तथा ^{11}B (81%) आवर्त्त सारणी में बोरॉन के लिए औसत परमाणु भार है-

(a) 10.8 (b) 10.2
(c) 11.2 (d) 10.0

AIPMT-1990

Ans. (a) : Atomic no. of boron is 5

Average atomic weight = $\frac{\sum \%\text{ abundant} \times \text{atomic mass}}{100}$

$= \frac{19 \times 10 + 81 \times 11}{100}$

$= \frac{190 + 891}{100} = \frac{1081}{100}$

$= 10.81$

66. Haemoglobin contains 0.334% of iron by weight. The molecular weight of haemoglobin is approximately 67200. The number of iron atoms (Atomic weight of Fe is 56) present in one molecule of haemoglobin is
हीमोग्लोबिन में लौह कणों का भार 0.334% होता है। हीमोग्लोबीन का परमाणु द्रव्यमान लगभग 67200 है। हीमोग्लोबिन के लिए अणु में लौह कण (लौह कण का परमाणु द्रव्यमान = 56) के परमाणु की संख्या कितनी है?

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

AIPMT-1998

Ans. (a) : Molecular weight of haemoglobin is approximately 67200 which contains 0.334% of iron by weight

Weight of iron = $\frac{0.334}{100} \times 67200 = 224.4$

$\therefore$ The number of Fe atoms in one Hb molecules

No. of Fe atoms = $\frac{\text{weight of iron in haemoglobin}}{\text{atomic weight of iron}}$

$= \frac{224.4}{56} = 4.007 \approx 4$

67. Which of the following fertilizers has the highest nitrogen percentage?
निम्नलिखित में से किस उर्वरक में नाइट्रोजन की प्रतिशत मात्रा सबसे अधिक होती है?

(a) Ammonium sulphate/अमोनिया सल्फेट
(b) Calcium cyanamide/कैल्सियम सायनामाइड
(c) Urea/यूरिया
(d) Ammonium nitrate/अमोनियम नाइट्रेट

AIPMT-1993

Ans. (c) : Ammonium sulphate = $(NH_4)_2SO_4$
Calcium cyanamide = $CaCN_2$
Formula of Urea = NH_2CONH_2
Ammonium nitrate = NH_4NO_2
% of nitrogen-

$(NH_4)_2\ SO_4 = \frac{28}{132} \times 100 = 21.21\%$

$CaCN_2 = \frac{28}{80} \times 100 = 35\%$

$CO\ (NH_2)_2 = \frac{28}{60} \times 100 = 46.6\%$

$NH_4NO_2 = \frac{28}{80} \times 100 = 35\%$

02.

Structure of Atom

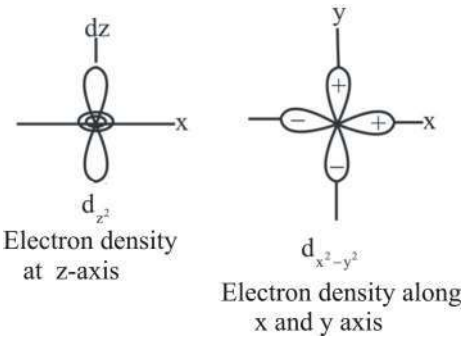
1. Discovery of Sub-atomic Particles

1. Which of the following pairs of d-orbitals will have electron density along the axis?
निम्न में से d-कक्षकों के किस युग्म में इलेक्ट्रॉन घनत्व अक्षों के अनुदिश है ?

(a) d_{z^2} , d_{xz} (b) d_{xz}, d_{yz}
(c) d_{z^2} , $d_{x^2-y^2}$ (d) d_{xy} $d_{x^2-y^2}$

NEET (UG) 24.07.2016, Phase-II

Ans. (c) : d_{z^2} , $d_{x^2-y^2}$ pair of orbitals have electron density along the axis due to their orientation in space and dxy, dyz, dxz have electron density between the axis–



d_{z^2}
Electron density at z-axis

$d_{x^2-y^2}$
Electron density along x and y axis

2. The total number of atomic orbitals in fourth energy level of an atom is:/एक परमाणु के चौथे ऊर्जा स्तर में परमाणु ऑर्बिटलों की कुल संख्या है-

(a) 4 (b) 8
(c) 16 (d) 32

AIPMT (Screening)-2011

Ans. (c) : Total number of atomic orbitals in any energy level is given = n^2
Where, n = energy level
$\therefore$ Number of atomic orbitals in fourth energy level = $4^2 = 16$

3. The measurement of the electron position is associated with an uncertainty in momentum, which is equal to 1×10^{-18} g cm s^{-1}. The uncertainty in electron velocity is :
(Mass of an electron is 9×10^{-28} g)
इलेक्ट्रॉन की स्थिति का मापन, संवेग में अनिश्चितता से संबन्धित है जो कि 1×10^{-18} g cm s^{-1} के बराबर है इलेक्ट्रॉन के वेग अनिश्चितता है, (इलेक्ट्रॉन की संहति 9×10^{-28} g)

(a) 1×10^5 cm s^{-1} (b) 1×10^{11} cm s^{-1}
(c) 1×10^9 cm s^{-1} (d) 1×10^6 cm s^{-1}

AIPMT-2008

Ans. (c) : Uncertainty in momentum ($m\Delta v$) = 1×10^{-18} g cm s^{-1}
Uncertainty in velocity Δv

$$= \frac{1\times10^{-18}}{9\times10^{-28}} \text{g cm s}^{-1} = 1.1\times10^{9} \text{ cm s}^{-1}$$

4. Given: The mass of electron is 9.11×10^{-31}Kg Planck constant is 6.626×10^{-34}Js, the uncertainty involved in the measurement of velocity within a distance of 0.1Å is:-
दिया गया: इलेक्ट्रॉन का द्रव्यमान 9.11×10^{-31}Kg प्लांक स्थिरांक 6.626×10^{-34}Js है, 0.1Å की दूरी के अंतर्गत वेग के मापन में निहित अनिश्चितता है:-

(a) 5.79×10^6 ms^{-1}
(b) 5.79×10^7 ms^{-1}
(c) 5.79×10^8 ms^{-1}
(d) $5.79 \times 10^5$$ms^{-1}$

AIPMT-2006

Ans. (a) : Mass of electron (m) = 9.11×10^{-31} kg
Planck constant (h) = 6.626×10^{-34} Js
Distance (Δx) = 0.1Å

$$\Delta x.\ m\ \Delta v = \frac{h}{4\pi}$$

$$0.1\times10^{-10}\times9.11\times10^{-31}\times\Delta v = \frac{6.626\times10^{-34}}{4\times3.143}$$

$$\Delta v = \frac{6.626\times10^{-34}}{0.1\times10^{-10}\times9.11\times10^{-31}\times4\times3.143}$$

$$= 5.79\times10^{6} \text{ ms}^{-1}$$

5. A nuclide of an alkaline earth metal undergoes radioactive decay by emission of three α-particle in succession. The group of the periodic table to which the resulting daughter element would belong is :-
एक क्षारीय मृदा धातु के एक न्यूक्लिआइड का एक के बाद एक तीन α-कणों के उत्सर्जन के साथ रेडियोएक्टिव क्षय होता है। आवर्त तालिका का वर्ग जिसमें विघटन तत्व रखा जायेगा, वह है:-

(a) Gr. 4 (b) Gr.6
(c) Gr.16 (d) Gr.14

AIPMT-2005

Ans. (d) : 3α - decay means 3α particles are emitted.

$$\alpha = {}_2He^4$$

So, $$3\alpha = 3\times {}_2He^4$$

Single helium has 2 protons then 3 He has 6 protons.
So, after 3- alpha decay atomic number decrease by 6. Parent atom was in the 2nd group so the daughter will belong to the 14^{th} group after decrease in atomic number by 6.

6. $_{92}U^{235}$, nucleus absorb a neutron and disintegrate in $_{54}Xe^{139}$, $_{38}Sr^{94}$ and x So, What will be the product x:/ $_{92}U^{235}$ नाभिक एक न्यूट्रान अवशोषित करता है और विखण्डित होकर $_{54}Xe^{139}$, $_{38}Sr^{94}$ व x उत्सर्जित करता है, तो उत्पन्न x क्या है ?

(a) 3 - neutrons (b) 2 - neutrons
(c) α - partical (d) β - partical

AIPMT-2002

Ans. (b) : When $_{92}U^{235}$ nucleus absorbs a neutron i.e. when $_{92}U^{235}$ nucleus undergoes a controlled nuclear fission it disintegrate into two lighter nuclei $_{54}Xe^{139}$ and $_{38}Sr^{94}$ along with some neutrons.
The nuclear reaction is as follows:

$$_{92}U^{235} + {}_0n^1 \rightarrow {}_{54}Xe^{139} + {}_{38}Sr^{94} + x$$

When we can balance the nuclear reaction by equating the number of protons and neutrons on both side of the reaction. Thus, the balanced nuclear reaction is as follows: $_{92}U^{235} + {}_0n^1 \rightarrow {}_{54}Xe^{139} + {}_{38}Sr^{94} + 2{}_0n^1$
Thus, two neutrons are produced in this reaction. Thus, $_{92}U^{235}$ nucleus absorbs a neutron and disintegrates into $_{54}Xe^{139}$, $_{38}Sr^{94}$ and 2 neutrons.

7. If a $_a^bX$ species emits firstly a positron, then two α and two β and at last one α is also emitted and finally converts into stable $_d^cY$ species so correct relation will be:/यदि $_a^bX$ से पॉजीट्रॉन पहले निकलता है, फिर दो α व दो β निकलते हैं, फिर अन्त में एक निकलता है α, व अंत में एक $_d^cY$ स्थाई यौगिक बनता है, तो निम्न सत्य होगा-

(a) a =c + 12, d = b – 5 (b) a = c – 8, d = b – 1
(c) a = c – 6, d = b – 0 (d) a = c – 4, a = b – 2

AIPMT-2001

Ans. (a) :

$$_a^bX \longrightarrow {}_d^cY + \underset{\text{Positron}}{{}_{+1}^{0}e} + 3\underset{\alpha-\text{Particle}}{{}_2^4H_e} + 2\underset{\beta\text{-particle}}{{}_{-1}^{0}e}$$

Illaborating it following is the flowchart-

$$_a^bX \xrightarrow{-{}_{+1}^{0}e} {}_{a-1}^{b}X \xrightarrow{-2\alpha({}_2^4He)} {}_{a-5}^{b-8}X \xrightarrow{-2\beta({}_{-1}^{0}e)} {}_{a-3}^{b-8}X \xrightarrow{-\alpha({}_2^4He)} {}_{a-5}^{b-12}X$$

According to the question, $_{a-5}^{b-12}X \equiv {}_d^cY$ So,

d= a-5
c= b-12
Then, a = c+12
b = d+1+6-2
b = d+5
d = b-5

2. Atomic Models

8. The number of protons, neutrons and electrons in $_{71}^{175}Lu$, respectively, are/ $_{71}^{175}Lu$, में प्रोटॉनों, न्यूट्रॉनों और इलेक्ट्रॉनों की संख्याएँ क्रमशः है:

(a) 104, 71 and 71/104, 71 और 71
(b) 71, 71 and 104/71, 71 और 104
(c) 175, 104 and 71/175, 104 और 71
(d) 71, 104 and 71 /71, 104 और 71

NEET (UG) 13.09.2020

Ans. (d) : According to the question,

$$_{71}Lu^{175}$$

$$n_p = n_e = 71$$

$$n_p + n_n = 175$$

$$n_n = 175 - 71 = 104$$

9. Which one is the wrong statement?
निम्न में से कौन सा कथन गलत है

(a) de-Broglie's wavelength is given by $\lambda = \frac{h}{mv}$, where m = mass of the particle, v = group velocity of the particle
डी-ब्रोगली तरंगदैर्ध्य है $\lambda = \frac{h}{mv}$, जहाँ m = कण का द्रव्यमान, v = कण का समूह वेग।

(b) The uncertainty principle is $\Delta E \times \Delta t \geq \frac{h}{4\pi}$
अनिश्चितता सिद्धान्त के अनुसार $\Delta E \times \Delta t \geq \frac{h}{4\pi}$ ।

(c) Half-filled and fully filled orbitals have greater stability due to greater exchange energy, greater symmetry and more balanced arrangement/अर्द्धपूरित एवं पूरित कक्षकों का उच्च स्थायित्व उच्च विनिमय ऊर्जा, उच्च सममिति, अधिक संतुलित व्यवस्था के कारण है।

(d) The energy of 2s orbital is less than the energy of 2p orbital in case of Hydrogen like atoms/हाइड्रोजन जैसे परमाणुओं के लिए 2s कक्षक की ऊर्जा 2p कक्षक की ऊर्जा से कम होती है।

NEET (UG) 07.05.2017

Ans. (d) : The energy of ns^2 in H-atom is determined only by principle quantum number (n). The energy of orbitals in hydrogen atom follows the following order.
$1s < 2s = 2p < 3s = 3p = 3d < 4s = 4p = 4d = 4f < ....$
This is the order because the energy of the orbital only depends on the principal quantum number (n) for hydrogen like monoelectronic species.
Thus, 2s, 2p have same energy 3s, 3p and 3d have same energy and so on.....
So, option 'd' is incorrect.

10. If uncertainty in position and momentum are equal, then uncertainty in velocity is –
यदि स्थिति तथा संवेग में अनिश्चितता बराबर-बराबर हों तो वेग में अनिश्चितता हैं-

(a) $1/m\sqrt{(h/\pi)}$ (b) $\sqrt{(h/\pi)}$

(c) $1/2m\sqrt{(h/\pi)}$ (d) $\sqrt{(h/2\pi)}$

AIPMT-2008

Ans. (c) : If uncertainty in the measurement of position and momentum are equal then uncertainty in the measurement of velocity is equal to $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$.

$$\Delta x \ \Delta P = \frac{h}{4\pi}$$

Given, $\Delta x = \Delta P$

Then, $\Delta x^2 = \frac{h}{4\pi}$

Hence, $\Delta x = \Delta P = \sqrt{\frac{h}{4\pi}}$

But $\Delta P = m\Delta u$

$\therefore \quad \Delta u = \frac{1}{2m}\sqrt{\frac{h}{\pi}}$

11. A 300 gram radioactive sample has half life of 3 hour's. After 18 hour's remaining quantity will be :/300 ग्राम रेडियो एक्टिव पदार्थ की प्रारम्भिक मात्रा के नमूने की अर्द्धआयु-3 घण्टे है। 18 घण्टे बाद शेष मात्रा होगी –

(a) 4.68 gram (b) 2.34 gram

(c) 3.34 gram (d) 9.37 gram

AIPMT-2000

Ans. (a) : Original quantity of radioactive substance = 300 grams

Half-life = 3 hours

No. of Half lives in 18 hours = $\frac{18}{3} = 6$

After 18 hours, $\frac{1}{(2)^6}$ of the original would be remaining = $\frac{1}{64} \times 300$ gm = 4.6875 grams

12. The bombardment of α-particle on $_7N^{14}$, emits proton then new atom will be
$_7N^{14}$ पर α -कणों की बोछार से एक प्रोटान निकलता है, तो बनने वाला परमाणु होगा :-

(a) $_8O^{17}$ (b) $_8O^{16}$

(c) $_6C^{14}$ (d) Ne

AIPMT-1999

Ans. (a) : The bombardment of α - particle on $_7N^{14}$ emits proton –

$$_2He^4 + {}_7N^{14} \rightarrow {}_1H^1 + {}_8O^{17}$$

Atomic number and mass number must be equal in reactant and product following law of conservation of mass.

3. Bohr's Model for Hydrogen Atom / Quantum No.

13. Match List I with List II.

List-I Quantum Number		List-II Information provided	
A	m_l	**I**	**Shape of orbital**
B	m_s	**II**	**Size of orbital**
C	l	**III**	**Orientation of orbital**
D	n	**IV**	**Orientation of spin of electron**

Choose the correct answer from the options given below :
सूची I का सूची II के साथ मिलान कीजिए :

सूची I (क्वांटम संख्या)	सूची II (उपलब्ध जानकारी)
A. m_l	**I.** कक्षक की आकृति
B. m_s	**II.** कक्षक का आकार
C. l	**III.** कक्षक का अभिविन्यास
D. n	**IV.** इलेक्ट्रॉन के चक्रण का अभिविन्यास

(a) A- III, B- IV, C- I, D-II
(b) A- III, B- IV, C- II, D-I
(c) A- II, B- I, C- IV, D-III
(d) A- I, B- III, C- II, D-IV

NEET (UG) - 05.05.2024

Ans.(a) :

List-I Quantum Number		List-II Information provided	
A	m_l	III	Orientation of orbital
B	m_s	IV	Orientation of spin of electron
C	l	I	Shape of orbital
D	n	II	Size of orbital

14. The energy of an electron in the ground state (n = 1) for He^+ ion is –x J, then that for an electron in n = 2 state for Be^{3+} ion in J is :
He^+ आयन की मूल अवस्था (n = 1) में किसी इलेक्ट्रॉन की ऊर्जा –xJ है, तब Be^{3+} आयन की n = 2 अवस्था में उपस्थित इलेक्ट्रॉन के लिए J में ऊर्जा होती है :

(a) $-\frac{x}{9}$ (b) –4x

(c) $-\frac{4}{9}x$ (d) – x

NEET (UG) - 05.05.2024

Ans.(d) : Given that, energy of an electron in the ground state for He^+ ion is –x joule

$$E_{He^+} = \frac{-13.6z^2}{n^2}$$

$\therefore He^{+} = xJ$

$E_{He^+} = -13.6 \times 4J = -2$ Joule $\therefore He^{+} = xJ$

So, $E_{Be^{3+}} = \frac{-13.6\times(4)^2}{(2)^2}$

$= \frac{-13.6\times16}{4}$

$E_{Be^{3+}} = -13.6\times4$ Joule $(\because -x\,J = 13.6\times4J)$

Or $E_{Be^{3+}} = -x$ Joule

15. In hydrogen atom, the de-Broglie wavelength of an electron in the second Bohr orbit is :–
[Given that Bohr radius, $a_0 = 52.9$ pm]
हाइड्रोजन परमाणु के द्वितीय बोर कक्ष में एक इलेक्ट्रान की डि-ब्रागली तरंगदैर्घ्य होगी,
[दिया गया है : बोर त्रिज्या, $a_0 = 52.9$ pm]

(a) 105.8 pm (b) 211.6 pm
(c) 211.6 π pm (d) 52.9 π pm

NEET Odisha (UG) 20.05.2019

Ans. (c) : Given,
Bohr radius, $a_o = 52.9$ pm and $n = 2$
$r_n = n^2a_o = (2)^2 a_o = 4\times52.9$ pm $= 211$ pm
The angular momentum of an electron in a given stationary state can be expressed as :

$$mvr = n.\frac{h}{2\pi} \text{ ——(i)}$$

$$mvr = 2\times\frac{h}{2\pi}$$

$mvr\pi = h$ _____ (i)
de-Broglie equation.

$$\lambda = \frac{h}{mv}$$

$\lambda mv = h$ _____ (ii)
From equation (i) and (ii) we get $\lambda = \pi r$
putting the value of r,
$\lambda = 211.6\ \pi$ pm

16. Which of the following series of transitions in the spectrum of hydrogen atom fall in visible region?
हाइड्रोजन परमाणु के स्पेक्ट्रम में, निम्न में से कौन सी संक्रमण श्रेणी दृश्य क्षेत्र में पड़ती है?

(a) Balmer series/बामर श्रेणी
(b) Paschen series/पाशन श्रेणी
(c) Brackett series/ब्रैकेट श्रेणी
(d) Lyman series/लाईमन श्रेणी

NEET (UG) 05.05.2019

Ans. (a) : In H. spectrum, Balmer series transition fall in visible region.
- As a hydrogen atom consists of only one electron the electron jumps from the higher level to the lower level it releases energy in the form of spectral emission.
- The hydrogen atom is capable to show series Lyman, Balmer, Brockett and Pascher.
- The only series which fall in the visible region is the Balmer series.

17. The frequency of radiation emitted when the electron falls from n = 4 to n = 1 in a hydrogen atom will be (Given ionization energy of H = 2.18×10^{-18} J atom^{-1} and h = 6.625×10^{-34} Js):
एक हाइड्रोजन परमाणु में जब इलेक्ट्रॉन n = 4 से n = 1 पर गिरता है, तो उत्सर्जित विकिरण की आवृत्ति होगी (दिया गया है H की आयनन ऊर्जा = 2.18×10^{-18} J atom^{-1} और h = 6.625×10^{-34} Js) :-

(a) 1.03×10^{15} s^{-1} (b) 3.08×10^{15} s^{-1}
(c) 2.00×10^{15} s^{-1} (d) 1.54×10^{15} s^{-1}

AIPMT-2004

Ans. (b) : Ionisation energy :- Ionisation energy is the Minimum energy required to remove the most loosely bound electron of an isolated gaseous atom, positive ion, or molecule.
$X(g) + \text{energy} \longrightarrow X^+ + e^-$
X is any atom or molecule.
Given –

$$\text{I.E.} = -E_1 = 2.18\times10^{-18}\ \text{J/atom} = R_H$$

$$\therefore \quad E_n = \frac{E_1}{n^2}\ ,\ E_4 = \frac{E_1}{4^2}$$

$$E_4 = -\frac{2.18\times10^{-18}}{4^2} = -1.36\times10^{-19}\ \text{J/atom}$$

$$\Delta E = E_1 - E_4 = \left(-2.18\times10^{-18}\right) - \left(-1.36\times10^{-19}\right)$$

$$= -2.04\times10^{-18}\ \text{J/atom}$$

$$\text{The Frequency}(\nu) = \frac{\Delta E}{h} = \frac{2.04\times10^{-18}}{6.626\times10^{-34}}$$

$$\nu = 3.08\times10^{15}\ \text{Sec}^{-1}$$

18. In Hydrogen atom, energy of first excited state is – 3.4 eV. Then find out KE of same orbit of Hydrogen atom:
हाइड्रोजन की प्रथम उत्तेजित अवस्था की ऊर्जा – 3.4 eV है, तो इसी कक्षा की KE होगी -

(a) + 3.4 eV (b) + 6.8 eV
(c) – 13.6 eV (d) + 13.6 eV

AIPMT-2002

Ans. (a) : Total energy (E_n) = KE + PE = –KE

$$\text{In the first Exited state} = \frac{1}{2}mv^2 + \left[-\frac{Ze^2}{r}\right]$$

$$= +\frac{1}{2}\frac{Ze^2}{r} - \frac{Ze^2}{r} = \frac{Ze^2}{r}\left[\frac{1}{2} - 1\right]$$

$$= \frac{Ze^2}{r}\left[\frac{1-2}{2}\right] = -\frac{Ze^2}{2r}$$

Energy of first excited state is –3.4 eV

$$-3.4 \text{ eV} = -\frac{1}{2}\frac{Ze^2}{r}$$

$$\therefore \text{KE} = \frac{1}{2}\frac{Ze^2}{r} = +3.4\text{eV}$$

Note: Energy in excited state /total energy is nothing but kinetic energy with opposite sign.

E_n= -K.E = +3.4 eV

19. The following quantum numbers are possible for how many orbital n = 3, ℓ = 2, m = +2

निम्न क्वाण्टम संख्याऐं n = 3, ℓ = 2, m = +2 कितने कक्षक को निरूपित करती है-

(a) 1 (b) 2

(c) 3 (d) 4

AIPMT-2001

Ans. (a) : n = 3 , l = 2 , m = + 2 represents one of the 3d orbitals with magnetic quantum number + 2

No two orbitals have the same set of n, l and m. Hence given quantum number is possible for only one orbital with 2 electrons.

20. The value of Planck's constant is 6.63×10^{-34}Js. The velocity of light is 3.0×10^{8} ms^{-1}. Which value is closest to the wavelength in nanometers of a quantum of light with frequency of 8×10^{15} s^{-1}: /प्लांक स्थिरांक का मान 6.63×10^{-34}Js है। प्रकाश का वेग 3.0×10^{8} ms^{-1} है। कौनसा मान 8×10^{15} s^{-1} की आवत्ति वाले प्रकाश के क्वांटम के नैनोमीटर में तंरगदैर्ध्य के सन्निकट है:

(a) 2×10^{-25} (b) 5×10^{-18}

(c) 4×10^{1} (d) 3×10^{7}

AIPMT-2003

Ans. (c): We know that

$$\text{Frequency } (\nu) = \frac{c}{\lambda}$$

Where,

λ = Wavelength of a quantum of light= ?

ν = frequency of a quantum of light = 8×10^{15} s^{-1}

Velocity of light (c) = 3×10^{8} m/s

$\therefore$

$$\lambda = \frac{c}{\nu} = \frac{3\times10^{8}}{8\times10^{15}} = 0.375\times10^{-7}\text{ m} \quad (\because 1\text{m} = 10^{9}\text{ nm})$$

$\Rightarrow 0.375\times10^{-7}\times10^{+9}$

$\Rightarrow 3.75\times10^{1}$ nm

Hence, 4×10^{1} will be the closest value to the wavelength in (nm) of a quantum of light frequency of light with 8×10^{15} s^{-1}

21. Consider the following sets of quantum number: क्वान्टम नम्बरों के निम्न सेटों पर विचार कीजिए:

	n	l	m	s
(a)	**3**	**0**	**0**	**+½**
(b)	**2**	**2**	**1**	**+½**
(c)	**4**	**3**	**–2**	**–½**
(d)	**1**	**0**	**–1**	**–½**
(e)	**3**	**2**	**3**	**+½**

Which of the following sets of quantum number is not possible:/क्वान्टम नम्बरों के निम्न सेटों में से कौनसा सम्भव नहीं है:-

(a) a and c/ a तथा c

(b) b, c and d/ b, c तथा d

(c) a, b, c and d/ a, b, c तथा d

(d) b, d, and e/ b, d, तथा e

AIPMT-2007

Ans. (d): According to the afbhau rule the value of quantum no is related to the n (principle quantum number).

- Value of ℓ (azimuthal quantum no.) = 0 to (n-1)
- Value of m (magnetic quantum no.) = - ℓ to + ℓ
- Value of s (spin quantum no.) = $+1/2$ or $-1/2$

From the above formulae of quantum no., we observe

(b) n = ℓ, Whereas ℓ < n always as ℓ = 0 to (n-1)

(d) At ℓ =0, m=0 as m = - ℓ to + ℓ

(e) If ℓ = 2, then m= -2,-1,0,1,2

Thus b, d and e are not possible.

22. For given energy, corresponding wavelength will be E = 3.03×10^{-19} Joules (h = 6.6×10^{-34} J × sec., C = 3×10^{8} m/sec.)

ऊर्जा E = 3.03×10^{-19} जूल के संगत तरंगदैर्ध्य होगा (h = 6.6×10^{-34} J × sec., C = 3×10^{8} m/sec.)

(a) 65.3 nm. (b) 6.53 nm.

(c) 3.4 nm. (d) 653 nm.

AIPMT-2000

Ans. (d) : Given, E = 3.03×10^{-19}J

Using the formula, $\lambda = \frac{hc}{E}$

$$= \frac{6.6\times10^{-34}\times3\times10^{8}}{3.03\times10^{-19}}\text{m}$$

= 653 nm

23. Incorrect set of quantum numbers from the following is/निम्नलिखित में से क्वांटम संख्याओं का गलत समुच्चय है

(a) n= 4, l =2, m_l = -2,-1, 0,+1,+2, m_s=-1/2

(b) n=5, l=3, m_l=-3,-2,-1,0,+1,+2,+3, m_s = +1/2

(c) n= 4, l =3, m_l= -3,-2,-1,0,+1,+2,+3, m_s=-1/2

(d) n=5, l =2, m_l=-2,-1,+1, +2, m_s=+1/2

RE-NEET Manipur (UG) 06.06.2023

Ans. (d) : For any set of Quantam number the following representation is used,
n = Principal quantum number.
l = Azimuthal quantum number.
m= Magnetic quantum number.
s= Spin quantum number.
For given value of n, l ranges from 0 to n–1. It means 'l' depends on the value of n.
For given value of l, m ranges from $-l$ to l
spin quantum number is always $+\frac{1}{2}$ and $-\frac{1}{2}$

Given, n = 5, l = 2, m_l =–2,–1,+1,+2, $m_s = +\frac{1}{2}$

This is incorrect because, value of m_l is not completed.
The correct set is

$$n = 5,\ l = 2,\ m_l = -2, -1, 0, +1, +2,\ m_s = +\frac{1}{2} \text{ or } \frac{-1}{2}.$$

24. The relation between (n_m= the number of permissible values of magnetic quantum number (m)) for a given value of azimuthal quantum number (I), is
दिगंशीय क्वांटम संख्या (l) n_m = (चुंबकीय क्वांटम संख्या (m) के अनुमत मान संख्या) के बीच संबंध है :

(a) $n_m = l + 2$ (b) $l = \frac{n_m - 1}{2}$

(c) $l = 2n_m + 1$ (d) $n_m = 2l^2 + 1$

NEET (UG)- 07.05.2023

Ans. (b) : Magnetic quantum Number = $-l$ to $+l$
$l = 0$, m = 0
l= 1, m = –1, 0, +1
l = 2, m = –2, –1, 0, +1, +2
Value of $n_m = 2l + 1$
$n_m - 1 = 2l$
$$l = \frac{n_m - 1}{2}$$

25. Match List - I with List - II:
सूची- I को सूची - II के साथ मिलाइए:

List-I/सूची-I (quantum number) (क्वांटम संख्या)		List-II/सूची- II (orbital) (कक्षक)	
A.	n = 2, 1 = 1	i.	2 s
B.	n = 3, 1 = 2	ii.	3 s
C.	n = 3, 1 = 0	iii.	2 p
D.	n = 2, 1 = 0	iv.	3 d

Choose the correct answer from the options given below:
नीचे दिए गए विकल्पों से सही उत्तर चुनिए:

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

NEET (UG) Re-Exam-04.09.2022

Ans. (d) : Since l = 0 = s-subshell
l = 1 = p-subshell
l = 2 = d-subshell
l = 3 = f-subshell
$\therefore$ n = 2, l = 1 $\Rightarrow$ 2p
n = 3, l = 2 $\Rightarrow$ 3d
n = 3, l = 0 $\Rightarrow$ 3s
n = 2, l = 0 $\Rightarrow$ 2s

26. If radius of second Bohr orbit of the He^+ ion is 105.8 pm, what is the radius of third Bohr orbit of Li^{2+} ion?/यदि He^+ आयन की दूसरी बोर कक्षा की त्रिज्या 105.8 pm हो तो Li^{2+} आयन की तीसरी बोर कक्षा की त्रिज्या क्या होगी?

(a) 158.7 Å (b) 158.7 pm
(c) 15.87 pm (d) 1.587 pm

NEET (UG) 17.07.2022

Ans. (b) : Borh's radius for n^{th} orbit,

$$r_n = \frac{0.53n^2}{Z}\text{Å}$$

Where, Z = atomic no. and n = orbit no.

So, $r \propto \frac{n^2}{Z}$

Given, for Helium, Z = 2 & n = 2; r_{He} = 105.8 pm.
for lithium, Z = 3 & n = 3; r_{Li} = ?
Mathematically,

$$\frac{r_{He}}{r_{Li}} = \frac{\frac{n^2_{He^+}}{Z_{He^+}}}{\frac{n^2_{Li^{2+}}}{z_{Li^{2+}}}} = \frac{2}{3}$$

So, $r_{Li^{2+}} = r_{He^+} \times \frac{3}{2} = 105.8 \times \frac{3}{2} = 158.7\,\text{pm}$

27. The number of angular nodes and radial nodes in 3s orbital are/3s कक्षक के लिए कोणीय नोड़ो और त्रिज्य नोड़ो की संख्याएँ हैं

(a) 0 and 1, respectively/क्रमशः 0 और 1
(b) 0 and 2, respectively/क्रमशः 0 और 2
(c) 1 and 0, respectively/क्रमशः 1 और 0
(d) 3 and 0, respectively/क्रमश : 3 और 0

NEET (UG) 14.10.2020, Phase-II

Ans. (b) : No. of angular nodes = l
No. of radial nodes = n – l – 1
For 3s, n = 3 and l = 0
$\therefore$ No. of angular nodes (l) = 0
$\therefore$ No of radial nodes = 3 – 0 – 1= 2

28. Orbital having 3 angular nodes and 3 total nodes is/3 कोणीय नोड तथा 3 कुल नोड रखने वाला कक्षक है–

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

NEET Odisha (UG) 20.05.2019

Ans. (d) :
Orbital having angular node (ℓ) = 3 (Azimuthal quantum number)
Total node = Radial node + angular node
$= n - \ell - 1 + \ell = n - 1$
For, n = 4
Total node = n – 1 = 3
$\ell = 3$ signifies it is a f-orbital.
n = 4 shows it is 4^{th} shell
$\therefore$ It is 4f orbital.

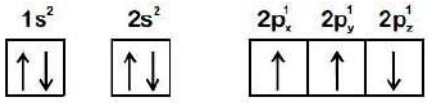
29. Which one is a wrong statement?
निम्नलिखित में से कौन-सा कथन असत्य है?

(a) Total orbital angular momentum of electron in 's' orbital is equal to zero/'s' कक्षक में इलेक्ट्रॉन का कुल कक्षक कोणीय संवेग शून्य के बराबर है।

(b) An orbital is designated by three quantum numbers while an electron in an atom is designated by four quantum numbers
एक कक्षक तीन क्वांटम संख्याओं से निर्दिष्ट है जबकि एक परमाणु में एक इलेक्ट्रॉन चार क्वांटम संख्याांओं से निर्दिष्ट है।

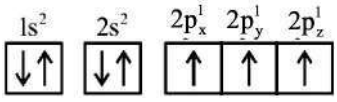
(c) The value of m for dz^2 is zero
dz^2 के लिए m का मान शून्य है।

(d) The electronic configuration of N atom is
N परमाणु का इलेक्ट्रॉनिक विन्यास



NEET (UG) 06.05.2018

Ans. (d) : According to Hund's rule of maximum multiplicity the correct electronic configuration of N atom is-



HUNDS RULE: This rule states pairing of electron in a particular subshell of orbital untill all orbitals of subshell are singly occupied with **parallel spin**.

30. How many electrons can fit in the orbital for which n = 3 and ℓ = 1?
n = 3 एवं ℓ = 1 के कक्षक में कितने इलेक्ट्रॉन आ सकते है ?

(a) 2 (b) 6
(c) 10 (d) 14

NEET (UG) 24.07.2016, Phase-II

Ans. (a) : n = principle quantum number
ℓ = azimuthal quantum number
Given, n = 3
ℓ = 1, show p subshell which contain
3 orbitals, each orbital contains $2e^-$
Then, $m_\ell = -1, 0, +1$

$s = \pm\frac{1}{2}, \pm\frac{1}{2}, \pm\frac{1}{2}$

So, no. of total e^- for n = 3 and ℓ = 1 are 6 but an orbital contain only 2 electron.

31. Two electrons occupying the same orbital are distinguished by :
दो इलेक्ट्रॉन जो कि एक ही कक्षक में है। इनमें अन्तर किसके द्वारा किया जा सकता है?

(a) Spin quantum number/प्रचक्रण क्वांटम संख्या
(b) Principal quantum number/मुख्य क्वांटम संख्या
(c) Magnetic quantum number
चुम्बकीय क्वांटम संख्या
(d) Azimuthal quantum number
दिगंशीय क्वांटम संख्या

NEET (UG) 01.05.2016

Ans. (a) : For the two electrons occupying the same orbital, values of n, *l*, m are same but 's' is different.
i.e., $+\frac{1}{2}$ and $-\frac{1}{2}$

32. What is the maximum number of orbitals that can be identified with the following quantum numbers?/निम्न क्वांटम संख्या के लिये अधिकतम अभिनिर्धारित कक्षकों की संख्या क्या होगी?
n = 3, *l* =1, m_l =0

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

AIPMT-06.05.2014

Ans. (a) : Quantum number- In quantam physics and chemistry quantam numbers describe values of conserved quantities in the dynamics at a quantam system.
According to quantum no. relation -
n = Principle Quantum no.
l = Azimuthal Quantum no.
m_l = Magnetic Quantum no.
Here *l* = 1, represents p subshell
no. of orbital in p subshell = n = 3
$m_l = -1$ to + 1
$m_l = -1, 0, +1$
$m_l = 0$ signifies one orbital

33. Based on equation E = -2.178 × 10^{-18} $\left(\frac{Z^2}{n^2}\right)$ certain conclusion are written. Which of them is not correct ?
समीकरण E = –2.178 × 10–18 J $\left(\frac{Z^2}{n^2}\right)$ पर आधारित कुछ निष्कर्ष लिखें है, इनमें से कौन सा सही नहीं है?

(a) For n = 1, the electron has a more negative energy than it does for n = 6 which means that the electron is more lossely bound in the smallest allowed orbit.
n = 1 के लिए इलेक्ट्रॉन की अधिक ऋणात्मक ऊर्जा होगी n = 6 से। इससे पता चलता है कि सबसे छोटे अनुमत कक्ष से अधिक ढिलाई से बंध इलेक्ट्रॉन होंगे।

(b) The negative sign in equation simply means that the energy of electron bound to the nucleus is lower than it would be if the electrons were at the infinite distance from the nucleus
समीकरण में ऋणात्मक चिन्ह दिखाता है कि जो इलेक्ट्रॉन न्यूक्लिअस से आबंध है उसकी ऊर्जा कम होगी उन इलेक्ट्रॉनों से जो न्यूक्लिअस से अनंत दूरी पर हों।

(c) Larger the value of n, the larger is the orbit radius/ जितना n का मान वृहत्तर (Larger) होगा उतना कक्ष की त्रिज्या वृहतर होगी।

(d) Equation can be used to calculate the change in energy when the electron change orbit
इस समीकरण को प्रयोग करके ऊर्जा का अंतर निकालते हैं जब इलेक्ट्रॉन कक्ष बदलता है।

NEET (UG) 05.05.2013

Ans. (a) : According to equation

$$E = -2.178\times10^{-18}.\left(\frac{Z^2}{n^2}\right) J$$

For n=1, $E_1 = -2.178\times10^{-18}\frac{Z^2}{(1)^2}J$

$$= -2.178\times10^{-18}\left(Z^2\right)J$$

For n = 6, $E_6 = -2.178\times10^{-18}\frac{Z^2}{(6)^2}J$

$$= \left(\frac{-2.178\times10^{-18}}{36}Z^2\right)J$$

$$= \left(-0.6066\times10^{-18}Z^2\right)J$$

$$= \left(-6.055\times10^{-20}Z^2\right)J$$

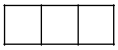
From the above calculation E_6 is more negative than E_1.

34. What is the maximum numbers of electrons that can be associated with the following set of quantum numbers ?
n = 3, *l* = 1 and, m = –1
निम्न क्वांटम संख्या के साथ अधिकतम कितने इलेक्ट्रॉन संबंधित होंगे?
n = 3, *l* = 1 और m = –1

(a) 2 (b) 10
(c) 6 (d) 4

NEET (UG) 05.05.2013

Ans. (a) : For principle quantum number n, *l* has 0 to (n – 1) values.
If Azimuthal quantum number *l* = *l*
Then, 'm' magnetic quantum number = –*l* to + *l* values
S (spin quantum number) has $\pm\frac{1}{2}$ values
Here, n = 3 and *l* = 1
m = –1 0 +1



m= -1 represents only one orbital and an orbital can hold only two electrons.

$$S = \pm\frac{1}{2}m$$

If m = –1, $S = \pm\frac{1}{2}(-1)$

$$= \pm\frac{1}{2}$$

= ⇅
2 electrons

35. The correct set of four quantum number for the valence electron of rubidium atom (Z = 37) is:
रूबीडियम परमाणु (Z = 37) के संयोजक इलेक्ट्रॉन के लिए चार क्वान्टम संख्याओं का सही सेट है-

(a) 5, 0, 0, + ½ (b) 5, 1, 0, + ½
(c) 5, 1, 1, + ½ (d) 6, 0, 0, + ½

AIPMT (Screening)-2012

Ans. (a): Electronic configuration of Rb = [kr] $5s^1$. Rb is alkali metal with valence electron in 5s subshell,

n = 5, ℓ = 0 and m = 0

"s" can have value $\pm\frac{1}{2}$

For s- orbital i.e., ℓ = 0 value of 'm' is always '0'.
Thus, the correct set of quantum numbers for Rb (37) is
5, 0, 0 + $\frac{1}{2}$

36. According to the Bohr Theory, which of the following transitions in the hydrogen atom will give rise to the least energetic photon?
बोर सिद्धांत के अनुसार निम्न में से हाइड्रोजन परमाणु में कौन-सा संक्रमण न्यूनतम ऊर्जा युक्त फोटॉन उत्सर्जित करेगा।

(a) n = 5 to n = 3 (b) n = 6 to n = 1
(c) n = 5 to n = 4 (d) n = 6 to n = 5

AIPMT (Mains)-2011

Ans. (d) : We know that

$$\Delta E \propto \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] \text{ where } n_2 > n_1$$

ΔE = Energy of Photon obtained from the transition.
So, higher the value of n, lesser will be the value of E.
∴ n = 6 to n = 5 will give least energetic photon.

37. The energy absorbed by each molecule (A_2) of a substance is 4.4×10^{-19} J and bond energy per molecule is 4.0×10^{-19} J. The kinetic energy of the molecule per atom will be :
एक पदार्थ के प्रत्येक अणु (A_2) द्वारा शोषित ऊर्जा है 4.4×10^{-19} J और बन्ध ऊर्जा प्रति अणु है 4.0×10^{-19} J अणु की गतिज ऊर्जा प्रति परमाणु होगी:

(a) 4.0×10^{-20} J (b) 2.0×10^{-20} J
(c) 2.2×10^{-19} J (d) 4×10^{-19} J

AIPMT-2009

Ans. (b) : Energy absorbed by each molecules
$= 4.4\times10^{-19}$J
Energy required to break the bond = 4.0×10^{-19}J
Remaining energy to get converted to kinetic energy
$= (4.4\times10^{-19} - 4.0\times10^{-19})$J = 0.4×10^{-19} J per molecule
$\therefore$ Kinetic energy per atom = 0.2×10^{-19}J or 2×10^{-20}J

38. The energy of second Bohr orbit of the hydrogen atom is –328 kJ mol^{-1}; hence the energy of fourth Bohr orbit would be:/हाइड्रोजन परमाणु के द्वितीय बोहर ऑर्बिट को ऊर्जा –328 kJ mol^{-1} है। अतः चतुर्थ बोहर ऑर्बिट की ऊर्जा होगी-

(a) –1312 kJ mol^{-1} (b) –82 kJ mol^{-1}
(c) –41 kJ mol^{-1} (d) –164 kJ mol^{-1}

AIPMT-2005

Ans. (b) : $E_n \propto \frac{1}{n^2}$

$\frac{E_4}{E_2} = \left(\frac{n_2}{n_4}\right)^2$

$E_4 = -328 \text{ KJ/mol} \times \left(\frac{n_2}{n_4}\right)^2$

$E_4 = -328 \text{ KJ/mol} \times \left(\frac{2}{4}\right)^2$, $E_4 = -82$ KJ/ mol.

39. The radius of hydrogen shell is 0.53 Å, then in first exited state radius of shell will be :
हाइड्रोजन के कोश की त्रिज्या 0.53Å है तो प्रथम उत्तेजित अवस्था में कोश की त्रिज्या होगी–

(a) 2.12Å (b) 1.06Å
(c) 8.5 Å (d) 4.24Å

AIPMT-1998

Ans. (a) : Radius of n^{th} orbit of hydrogen atom
$r_n = 0.53 \times n^2$
The radius of orbit for the first excited state (n = 2)
$\therefore r_n = 0.53\times(2)^2 = 2.12$ Å

40. What will be the longest wavelength line in Balmer series of spectrum?
स्पेक्ट्रम के बामर श्रृंखला में सबसे लंबी तरंगदैर्ध्य रेखा क्या होगी?

(a) 546 nm (b) 656 nm
(c) 566 nm (d) 556 nm

AIPMT- 1996

Ans. (b) : Balmer examined the four visible lines in the spectrum of the hydrogen atom.
There wavelength are 410nm, 434 nm, 486nm and 656 nm.
The longest wavelength line in Balmer series of spectrum belongs to red light. Shortest wavelength line belongs to the blue light.

41. Who modified Bohr's theory by introducing elliptical orbits for electron path?
इलेक्ट्रॉन पथ के लिए अण्डाकार कक्षाओं की शुरूआत करके बोर के सिद्धांत को किसने संशोधित किया?

(a) Rutherford/रदरफोर्ड
(b) Thomson/थॉमसन
(c) Hund/हुंड
(d) Sommerfeld/सोमरफेल्ड

AIPMT- 1999

Ans. (d) : Sommerfeld modified the Bohr's theory by introducing elliptical orbits for, electron path around the nucleus.
It is also known as Bohr's sommerfeld model.
Sommerfeld suggested that if electronic orbits could be elliptical instead of circular, the energy of electron would be the same, except in the presence of magnetic field.

42. In a Bohr's model of an atom, when an electron jumps from n = 1 to n = 3, how much energy will be emitted or absorbed?
परमाणु के बोर मॉडल में, जब एक इलेक्ट्रॉन n = 1 से n = 3 तक कूदता है, तो कितनी ऊर्जा उत्सर्जित या अवशोषित होगी?

(a) 2.389×10^{-12} ergs/0.389×10^{-12} अर्ग
(b) 0.239×10^{-10} ergs/0.239×10^{-10} अर्ग
(c) 2.15×10^{-11} ergs/2.15×10^{-11} अर्ग
(d) 0.1936×10^{-10} ergs/0.1936×10^{-10} अर्ग

AIPMT- 1996

Ans. (d) : $\Delta E = \left(\frac{-R_H}{n_f^2}\right) - \left(\frac{-R_H}{n_i^2}\right)$

where,
n_f = final orbit
n_i = initial orbit
R_H = Rydberg's constant = 2.18×10^{-18}

$\Delta E = \left(\frac{-2.18\times10^{-18}}{3^2}\right) - \left(\frac{-2.18\times10^{-18}}{1^2}\right)$

$= -2.18\times10^{-18}\left(\frac{1}{9} - \frac{1}{1}\right)$

$= -2.18\times10^{-18} \times \left(\frac{-8}{9}\right)$

$= 1.93 \times 10^{-18}$J
$= 1.93 \times 10^{-11}$ ergs. [$\because$ 1J = 10^{-7} ergs]
$= 0.193 \times 10^{-10}$ ergs.

43. The radius of hydrogen atom in the ground state is 0.53 Å. The radius of Li^{2+} ion (atomic number = 3) in a similar state is
मूल अवस्था में हाइड्रोजन परमाणु की त्रिज्या 0.53 Å है। समान अवस्था में, Li^{2+} आयन (परमाणु संख्या = 3) की त्रिज्या कितनी होती है?

(a) 0.53 Å (b) 1.06 Å
(c) 0.17 Å (d) 0.265 Å

AIPMT- 1995

Ans. (c) : $r_{Li^{2+}} = \frac{n^2}{Z} \times r_H$

Where,
n = No. of orbit
Z = atomic number
$r_H = 0.53$
Given, Li^{2+} ion is in ground state. So, n = 1. Then,

$r_{Li^{2+}} = \frac{0.53}{3}$ Å

= 0.176 Å

44. The energy of an electron in the n^{th} Bohr orbit of hydrogen atom is/हाइड्रोजन परमाणु की nवीं बोर कक्षा में इलेक्ट्रॉन की ऊर्जा कितनी होती है?

(a) $\frac{13.6}{n^4} eV$ (b) $\frac{13.6}{n^3} eV$
(c) $\frac{13.6}{n^2} eV$ (d) $\frac{13.6}{n} eV$

Ans. (c) : $E_n = \frac{2\pi^2 m_e^4 z^2}{n^2 h^2 (4\pi\varepsilon_0)^2}$

$E_n = 13.6 \frac{z^2}{n^2} eV$

where z = 1 for H–atom

$E_n = \frac{13.6}{n^2} eV.$

45. The spectrum of (He) is expected to be similar to that/हीलियम (He) का स्पेक्ट्रम अनुमानतः निम्नलिखित में से किसके समान है

(a) H (b) Li^+
(c) Na (d) He^+

AIPMT- 1988

Ans. (b) : The no. electron in Li^+ is 2, which is equal to the electron of He.
So, the spectrum of He is similar to that of Li^+.
$\because$ H has one electron, Na has 11 electron and He^+ has one electron therefore there spectrum is not same as the He.

46. If *r* is the radius of the first orbit, the radius of n^{th} orbit of H-atom is given by
यदि प्रथम कक्षा की त्रिज्या r हो, तो हाइड्रोजन परमाणु की nवीं कक्षा की त्रिज्या हैं-

(a) rn^2 (b) rn
(c) r/n (d) r^2n^2

AIPMT- 1988

Ans. (a) : According to Bohr's model,

$r_n \propto \frac{n^2}{Z}$

$r_n = r\frac{n^2}{Z}$

So, $r_n = rn^2$ as z = 1 for H-atom.
r_n = radius n^{th} orbit
n = no. of orbit
Z = atomic number.
r = 0.53

47. Which of the following statements do not form a part of Bohr's model of hydrogen atom?
निम्नलिखित में से कौन-सा कथन हाइड्रोजन परमाणु के बोर मॉडल का भाग नहीं है?

(a) Energy of the electrons in the orbits are quantized.
कक्षा में इलेक्ट्रॉन की ऊर्जा क्वांटाइज्ड होती है।

(b) The electron in the orbit nearest the nucleus has the lowest energy./नाभिक के निकट वाली कक्षा में इलेक्ट्रॉन की ऊर्जा सबसे कम होती है।

(c) Electrons revolve in different orbits around the nucleus./नाभिक के चारों ओर की विभिन्न कक्षाओं में इलेक्ट्रॉन भ्रमण करते हैं।

(d) The position and velocity of the electrons in the orbit cannot be determined simultaneously./कक्षा में इलेक्ट्रॉन की स्थिति एवं गति साथ-साथ ज्ञात नहीं की जा सकती।

AIPMT- 1989

Ans. (d) : The electron's position and velocity in orbit cannot be determined simultaneously. This statement is according to Heisenberg's uncertainty principle not from the Bohr's theory.
According to Bohr, an electron is located at a defined distance in an atom from the nucleus that revolves with a defined velocity around it.

48. For which of the following sets of four quantum numbers, an electron will have the highest energy?
निम्नलिखित चार क्वांटम संख्याओं के किस समूह में इलेक्ट्रॉन की ऊर्जा अधिकतम है?

	n	*l*	m	s
(a)	3	2	1	+1/2
(b)	4	2	–1	+1/2
(c)	4	1	0	–1/2
(d)	5	0	0	–1/2

AIPMT- 1994

Ans. (b) : Electronic energy depends upon, (n + *l*)
(a) (n + *l*) = (3 + 2) = 5 (b) (n + *l*) = (4 + 2) = 6
(c) (n + *l*) = (4 + 1) = 5 (d) (n + *l*) = (5 + 0) = 5
If any two values of (n + *l*) are same then, electron with higher value of n will have higher energy.

49. In a given atom no two electrons can have the same values for all the four quantum numbers. The is called/दिए गये परमाणु में दो इलेक्ट्रॉन के चारों क्वांटम संख्याओं के मान समान नहीं हो सकते हैं। इस कथन को कहते हैं-

(a) Hund's Rule/हुंड्स नियम

(b) Aufbau principle/ऑफबाऊ सिद्धांत

(c) Uncertainty principle/अनिश्चितता का सिद्धांत

(d) Pauli's Exclusion principle.
पाउली का अपवर्जन सिद्धांत

AIPMT- 1991

Ans. (d) : According to Pauli's exclusion principle, in a single atom, no two electrons will have an identical set.
Every electron have its own unique state.
2 Rule of the Pauli :-
(i) Only two electron can be filled in a single orbital.
(ii) Two electrons which are present in orbital are antiparallel with each other.

50. For azimuthal quantum number l = 3, the maximum number of electrons will be
द्विगंशी (azimuthal) क्वांटम संख्या l = 3 के लिए इलेक्ट्रॉन की अधिकतम संख्या होगी-

(a) 2 (b) 6
(c) 0 (d) 14

AIPMT- 1991

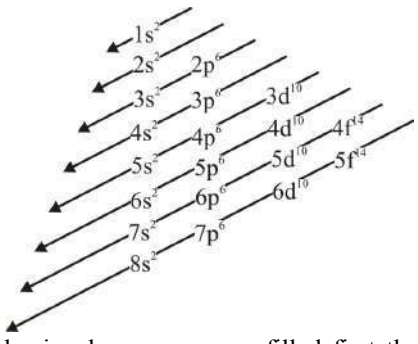
Ans. (d) : maximum electron in l- subshell
0-s : 2 e^-
1-p : 6 e^-
2- d :10 e^-
3- f :14 e^-
If l =3 then, f sub-shell, maximum no.of electron is14.

51. The order of filling of electrons in the orbitals of an atom will be/ परमाणु के कक्षकों में इलेक्ट्रॉन ीारने का क्रम निम्नलिखित में से क्या होगा?

(a) 3*d*, 4*s*, 4*p*, 4*d*, 5*s* (b) 4*s*, 3*d*, 4*p*, 5*s*, 4*d*
(c) 5*s*, 4*p*, 3*d*, 4*d*, 5*s* (d) 3*d*, 4*p*, 4*s*, 4*d*, 5*s*

AIPMT- 1991

Ans. (b) : This order is followed, while filling of an electron in a subshell.



Orbitals having low energy are filled first then higher energy orbitals are filled.
We can find energy with the use of (n + l) rule.
For 4s, n = 4 and l = 0. Then, (n + l) = 4
For 3d, n = 3 and l = 2. Then, (n + l) = 5
For 4p, n = 4 and l = 1. Then, (n + l) = 5
For 5s, n = 5 and l = 0. Then, (n + l) = 5
For 4d, n = 4 and l = 2. Then, (n + l) = 6
If any two values of (n + l) are same then, electron with higher value of n will have higher energy.
∵ 4s has lowest energy and 4d has highest energy. Thus, option (b) is the correct order.

52. The total number of electrons that can be accommodated in all the orbitals having principal quantum number 2 and azimuthal quantum number 1 are/मुख्य क्वांटम संख्या 2 तथा द्विगंशी क्वांटम संख्या 1 की सभी कक्षाओं में उपस्थित इलेक्ट्रॉनों की कुल संख्या हो सकती है।

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

AIPMT- 1990

Ans. (c) : For a given value of the principal quantum number (n), the possible value of l ranges from 0 to n–1.
So, n = 2. Then, l = 0 and 1
If, l = 1, i.e., p sub-shell.
Thus, all 2 p sub-shell can accommodate 6 electron.

53. The number of spherical nodes in 3p orbitals are/is
3p कक्षक में गोलीय नोड़ों की संख्या कितनी होती है?

(a) one (b) three
(c) none (d) two

AIPMT- 1988

Ans. (a) : For spherical nodes = n–l –1
n = principal quantum no.
l = azimuthal quantum number
For 3p orbital
n = 3 and l =1
Spherical nodes = 3–1–1 =1

4. Quantum Mechanical Model of Atom

54. The orientation of an atomic orbital is governed by:-
परमाणु ऑर्बिटल का अभिविन्यास निर्धारित होता है-

(a) Azimuthal quantum number
दिगंशी क्वांटम संख्या द्वारा

(b) Spin quantum number/प्रचक्रण क्वांटम संख्या द्वारा

(c) Magnetic quantum number
चुम्बकीय क्वांटम संख्या द्वारा

(d) Principal quantum number
मुख्य क्वांटम संख्या द्वारा **AIPMT-2006**

Ans. (c) : Quantum mechanical model has been derived from Schrodinger's equation : Principle quantum number, Azimuthal quantum number, and Magnetic quantum number have been derived from this equation.
The spin quantum number is the only one that has not been derived from the equation.

(1) Principle quantum number (n). It gives information about the shell number of the electron. In other words about the periods in periodic table.
(2) Azimuthal quantum number (ℓ): It gives information about the sub-shell. Sub-shells represent the lines obtained in atomic spectrums. In the periodic table, it gives information about groups.
(3) Magnetic quantum number (m): It gives information about the orientation of the different orbitals that are present in the sub-shells. They were discovered from the lines present on the atomic spectrum. In the periodic table, it gives information about the groups.
(4) Spin quantum number (s): It represents spins of electrons. No two-electrons with the same spin can occupy the same orbital.

55. The electronic configuration of Cu (atomic number 29) is
Cu (परमाणु संख्या 29) का इलेक्ट्रॉनिक विन्यास है-
(a) $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2 3d^9$
(b) $1s^2\ 2s^2 2p^6\ 3s^2 3p^6 3d^{10}\ 4s^1$
(c) $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2 4p^6\ 5s^2 5p^1$
(d) $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2 4p^6 3d^3$

AIPMT- 1991

Ans. (b) : The configuration of copper is expected to be $3d^9\ 4s^2$.
But, due to extra stability of half-filled and full filled orbital, Cu have configuration $3d^{10}\ 4s^1$
$\because$ 3d sub-shell is full-filled, which is more stable than $3d^9$.
$_{29}Cu = 1s^2\ 2s^2 2p^6\ 3s^2 3p^6 3d^{10}\ 4s^1$.

56. An ion has 18 electrons in the outermost shell, it is
एक आयन की बाह्य कक्षा में 18 इलेक्ट्रॉन है। यह है-
(a) Cu^+ (b) Th^{4+}
(c) Cs^+ (d) K^+

AIPMT- 1990

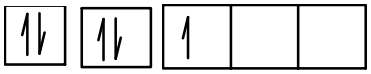
Ans. (a) : Electronic configuration of given options-
- Cu(29) = 2, 8, 18, 1
  Cu^+ =2, 8, 18
- Th (90) = 2, 8, 18, 32, 18, 10, 2
  Th^{4+} =2, 8, 18, 32, 18, 8
- Cs(55)= 2, 8, 18, 18, 8, 1
  Cs^+ = 2, 8, 18, 18, 8
- K (19) = 2, 8, 8, 1
  K^+= 2, 8, 8

57. Number of unpaired electrons in N^{2+} is / are
N^{2+} में अयुग्मित इलेक्ट्रॉनों की संख्या है-
(a) 2 (b) 0
(c) 1 (d) 3

AIPMT-1989

Ans. (c) : $_7N = 1s^2, 2s^2, 2p^3$

$N^{2+} =$ $1s^2$ $2s^2$ $2p^1$



58. If n = 6, the correct sequence for filling of electrons will be :
यदि n = 6 हो तो इलेक्ट्रॉन भरने का क्रम होगा-
(a) $ns \rightarrow np \rightarrow (n-1)d \rightarrow (n-2)f$
(b) $ns \rightarrow (n-2)f \rightarrow (n-1)d \rightarrow np$
(c) $ns \rightarrow (n-1)d \rightarrow (n-2)f \rightarrow np$
(d) $ns \rightarrow (n-2)f \rightarrow np \rightarrow (n-1)d$

AIPMT (Screening)-2011

Ans. (b) : For the principle quantum number 'n', the correct sequence of filling of electron will be
$ns \rightarrow (n-2)f \rightarrow (n-1)d \rightarrow np$
Here n = 6 Hence the correct sequence of filling of electron will be $\underline{6s \rightarrow 4f \rightarrow 5d \rightarrow 6p}$

59. Maximum number of electrons in a subshell or an atom is determined by the following :
किसी परमाणु के उपकोश में कुल इलेक्ट्रॉनों की संख्या कितनी होगी।
(a) $2n^2$ (b) $4l + 2$
(c) $2l + 2$ (d) $4l - 2$

AIPMT-2009
AIPMT-1989

Ans. (b) : Total number of subshell = $(2\ell + 1)$
$= 2(2\ell + 1)$
$= 4\ell + 2$
Maximum number of electron in a sub-shell.

60. Which of the following is not permissible arrangement of electrons in an atom ?
एक परमाणु में इलेक्ट्रॉनों की अनुमेय व्यवस्था निम्न में से कौन सी नहीं होगी?
(a) $n = 3, l = 2, m = -2, s = -\frac{1}{2}$
(b) $n = 4, l = 0, m = 0, s = -\frac{1}{2}$
(c) $n = 5, l = 3, m = 0, s = +\frac{1}{2}$
(d) $n = 3, l = 2, m = -3, s = -\frac{1}{2}$

AIPMT-2009

Ans. (d) :
- In an atom for any value of n, the value of $\ell = 0$ to (n -1)
- For a given value of ℓ, the value of $m_\ell = -\ell$ to $+\ell$ and
- value of s = + ½ or – ½

In option (d) $\ell = 2$ and m = –3
This is not possible as values of ℓ which are possible for $\ell = 2$ are –2, –1, 0, +1 and +2 only.

61. The orbital angular momentum of a p-electron is given as/एक p - इलेक्ट्रॉन का ऑर्बिटल कोणीय संवेग इस प्रकार दिया जाता है:-

(a) $\sqrt{\frac{3}{2}}\frac{h}{\pi}$ (b) $\sqrt{6}\frac{h}{2\pi}$

(c) $\frac{h}{\sqrt{2\pi}}$ (d) $\sqrt{3}\frac{h}{2\pi}$

AIPMT (Mains)- 2012

Ans. (c) : For p – electron, $\ell = 1$

Orbital angular momentum $= \sqrt{\ell \times (\ell+1)} \times \frac{h}{2\pi}$

$= \sqrt{2} \cdot \frac{h}{2\pi} = \frac{h}{\sqrt{2\pi}}$

62. Maximum number of electrons in a subshell with ℓ= 3 and n = 4 is

एक उपकोष में, जिसके लिये ℓ = 3 तथा n = 4 है, इलेक्ट्रॉनों की अधिकतम संख्या है-

(a) 10 (b) 12

(c) 14 (d) 16

AIPMT (Screening)-2012

Ans. (c) : Number of electron that accommodated in any sub shell is given by

$= 2(2\ell + 1)$

ℓ = Azimuthal or orbital angular momentum quantum number.

Now, for f-subshell $\ell = 3$

and given, n = 4

Maximum number electrons that can be in f- subshell

$= 2(2 \times 3 + 1) = 14$ electron

Note:- Official answer (b)

63. The angular momentum of electron in 'd' orbital is equal to:-

d-कक्षक में इलेक्ट्रॉन का कोणीय संवेग के बराबर है:

(a) $\sqrt{2}\hbar$ (b) $2\sqrt{3}\hbar$

(c) $0\,\hbar$ (d) $\sqrt{6}\hbar$

AIPMT- 03.05.2015

Ans. (d) : Angular momentum is given by the formula,

$L = \frac{h}{2\pi}\sqrt{\ell(\ell+1)}$

Where ℓ is the azimuthal quantum number and

h = Planck's constant

For- s- orbital $\ell = 0$

p - orbital $\ell = 1$

d - orbital $\ell = 2$

f- orbital $\ell = 3$

$L = \frac{h}{2\pi}\sqrt{2(2+1)} = \frac{\sqrt{6h}}{2\pi} = \sqrt{6h}$

Where, $h = \frac{h}{2\pi}$

64. Given below are two statements :

नीचे दो कथन दिए गए है:

Statement I / कथन I

The value of wave function, (ψ) depends upon the coordinates of the electron in the atom.

तरंग फलन का मान, (ψ) परमाणु में इलेक्ट्रॉन के निर्देशांक पर निर्भर करता है।

Statement II/ कथन II

The probability of finding an electron at a point within an atom is proportional to the orbital wave function.

एक परमाणु के भीतर एक बिंदु पर एक इलेक्ट्रॉन के पाये जाने की संभावना कक्षीय तरंग फलन के समानुपाती होती है।

In the light of the above statments, choose the correct answer from the options given below.

उपरोक्त कथनों के आलोक में नीचे दिए विकल्पों में से सही उत्तर का चयन कीजिए।

(a) Both **Statement I** and **Statement II** are ture/ कथन I और कथन II दोनों सत्य हैं

(b) Both statement I and statement II are false/ कथन I और कथन II दोनों गलत हैं

(c) Statement I is true but statement II is false/ कथन I सत्य है लेकिन कथन II गलत है

(d) Statement I is false but statement II is true/ कथन I गलत है लेकिन कथन II सत्य है

RE-NEET Manipur (UG) 06.06.2023

Ans. (c) : The value of wave function (ψ) depends upon the coordinates (x,y,z) of the electron in the atom and the probability of finding an electron at a point within an atom is proportional to square of the orbital wave function (ψ^2). ψ^2 is always positive.

Hence : Statement I is true but statement II is false.

65. When electromagnetic radiation of wavelength 300 nm falls on the surface of a metal, electrons are emitted with the kinetic energy of 1.68×10^5 J mol^{-1}. What is the minimum energy needed to remove an electron from the metal?

($h = 6.626 \times 10^{-34}$ Js, $c = 3 \times 10^8$ ms^{-1},

$N_A = 6.022 \times 10^{23}$ mol^{-1})

जब 300 nm तरंगदैर्ध्य वाला विद्युत-चुंबकीय विकिरण किसी धातु के पृष्ठ से टकराता है, तो 1.68×10^5 J mol^{-1} गतिज ऊर्जा वाले इलेक्ट्रॉन उत्सर्जित होते है। धातु से एक इलेक्ट्रॉन के निष्कासन के लिए कम से कम कितनी ऊर्जा आवश्यक होगी?

($h = 6.626 \times 10^{-34}$ Js, $c = 3 \times 10^8$ ms^{-1},

$N_A = 6.022 \times 10^{23}$ mol^{-1})

(a) 2.31×10^6 J mol^{-1} (b) 3.84×10^4 J mol^{-1}

(c) 3.84×10^{-19} J mol^{-1} (d) 2.31×10^5 J mol^{-1}

NEET (UG) Re-Exam-04.09.2022

Ans. (d) : Energy of a 300 nm photon is given by

$$E = \frac{hc}{\lambda} = \frac{6.626\times10^{-34}\,Js\times3\times10^{8}\,ms^{-1}}{300\times10^{-9}\,m}$$

$$= 6.626\times10^{-19}\,J$$

Energy of one mole of photons.

$$= 6.626\times10^{-19}\times6.022\times10^{23}\ mol^{-1}$$

$$= 3.99\times10^{5}\ J\ mol^{-1}$$

The minimum energy needed to remove one mole of electron

$$= (3.99 - 1.68)\times10^{5}\ J\ mol^{-1}$$

$$= 2.31\times10^{5}\ J\ mol^{-1}$$

66. A particular station of All India Radio, New Delhi broadcasts on a frequency of 1,368 kHz (kilohertz). The wavelength of the electromagnetic radiation emitted by the transmitter is : [speed of light c = 3.0 × 10^8 ms^{-1}]
ऑल इंडिया रेडियो, नई दिल्ली का एक स्टेशन 1,368 kHz (किलो हर्ट्ज) की आवृत्ति पर प्रसारण करता है। संचारक (ट्रांसमीटर) द्वारा उत्सर्जित विद्युत चुम्बकीय विकिरण का तरंगदैर्ध्य है : [प्रकाश का वेग c = 3.0 × 10^8 ms^{-1}]

(a) 21.90 cm (b) 219.3 m
(c) 2019.2 m (d) 2192 m

NEET (UG) 12.09.2021

Ans. (b) : Frequency (ν) = 1368 kHz
= 1,368000 Hz

$$\text{The wavelength } (\lambda) = \frac{c}{\nu} = \frac{3\times10^{8}}{1368\times10^{3}}$$

$$= 219.3\ m$$

67. Calculate the energy in joule corresponding to light of wavelength 45 nm.
(Planck's constant h = 6.63 ×10^{-34} Js; speed of light c = 3×$10^8$$ms^{-1}$)
45 nm के तरंगदैर्ध्य के प्रकाश के लिये ऊर्जा का मान जूल में निकालो: (प्लांक स्थिरांक h = 6.63 ×10^{-34} Js; प्रकाश का वेग c = 3×$10^8$$ms^{-1}$)

(a) 6.67×10^{15} (b) 6.67×10^{11}
(c) 4.42×10^{-15} (d) 4.42×10^{-18}

AIPMT-06.05.2014

Ans. (d) : Wavelength 'λ' = 45 nm = 45 × 10^{-9} m

$h = 6.63\times10^{-34}\,Js$

$c = 3\times10^{8}$ m/s

$E = \frac{hc}{\lambda}$, putting values of h, λ and c

$$E = \frac{6.63\times10^{-34}\times3\times10^{8}}{45\times10^{-9}\,m} = 4.42\times10^{-18}\ \text{Joule}$$

68. The value of Planck's constant is 6.63 × 10^{-34} Js. The speed of light is 3 × 10^{17} nm s^{-1}. Which value is closest of the wavelength in nanometer of a quantum of light with frequency of 6 × 10^{15} s^{-1}?/प्लांक स्थिरांक का मान 6.63 ×10^{-34} Js है व प्रकाश की गति 3 ×10^{17} nms^{-1} है। 6 × 10^{15} s^{-1} आवृत्ति वाले क्वांटम प्रकाश की तरंगदैर्ध्य नैनोमीटर में निम्न में से कौन से मान के सबसे अधिक नजदीक होगी?

(a) 75 (b) 10
(c) 25 (d) 50

NEET (UG) 05.05.2013

Ans. (d) : Given Plank's constant (h) = 6.63×10^{-34}Js

Speed of Light (c) = 3×10^{17} nm/s

frequency(ν) = $6\times10^{15}\,s^{-1}$

We know that

$$E = \frac{hc}{\lambda}$$

$$h\nu = \frac{hc}{\lambda}$$

$$\nu = \frac{c}{\lambda}$$

$$\lambda = \frac{c}{\nu}$$

$$= \frac{3\times10^{17}\,nm/s}{6\times10^{15}\,s^{-1}}$$

$$= \frac{1\times10^{17}\,nm}{2\times10^{15}}$$

$$= 5\times10$$

$$= 50\ nm$$

69. According to law of photochemical equivalence the energy absorbed (in ergs/mole) is given as (h = 6.62 × 10^{-27} ergs, c = 3 × 10^{10} cm s^{-1}. N_A = 6.02 × 10^{23} mol^{-1})

(a) $\frac{1.956\times10^{16}}{\lambda}$ (b) $\frac{1.956\times10^{8}}{\lambda}$
(c) $\frac{2.859\times10^{5}}{\lambda}$ (d) $\frac{2.859\times10^{16}}{\lambda}$

NEET Karnataka (UG) 18.05.2013

Ans. (b): Photochemical equivalence law fundamental principle relating to chemical reaction. According to Stark Einstein's law of photochemical equivalence

$$E = \frac{hc}{\lambda}\times N_A$$

$$= \frac{6.62\times10^{-27}\times3\times10^{10}\times6.02\times10^{23}}{\lambda}$$

$$E = \frac{1.195\times10^{8}}{\lambda}$$

70. The energies E_1 and E_2 of two radiations are 25 eV and 50 eV respectively. The relation between their wavelengths i.e. λ_1 and λ_2 will be:
दो विकिरणों की ऊजाऐं E_1 तथा E_2 क्रमशः 25 eV तथा 50 eV हैं, उनके तरंगदैर्ध्य, अर्थात् λ_1 तथा λ_2 के बीच सम्बन्ध होगा :

(a) $\lambda_1 = \frac{1}{2}\lambda_2$ (b) $\lambda_1 = \lambda_2$

(c) $\lambda_1 = 2\lambda_2$ (d) $\lambda_1 = 4\lambda_2$

AIPMT (Screening)-2011

Ans. (c) : $E = h\nu = h\,\frac{c}{\lambda}$

$$E_1 = \frac{hc}{\lambda_1} \text{ and } E_2 = \frac{hc}{\lambda_2}$$

$$\frac{E_1}{E_2} = \frac{hc}{\lambda_1} \times \frac{\lambda_2}{hc} = \frac{\lambda_2}{\lambda_1}$$

or $$\frac{25}{50} = \frac{\lambda_2}{\lambda_1} \Rightarrow \frac{1}{2} = \frac{\lambda_2}{\lambda_1}$$

$$\Rightarrow \lambda_1 = 2\lambda_2$$

71. A 0.66 kg ball is moving with a speed of 100 m/s. The associated wavelength will be : ($h = 6.6 \times 10^{-34}$ Js)
0.66 kg का एक गेंद 100 m/s की गति से चल रहा है। इससे सम्बन्धित तरंगदैर्ध्य होगी ($h = 6.6 \times 10^{-34}$ Js)

(a) 6.6×10^{-32} m (b) 6.6×10^{-34} m

(c) 1.0×10^{-35} m (d) 1.0×10^{-32} m

AIPMT (Mains)-2010

Ans. (c) : According to de-Broglie equation.

$$\lambda = \frac{h}{mv}$$

Given, $h = 6.6 \times 10^{-34}$ Js

$m = 0.66$ kg

$v = 100$ m/s

Substituting values in the above expression-

$$\lambda = \frac{6.6 \times 10^{-34}}{0.66 \times 10} = 1 \times 10^{-35} \text{ m}$$

Thus the associated wavelength is-

$$\therefore \lambda = 1 \times 10^{-35} \text{ m}$$

72. Ionization energy of second orbit of Li^{+2} will be/ Li^{+2} आयन के दूसरे कक्ष की आयनन ऊर्जा क्या होगी :

(a) 122.4 eV (b) 40.8 eV

(c) 30.6 eV (d) 13.6 eV

AIPMT-1999

Ans. (c) : Ionization energy of second orbit of Li^{2+} will be –

$$E = 13.6\,\frac{Z^2}{n^2} \quad \begin{Bmatrix} Z = 3 \\ n = 2 \end{Bmatrix}$$

$$E = 13.6 \times \frac{3^2}{2^2} = 30.6 \text{eV}$$

73. $_nX^m$ emitted one α and 2β particles, then it will become:/ $_nX^m$ एक α तथा 2β कण उत्सर्जित करने पर बनेगा–

(a) $_nX^{m-4}$ (b) $_{n-1}X^{m-1}$

(c) $_nZ^{m-4}$ (d) None

AIPMT-1998

Ans. (a) : In α-decay, 4 unit mass number decreases and 2 unit atomic number decreases.

$$_nX^m \xrightarrow{\alpha-\text{decay}} {}_{n-2}X^{m-4} \xrightarrow{2\beta} \left[{}_nX^{m-4}\right]$$

In β-decay one unit atomic number increases, but mass will remain same.

74. When $X \rightarrow {}_7N^{14} + 2\beta^-$ then number of neutron will be in X:
$X \rightarrow {}_7N^{14} + 2\beta^-$ तो X में न्यूट्रॉन की संख्या होगी–

(a) 3 (b) 5

(c) 7 (d) 9

AIPMT-1998

Ans. (d) : Beta (β-emission) means conversion of neutron into protons so–

$_zX^A \rightarrow {}_7N^{14} + 2\beta^-$

hence, A = 14, z = 5

Neutrons = 14 – 5 = 9

75. Uncertainity in position of an e^- and He is similar. If uncertainity in momentum of e^- is 32×10^5, then uncertainity in momentum of He will be:
एक e^- तथा He कण की स्थिति में अनिश्चितता समान है। e^- के लिए संवेग में अनिश्चितता 32×10^5 तो He के लिए संवेग में अनिश्चितता क्या होगी–

(a) 32×10^5

(b) 16×10^5

(c) 8×10^5

(d) None of these/उपरोक्त में कोई नहीं

AIPMT-1998

Ans. (a) : According to Heisenberg's uncertainity principle: $\Delta x.\Delta p \geq \frac{h}{4\pi}$

Therefore for a same amount of uncertainity in position, all particles will have same uncertainity in momentum.

Given $\Delta p_e = 32 \times 10^5$

Then uncertainity in momentum of He will be –

$[\Delta p_{He} = 32 \times 10^5]$

76. The uncertainty in momentum of an electron is 1×10^{-5} kg m/s. The uncertainty in its position will be
($h = 6.62 \times 10^{-34}$ kg m^2/s)
एक इलेक्ट्रॉन के संवेग में अनिश्चितता 1×10^{-5} kg m/s. है, तो इसकी स्थिति में अनिश्चितता होगी-

(a) 5.27×10^{-30} m (b) 1.05×10^{-26} m
(c) 1.05×10^{-28} m (d) 5.25×10^{-28} m

AIPMT- 1999

Ans. (a) : The uncertainty in the position of electron is given by-

$$\Delta x = \frac{h}{4\pi\Delta p}$$

Where,

Δx = Position of electron.

Δp = Momentum of electron.

h = Planck's const. (6.62×10^{-34} kgm^2/s)

$$\Delta x = \frac{6.62\times10^{-34}}{4\times3.14\times1\times10^{-5}}$$

$$= \frac{6.62\times10^{-34}}{12.56\times10^{-5}}$$

$$= 0.527 \times 10^{-34}\times10^{+5}$$

$$= 0.527 \times 10^{-29}$$

$$= 5.27\times10^{-30}\text{m}$$

77. The de Broglie wavelength of a particle with mass 1 g and velocity 100 m/s is/1 g द्रव्यमान एवं 100 m/s वेग वाले कण की दे ब्रॉग्ली तरंगदैर्ध्य है-

(a) 6.63×10^{-35} m (b) 6.63×10^{-34} m
(c) 6.63×10^{-33} m (d) 6.65×10^{-35} m

AIPMT- 1999

Ans. (c) : momentum (p) = m × v

$$p = \frac{1}{1000} kg \times 100 m/s$$

$$= \frac{1}{10} = 10^{-1}$$

De Broglie wavelength, $\lambda = \frac{h}{p}$

$$= \frac{6.62\times10^{-34}}{10^{-1}}$$

$$= 6.62\times10^{-34}\times10^{1}$$

$$= 6.62\times10^{-33}\text{m}$$

78. The position of both, an electron and a helium atom is known within 1.0 nm. Further the momentum of the electron is known within 5.0 × 10^{-26} kg m s^{-1}. The minimum uncertainty in the measurement of the momentum of the helium atom is
एक इलेक्ट्रॉन और हीलियम परमाणु दोनों की स्थिति 1.0 mm के अन्तर्गत ज्ञात है। पुनः इलेक्ट्रॉन का संवेग 5.0 × 10^{-26} kg m s^{-1}. है। हीलियम परमाणु के संवेग मापन में निम्नतम अनिश्चिता है-

(a) 8.0×10^{-26} kg m s^{-1} (b) 80 kg m s^{-1}
(c) 50 kg m s^{-1} (d) 5.0×10^{-26} kg m s^{-1}

AIPMT- 1998

Ans. (d) : Uncertainty principle $\Delta x \times \Delta p \geq \frac{h}{4\pi}$

i.e., according to uncertainty principle, product of uncertainty in position and uncertainty in momentum is constant.

In the given question, the position of an electron and helium atom are same '1 nm' and momentum of the electron is 5.0×10^{-26} kg m s^{-1}.

So, uncertainty in momentum of helium atom is also same as the momentum of electron that is 5×10^{-26} kg ms^{-1}.

79. Uncertainty in position of an electron (Mass = 9.1×10^{-28} g) moving with a velocity of 3×10^4 cm/s accurate upto 0.001% will be
(Use h/(4π) in uncertainty expression where h= 6.626×10^{-27} erg second)
3×10^4 cm/s के वेग से भ्रमण कर रहे एक इलेक्ट्रॉन (द्रव्यमान 9.1×10^{-28} g) की स्थिति में 0.001% तक अनिश्चितता होगी-
(अनिश्चितता व्यंजक में h/4π का प्रयोग करें,
जहाँ h= 6.626×10^{-27} अर्ग सेकण्ड है।)

(a) 5.76 cm (b) 7.68 cm
(c) 1.93 cm (d) 3.84 cm

AIPMT- 1995

Ans. (c) : According to uncertainty principle

$$\Delta x \times m\Delta v = \frac{h}{4\pi} \qquad (\because p = mv)$$

Given, $m = 9.1\times10^{-28}$g

$v = 3\times10^4$ cm/s

accuracy = 0.001/100

Then, actual velocity Δv -

$$\Delta v = 3\times10^4 \times \frac{0.001}{100}$$

$$= 3\times10^4\times0.001\times10^{-2}$$

$$= 3\times10^4\times1\times10^{-5}$$

$$= 3\times10^{-1}$$

Uncertainty in position,

$$\Delta x = \frac{6.62\times10^{-27}}{4\times3.14\times9.1\times10^{-28}\times3\times10^{-1}}$$

$$= \frac{6.62\times10^{-27}\times10^{29}}{342.88} = 0.01930\times10^2$$

$$= 1.930 \text{ cm}$$

03.

Classification of Elements and Periodicity in Properties

1. Nomenclature of Elements with Atomic Numbers > 100

1. The IUPAC name of an element with atomic number 119 is/एक तत्व जिसका परमाणु क्रमांक 119 है, का IUPAC नाम है।

(a) ununoctium (b) ununennium
(c) unnilennium (d) ununnnium

NEET (UG) 17.07.2022

Ans. (b) : Notation for IUPAC nomenclature,
1-un
9-enn
So, nomenclature, can be written as the three notations for the 3 digits, followed by "ium".
$\therefore$ 119 = Ununennium.

2. Identify the incorrect match.
अनुचित सुमेल को पहचानिए।

Name/ नाम	IUPAC Official Name आई.यू.पी.ए.सी. अधिकृत नाम
(A) Unnilunium अननिलउनियम	(i) Mendelevium मैंडलीवियम
(B) Unniltrium अननिलट्राइयम	(ii) Lawrencium लारेंसियम
(C) Unnilhexium अननिलहेक्सियम	(iii) Seaborgium सीबोर्गियम
(D) Ununnnium अनअनयुनियम	(iv) Darmstadtium डर्मस्टेड्टियम

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

NEET (UG) 13.09.2020

Ans. (c) :
The atomic number of Unnilunium is 101 and the atom is Mendelevium.
The atomic number of Unniltrium is 103 and the atom is Lawrencium.
The atomic number of Unnilhexium is 106 and the atom is Seaborgium.
The atomic number of Ununnnium is 111 and the atom is not Darmstadtium. It is roentgenium.

2. Electronic Configurations and Types of Elements: s, p, d & f-blocks

3. Which one of the following represents all isoelectronic species?
निम्नलिखित में से कौन सा सभी समइलेक्ट्रॉनिक प्रजातियों को प्रदर्शित करता है?

(a) Na^+, Mg^{2+}, O^-,F^- (b) Ca^{2+}, Ar, K^+,Cl^-
(c) Na^+, Cl^-, O^-,NO^+ (d) N_2O,N_2O_4,NO^+,NO

RE-NEET Manipur (UG) 06.06.2023

Ans. (b) : The two or more atom/ion or molecules which have the same no. of electron is known as the isoelectronic species.

Electronic configuration -

$_{11}Na = 1s^2, 2s^2, 2p^6, 3s^1$
$Na^+ = 1s^2, 2s^2, 2p^6$
Total $\Rightarrow 10\, e^{\ominus}$
$_{12}Mg = 1s^2, 2s^2, 2p^6, 3s^2$
$Mg^{2+} = 1s^2, 2s^2, 2p^6$
Total $\Rightarrow 10\, e^{\ominus}$
$_{8}O = 1s^2, 2s^2, 2p^4$
$O^{\ominus} = 1s^2, 2s^2, 2p^5$
Total $\Rightarrow 9\, e^{\ominus}$
$_{9}F = 1s^2, 2s^2, 2p^5$
$F^{\ominus} = 1s^2, 2s^2, 2p^6$
Total $\Rightarrow 10\, e^{\ominus}$
$_{20}Ca = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2$
$Ca^{2+} = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6$
Total $\Rightarrow 18\, e^{\ominus}$
$_{18}Ar = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6$
Total $\Rightarrow 18\, e^{\ominus}$
$_{19}K = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1$
$K^+ = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6$
Total $= 18\, e^{\ominus}$
$_{17}Cl = 1s^2, 2s^2, 2p^6, 3s^2, 3p^5$
$Cl^- = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6$
Total $= 18\, e^{\ominus}$

$Na^+ = 10\,e^\ominus$

$Cl^\ominus = 18e^\ominus$

$O^\ominus = 9e^\ominus$

$NO^\oplus = 7+8-1 = 14e^\ominus$

$N_2O = 7\times2+8 = 14+8 = 22\,e^\ominus$

$N_2O_4 = 2\times7+4\times8 = 14+32 = 46$

$NO^+ = 14\,e^\ominus$

$NO = 7+8 = 15\,e^\ominus$

Hence ⇒ option (b) is correct.

Ca^{2+}, Ar, $K^\oplus$, $Cl^\ominus$

all have $18\,e^\ominus$

4. From the following pairs of ions which one is not an iso-electronic pair?/आयनों के निम्नलिखित युग्मों में से कौन एक समइलेक्ट्रॉनिक युग्म नहीं है?

(a) Fe^{2+}, Mn^{2+} (b) O^{2-}, F^-

(c) Na^+, Mg^{2+} (d) Mn^{2+}, Fe^{3+}

NEET (UG) 12.09.2021

Ans. (a) : : Isoelectronic refers to two atom, ion or molecule that have same number of total electrons and the same number of valence electron.

(a) $Fe^{2+} = 24e^-, Mn^{+2} = 23e^-$

(b) O^{2-} F^- = both have 10 electron

(c) Na^+, Mg^{2+} = both have 10 electron

(d) Mn^{2+}, Fe^{3+} = both have 23 electron

Note : Protons and Neutrons of isoelectronic species are different as they have different mass number.

5. 4d, 5p, 5f and 6p orbitals are arranged in the order of decreasing energy. The correct option is 4d, 5p, 5f तथा 6p कक्षक घटती ऊर्जा के क्रम में व्यवस्थित किये गये है। सही विकल्प है-

(a) 6p > 5f > 5p > 4d (b) 6p > 5f > 4d > 5p

(c) 5f > 6p > 4d > 5p (d) 5f > 6p > 5p > 4d

NEET (UG) 05.05.2019

Ans. (d) : (n+1) values for 4d = 4 + 2 = 6

5p = 5 + 1 = 6

5f = 5 + 3 = 8

6p = 6 + 1 = 7

Correct order of energy would be

[5f > 6P > 5P > 4d]

6. The element Z = 114 has been discovered recently. It will belong to which of the following family group and electronic configuration?
एक तत्व Z = 114 का हाल ही में आविष्कार हुआ है। यह निम्न में से किस परिवार/वर्ग तथा इलेक्ट्रोनिक विन्यास से संबंधित होगा?

(a) Halogen family
हैलोजन परिवार, $[Rn]\,5f^{14}6d^{10}7s^27p^5$

(b) Carbon family
कार्बन परिवार, $[Rn]\,5f^{14}6d^{10}7s^27p^2$

(c) Oxygen family
ऑक्सीजन परिवार, $[Rn]\,5f^{14}6d^{10}7s^27p^4$

(d) Nitrogen family
नाइट्रोजन परिवार, $[Rn]\,5f^{14}6d^{10}7s^27p^6$

NEET (UG) 07.05.2017

Ans. (b) : Correct option is (b) with electronic configuration [Rn] $7s^2$ $5f^{14}$ $6d^{10}$ $7p^2$ because [Rn] has atomic no 86 and more electrons in subshells $5d^{14}$, $6d^{10}$, $7s^2$, $7p^2$ are 28 added to make total count of 114. The last electron enters into p-subshell, so element having atomic no 114 belongs to p-block with electronic configuration **[Rn] $5d^{14}$ $6d^{10}$ $7s^2$ $7p^2$**.
It has valence cell configuration like ns^2 np^2 ($7s^2$ $7p^2$). So, it is group 14 compound i.e., carbon family.

7. The number of d-electrons in Fe^{2+}(Z = 26) is not equal to the number of electrons in which one of the following?/निम्नलिखित में से किसके इलेक्ट्रॉनों की संख्या Fe^{2+}(Z = 26) में d-इलेक्ट्रॉनों की संख्या के बराबर नहीं है?

(a) p-electrons in Cl (Z = 17)
Cl (Z = 17) में p-इलेक्ट्रॉनों के

(b) d-electrons in Fe (Z = 26)
Fe (Z = 26) में d-इलेक्ट्रॉनों के

(c) p-electrons in Ne (Z = 10)
Ne (Z = 10) में p-इलेक्ट्रॉनों के

(d) s-electrons in Mg (Z = 12)
Mg (Z = 12) में s-इलेक्ट्रॉनों के

AIPMT- 03.05.2015

Ans. (a) : Electronic configuration of the elements are:

Fe^{2+} : $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^6$

number of d-electrons = 6

Ne : $1s^2$ $2s^2$ $2p^6$

6 electrons in p-orbital

Mg : $1s^2$ $2s^2$ $2p^6$ $3s^2$

6 electrons in s-orbital i.e. same as in d-orbital of Fe^{+2}.

Cl : $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^5$

11 electrons in p-orbital and are not same as in d-orbital of Fe^{2+}.

8. Be^{2+} is isoelectronic with which of the following ions?/निम्न आयन में Be^{2+} किसके समइलेक्ट्रॉनिक है?

(a) H^+ (b) Li^+

(c) Na^+ (d) Mg^{2+}

AIPMT-06.05.2014

Ans. (b) : Isoelectronic- Isoelectronic is a phenomenon observed when two or more molecules have the same structure and the same electronic configurations.

Be^{2+} is isoelectronic with Li^+ .

Be(4) — $1s^2$ $2s^2$

Be^{2+} — $1s^2$ $2s^0 \rightarrow 2e^-$

Li(3) — $1s^2$ $2s^1$

Li^+ — $1s^2$ $2s^0 \rightarrow 1e^-$

9. The outer electronic configuration of Gd (At. No. 64) is : Gd का बाहरी इलेक्ट्रानिक विन्यास है (परमाणु संख्या 64)

(a) $4f^4\ 5d^5\ 6s^1$ (b) $4f^5\ 5d^4\ 6s^1$
(c) $4f^7\ 5d^1\ 6s^2$ (d) $4f^3\ 5d^5\ 6s^2$

NEET Karnataka (UG) 18.05.2013

Ans. (c) : Electronic configuration is : $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}, 4p^6, 5s^2, 4d^{10}, 5p^6, 6s^2, 4f^7, 5d^1$
$\therefore$ Outer electronic configuration : $[Xe]\ 4f^7, 5d^1, 6s^2$.

10. An atom has electronic configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3\ 4s^2$, you will place it in which group: / एक तत्व का इलेक्ट्रानिक विन्यास है $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3\ 4s^2$, आप इसे किस समूह में रखेगें-

(a) Fifth/ पाँचवे (b) Fifteenth / पन्द्रहवें
(c) Second / द्वितीय (d) Third / तृतीय

AIPMT-2002

Ans. (a) : An atom has electronic configuration $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^3, 4s^2$
It is a member of d - block element because the last electron is filled in d sub-shell as $3d^3$ and the following electronic configuration is possible for d sub-shell as (n-1) $d^{1\ to\ 10}$. Hence it is member of fifth group.

11. Which of the following electronic configuration will have maximum I.P. difference between II and III I.P./ निम्न में से किस इलेक्ट्रोनिक विन्यास में II I.P. व III I.P. में अधिकतम अन्तर होगा :

(a) $1s^2\ 2s^2\ 2p^6\ 3s^1$
(b) $1s^2\ 2s^2\ 2p^6\ 3s^2$
(c) $1s^2\ 2s^2\ 2p^6$
(d) $1s^2\ 2s^2\ 2p^5$

AIPMT-1999

Ans. (b) : $1s^2, 2s^2, 2p^6, 3s^2$ – This configuration becomes Neon (Ne) after removing 2– electrons from this atom. It will attain noble gas-configuration thus removing the 3rd electron would take a lot of energy as the atom would have become stable.
Hence, the maximum I.P. (ionization potential) difference between II and III I.P.

12. The ion that is isoelectronic with CO is वह आयन जो CO के समइलेक्ट्रॉनिक है-

(a) CN^- (b) N_2^+
(c) O^{2-} (d) N_2^-

AIPMT-1997

Ans. (a) : Isoelectronic with CO is :-
CO : 6 + 8 =14
$CN^- \Rightarrow 6+7+1=14$
$N_2^+ \Rightarrow 7\times2-1=13$
$O^{2-} \Rightarrow 8+2=10$
$N_2^- \Rightarrow 7\times2+1=15$
Hence, CO is isoelectronic with CN^- as both have 14 electrons.

13. Which one of the following is not isoelectronic with O^{2-}?/निम्नलिखित में से कौन O^{2-} के साथ समइलेक्ट्रॉनिक नहीं है?

(a) Tl^+ (b) Na^+
(c) N^{3-} (d) F^-

AIPMT- 1994

Ans. (a) : Not Isoelectronic with O^{2-} is :-
O^{2-} : 8 + 2 =10
• Tl^+: Tl has 81 electron.
So, Tl^+= 80 electron
• Na^+ : Na has 11 electron.
Na^+ has 10 electron
• N^{3-} : N has 7 electron.
So, N^{3-}= 7+3 = 10 electron
• F^- : F have 9 electron .
So, F^- = 9+1= 10 electron
Hence, in this Tl^+ is not isoelectronic with O^{2-}.

14. Electronic configuration of calcium atom can be written as /कैल्सियम परमाणु का इलेक्ट्रॉनिक विन्यास निम्नलिखित किस प्रकार से लिखा जा सकता है?

(a) $[Ne]4p^2$ (b) $[Ar]4s^2$
(c) $[Ne]4s^2$ (d) $[Kr]4p^2$

AIPMT- 1992

Ans. (b) : Atomic no. of calcium atom is 20.
$_{20}Ca = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2$.

15. The electronic configuration of an element is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$. What is the atomic number of the element, which is just below the above element in the periodic table?
एक तत्त्व का इलेक्ट्रॉनिक विन्यास $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$. है। उस तत्त्व की परमाणु संख्या क्या है, जो कि आवर्त्त सारणी में दिये गए तत्त्व के ठीक नीचे है?

(a) 36 (b) 49
(c) 33 (d) 34

AIPMT-1995

Ans. (c) : The given configuration is $1s^2\ 2s^2\ 2p^6\ 3s^2$ which is the configuration of phosphorus with atomic number 15.
Just below of this element is 15+18 = 33 atomic number. Which is As
Thus, 33 lies just below the atomic number 15.

16. If the atomic number of an element is 33, it will be placed in the periodic table in the
एक तत्त्व की परमाणु संख्या 33 है। इसका स्थान आवर्त सारणी में है-

(a) first group/प्रथम वर्ग में
(b) third group/तृतीय वर्ग में
(c) fifth group/ पाँचवें वर्ग में
(d) seventh group./सातवें वर्ग में

AIPMT-1993

Ans. (c): The electronic configuration of given element of atomic number 33 is
$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^{10}, 4s^2, 4p^3$
In this element the valence electron is in p-orbital. So, this element belongs to the p-block element.
Since, this p-block element have 5 valence electrons. Thus, it belongs to the group 15 or VA.

17. The electronic configuration of four elements are given below. Which elements does not belong to the same family as others?
चार तत्त्वों के इलेक्ट्रॉनिक विन्यास नीचे दिए गऐ है। निम्न में से कौन-सा तत्त्व अन्य की भाँति समान परिवार से संबंध नहीं रखता है?

(a) $[Xe]4f^{14}5d^{10}4s^2$ (b) $[Kr]4d^{10}5s^2$
(c) $[Ne]3s^23p^5$ (d) $[Ar]3d^{10}4s^2$

AIPMT-1989

Ans. (c) : The element having same no. of valence electrons belong to the same group.
$[Xe]4f^{14}5d^{10}6s^2$, $[Kr]4d^{10}5s^2$ and $[Ar]3d^{10}4s^2$ belong to the same group as all these elements have 2 valence electrons. The element with electronic configuration $[Ne]3s^23p^5$ belongs to the other family that is group-17 as it has 7 valence electrons.

18. Which electronic configuration of an element has abnormally high difference between second and third ionization energy?/एक तत्त्व के निम्न में से किस इलेक्ट्रॉनिक विन्यास में द्वितीय तथा तृतीय आयनन ऊर्जा में असामान्य रूप से उच्च अंतर है?

(a) $1s^2, 2s^2, 2p^6, 3s^1$
(b) $1s^2, 2s^2, 2p^6, 3s^1, 3p^1$
(c) $1s^2, 2s^2, 2p^6, 3s^2, 3p^2$
(d) $1s^2, 2s^2, 2p^6, 3s^2$

AIPMT-1993

Ans. (d) : Following is a flowchart representing consecutive removal of an electron from valence shell of given configurations.

(a) $1s^2,2s^2,2p^6,3s^1 \xrightarrow{+E_1} 1s^2,2s^2,2p^6 \xrightarrow{+E_2}$
$1s^2,2s^2,2p^5 \xrightarrow{+E_3} 1s^2,2s^2,2p^4$

(b) $1s^2,2s^2,2p^6,3s^2,3p^1 \xrightarrow{E_1} 1s^2,2s^2,2p^6,3s^2 \xrightarrow{+E_2}$
$1s^2,2s^2,2p^6,3s^1 \xrightarrow{E_3} 1s^2,2s^2,2p^6$

(c) $1s^2,2s^2,2p^6,3s^2,3p^2 \xrightarrow{E_1} 1s^2,2s^2,2p^6,3s^2,3p^1$
$\xrightarrow{+E_2} 1s^2,2s^2,2p^6,3s^2 \xrightarrow{+E_3} 1s^2,2s^2,2p^6,3s^1$

(d) $1s^2,2s^2,2p^6,3s^2 \xrightarrow{+E_1} 1s^2,2s^2,2p^6,3s^1$
$\xrightarrow{+E_2} 1s^2,2s^2,2p^6 \xrightarrow{+E_3} 1s^2,2s^2,2p^5$

In option (d) less second ionization energy is required for removal of second valence electron from 3s orbital. But after 2nd ionization, the ion achieves stable noble gas configuration.
Thus, very high energy is required to remove electron from completely filled 2p orbital.
This accounts for abnormally high difference in second and third ionization energy.

3. Periodic Trends in Properties of Elements

19. Given below are certain cations. Using inorganic qualitative analysis, arrange them in increase group number from 0 to VI.
नीचे कुछ धनायन दिए गए हैं। अकार्बनिक गुणात्मक विश्लेषण के उपयोग द्वारा, उन्हें बढ़ती समूह संख्या 0 से VI तक में व्यवस्थित कीजिए:

A. Al^{3+} B. Cu^{2+}
C. Ba^{2+} D. Co^{2+}
E. Mg^{2+}

Choose the correct answer from the options given below :
नीचे दिए गए विकल्पों से सही उत्तर चुनिए :

(a) B, C, A, D, E (b) E, C, D, B, A
(c) E, A, B, C, D (d) B, A, D, C, E

NEET (UG) - 05.05.2024

Ans.(d) : Group II Cu^{2+}
Group III Al^{3+}
Group IV Co^{2+}
Group V Ba^{2+}
Group VI Mg^{2+}
The correct order in group number of ion is
$Cu^{2+} < Al^{3+} < Co^{2+} < Ba^{2+} < Mg^{2+}$
B A D C E

20. Arrange the following elements in increasing order of electronegativity :
निम्नलिखित तत्वों को विद्युत ऋणात्मक के बढ़ते क्रम में व्यवस्थित कीजिए :

N, O, F, C, Si

Choose the correct answer from the options given below :
नीचे दिए गए विकल्पों से सही उत्तर चुनिए :

(a) Si < C < O < N < F
(b) O < F < N < C < Si
(c) F < O < N < C < Si
(d) Si < C < N < O < F

NEET (UG) - 05.05.2024

Ans.(d) : The elements in increasing order of electronegativity are –
Si < C < N < O < F
E.N value 1.82 2.5 3 3.5 4

21. Arrange the following elements in increasing order of first ionization enthalpy:
Li, Be, B, C, N
Choose the correct answer from the options given below:
निम्नलिखित तत्वों को प्रथम आयनन एन्थैल्पी के बढ़ते क्रम को व्यवस्थित कीजिए :
Li, Be, B, C, N
नीचे दिए गए विकल्पों से सही उत्तर चुनिए :

(a) Li < B < Be < C < N
(b) Li < Be < C < B < N
(c) Li < Be < N < B < C
(d) Li < Be < B < C < N

NEET (UG) - 05.05.2024

Ans.(a) : The element in increasing order of first ionization enthalpy is- Li<B<Be<C<N

Element	Li	B	Be	C	N
First ionization enthalpy $\left(\frac{\Delta_i H}{kJmol^{-1}}\right)$	520	801	899	1086	1402

22. With which of the following electronic configuration of an atom has the lowest ionization enthalpy:
निम्न इलेक्ट्रॉनिक विन्यासों में से किसके साथ परमाणु की आयनन एन्थैल्पी निम्नतम होगी?

(a) $1s^2 2s^2 2p^6$ (b) $1s^2 2s^2 2p^5$
(c) $1s^2 2s^2 2p^3$ (d) $1s^2 2s^2 2p^5 3s^1$

AIPMT-2007

Ans. (d) : Alkali metal have a very high tendency to lose electron as their uni positive cation has the inert gas configuration.
Thus, their I.E. value is very low. Among given option, $1s^2$, $2s^2$, $2p^6$, $3s^1$ is alkali metal.

23. Which of the following is correctly matched?
निम्नलिखित में से कौन सही सुमेलित है?

(a) Acidic oxides ⇒ Mn_2O_7, SO_2, TeO_3/ अम्लीय ऑक्साइड Mn_2O_7, SO_2, TeO_3
(b) Amphoteric oxides ⇒BeO, Ga_2O_3, GeO / उभयधर्मी ऑक्साइड BeO, Ga_2O_3, GeO
(c) Basic oxides ⇒ In_2O_3, K_2O, SnO_2/क्षारीय ऑक्साइड In_2O_3, K_2O, SnO_2
(d) Neutral oxides ⇒ CO, NO_2, N_2O/उदासीन ऑक्साइड CO, NO_2, N_2O

RE-NEET Manipur (UG) 06.06.2023

Ans. (a) : Metallic oxide are basic in nature.
- Non-metal oxide are acidic in nature.
- The oxide which behaves like both acid and base are called amphoteric oxide.
- Neutral oxide : The oxide which do not have a characterstics of an acid or a base are called the neutral oxide.

Hence, Mn_2O_7, SO_2, TeO_3 are acidic oxide.

24. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
नीचे दो कथन दिए गए है: एक को अभिकथन (A) के रूप में लेबल किया गया है और दूसरे को कारण (R) के रूप में लेबल किया गया है।

Assertion (A)/ दावा (A):

Ionisation enthalpy increases along each series of the transition elements from left to right. However, small variations occur.
संक्रमण तत्वों की प्रत्येक श्रेणी में बाएँ से दाएँ जाने पर आयनन एन्थैल्पी बढ़ती है। हालाँकि, छोटे बदलाव होते है।

Reason (R)/ कारण (R):

There is corresponding increase in nuclear charge which accompanies the filling of electrons in the inner d- orbitals.
इसके अनुरूप नाभिकीय आवेश में वृद्धि होती है तो आंतरिक d कक्षकों में इलेक्ट्रॉनों के भरण के साथ होता है।

In the light of the above statements, choose the most appropriate answer from the options given below.
उपरोक्त कथनों के आलोक में, नीचे दिए विकल्पों में से सबसे उपयुक्त चुनें।

(a) Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A)**/दोनो (A) और (R) सही है और (R), (A) का सही स्पष्टीकरण है
(b) Both **(A)** and **(R)** are correct but **(R)** is not the correct explanation of **(A)**/ दोनों (A) और (R) सही हैं लेकिन (R) (A) का सही स्पष्टीकरण नही है।
(c) **(A)** is correct but **(R)** is not correct/(**A**) सही है लेंकिन (**R**) सही नहीं है
(d) **(A)** is not correct but **(R)** is correct/(**A**) सही नही है लेकिन (**R**) सही है

RE-NEET Manipur (UG) 06.06.2023

Ans. (a) : Ionisation enthalpy inceases along each series of the transition elements from left to right due to the increase in nuclear charge.
Increasing of nuclear charge result in the outermost electron being more strongly bound to the nucleus which accompanies the filling of electrons in the inner d-orbitals.
Hence, Both (A) and (R) are correct and (R) is correct explanation of (A).

25. The element expected to form largest ion to achieve the nearest noble gas configuration is :
वह तत्व जो अनुमानतः निकटतम उत्कृष्ट गैस विन्यास प्राप्त करने के लिए सबसे अधिक बड़ा आयन बनाएगा है

(a) Na (b) O
(c) F (d) N

NEET (UG)- 07.05.2023

Ans. (d) :
- Electronic configuration of Na = $1s^2$, $2s^2$, $2p^6$, $3s^1$
  Electronic configuration of Na^+ = $1s^2$, $2s^2$, $2p^6$
- Electronic configuration of O = $1s^2$, $2s^2$, $2p^4$
  Electronic configuration of O^{2-} = $1s^2$, $2s^2$, $2p^6$
- Electronic configuration of F = $1s^2$, $2s^2$, $2p^5$
  Electronic configuration of $F^{\ominus}$ = $1s^2$, $2s^2$, $2p^6$
- Electronic configuration of N = $1s^2$, $2s^2$, $2p^3$
  Electronic configuration of N^{3-} = $1s^2$, $2s^2$, $2p^6$

In the Na^+, $F^{\ominus}$, O^{2-}, N^{-3} all are isoelectronic species. In Isoelecronic species the higher negative charge ion has higher size in comparasion to positive ion.
Hence the correct sequence of order of isoelectronic species are $N^{\ominus 3} > O^{2\ominus} > F^{\ominus} > Na^+$ so option D is correct.

26. If first ionization enthalpies of elements X and Y are 419 kJ mol^{-1} and 590 kJ mol^{-1} respectively and second ionization enthalpies of X and Y are 3069 kJ mol^{-1} and 1145 kJ mol^{-1}, respectively. Then correct statement is:
यदि X और Y की प्रथम आयनन एंथैल्पियाँ क्रमशः 419 kJ mol^{-1} और 590 kJ mol^{-1} हो, और X, और Y की द्वितीय आयनन एंथैल्पियाँ क्रमशः 3069 kJ mol^{-1} और 1145 kJ mol^{-1} हों, तो सही कथन है:

(a) X is an alkali metal and Y is an alkaline earth metal./X एक क्षार धातु है और Y एक क्षारीय मृदा धातु है।

(b) X is an alkaline earth metal and Y is an alkali metal./X एक क्षारीय मृदा धातु है और Y एक क्षार धातु है।

(c) Both X and Y are alkali metals.
X और Y दोनों क्षार धातुएँ हैं।

(d) Both X and Y are alkaline earth metals.
X और Y दोनों क्षारीय मृदा धातुएँ हैं।

NEET (UG) Re-Exam-04.09.2022

Ans. (a) : X is alkali metal as it has large size, it's IE_1 is less. After loss of the one electron it attains inert gas configuration so, its IE_2 is very high.
Y is alkaline earth metal, it's IE_1 is more than alkali metal due to stable ns^2 configuration. But its IE_2 is lower than the alkali metal.

27. The correct order of first ionization enthalpy for the given four elements is:/दिए गए चार तत्वों की प्रथम आयनन एंथैल्पी का सही क्रम हैं:

(a) C < N < F < O (b) C < N < O < F
(c) C < O < N < F (d) C < F < N < O

NEET (UG) Re-Exam-04.09.2022

Ans. (c) :
$C \rightarrow 1s^2, 2s^2, 2p^2$
$N \rightarrow 1s^2, 2s^2, 2p^3$(more stable configuration)
$O \rightarrow 1s^2, 2s^2, 2p^4$
$F \rightarrow 1s^2, 2s^2, 2p^5$
Order of 1st I.E is C < O < N < F
Nitrogen has half-filled p electron thus, its I.E. is more than oxygen and carbon. On the other hand F has p^5 E.C. which has higher tendency to accept the electron thus, F has more I.E.

28. Match the oxide given in column A with its property given in column B
कालम– I में दिये गये ऑक्साइड को उनके कालम– II में दिये गुण से सुमेलित कीजिए:

Column-I कालम– I	**Column-II कालम– II**
(i) Na_2O	**(A) Neutral/ उदासीन**
(ii) Al_2O_3	**(B) Basic/ क्षारीय**
(iii) N_2O	**(C) Acidic/ अम्लीय**
(iv) Cl_2O_7	**(D) Amphoteric/ उभयधर्मी**

Which of the following options has all correct pairs?/निम्न विकल्पों में से कौन-सा है जिसके सभी युग्म सही हैं?

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

NEET Odisha (UG) 20.05.2019

Ans. (a) :

Column-I/कॉलम-I		**Column-II/कॉलम-II**	
(i)	Na_2O	(b)	Basic/क्षारीय
(ii)	Al_2O_3	(d)	Amphoteric/उभयधर्मी
(iii)	N_2O	(a)	Neutral/उदासीन
(iv)	Cl_2O_7	(c)	Acidic/अम्लीय

29. For the second period elements the correct increasing order of first ionisation enthalpy is:
द्वितीय आवर्तक के तत्वों के लिये प्रथम आयनन एन्थैल्पी का सही बढ़ता क्रम होगा।

(a) Li < B < Be < C < O < N < F < Ne
(b) Li < B < Be < C < N < O < F < Ne
(c) Li < Be < B < C < O < N < F < Ne
(d) Li < Be < B < C < N < O < F < Ne

NEET (UG) 05.05.2019

Ans. (a) : Be and N have comparatively more stable valence sub-shell than 'B' and 'O'
Correct order of first ionisation enthalpy
Li < B < Be < C < O < N < F < Ne

30. The correct order of atomic radii in group 13 elements is
निम्नलिखित में से ग्रूप 13 के तत्वों में परमाणिवक त्रिज्याओं का कौन-सा क्रम सही है?

(a) B < Al < In < Ga < Tl
(b) B < Al < Ga < In < Tl
(c) B < Ga < Al < In < Tl
(d) B < Ga < Al < Tl < In

NEET (UG) 06.05.2018

Ans. (c) : Atomic radii is distance between the nucleus and the outermost shell of an atom.
According to general trend atomic radii increases as we move down the group and decreases across the period. As we move down the group the number of shells of elements is increasing resulting in increased size of atomic radii.
But **Gallium** in group 13 experiences poor shielding effect due to the presence of d-orbitals in it. Due to which outermost shell of Ga experiences more electronic nuclear charge than Al. Thus Ga has smaller atomic radius than Al.
Above reasons confirm that the correct order of atomic radii of group 13 elements is

Elements	B	Ga	Al	In	Tl
Atomic radii (Pm)	85	135	143	167	170

31. In which of the following options the order of arrangement does not agree with the variation of property indicated against it ?
निम्नलिखित में से कौन सा क्रम दिये गये गुणधर्म के परिवर्तन के अनुसार सहमत नहीं है?

(a) Li < Na < K < Rb (increasing metallic radius) /(बढ़ती हुई धात्विक त्रिज्या)

(b) $Al^{3+} < Mg^{2+} < Na+ < F^-$. (increasing ionic size) /बढ़ते हुये आयनिक आकार)

(c) B < C < N < O (increasing first ionization enthalpy) /(बढ़ता हुआ प्रथम आयनिक एन्थैल्पी)

(d) I < Br < Cl < F (increasing electron gain enthalpy) /(बढ़ती हुई इलेक्ट्रॉन लब्धि एन्थैल्पी)

NEET (UG) 01.05.2016

Ans. (c & d) : The correct order of increasing first ionization enthalpy is B < C < O < N due to extra stability of half-field orbital's in N-atom.

- The correct order of increasing negative electron gain enthalpy is: I < Br < F < Cl due to electron repulsion in small size of F atom.

32. Which is the correct order of increasing energy of the listed orbital's in the atom of titanium? (At. no. Z = 22)
टाईटेनियम परमाणु के दिये गये कक्षकों की ऊर्जा का बढ़ता हुआ सही क्रम कौन सा हैं? (प. स. Z = 22)

(a) 3s 3p 3d 4s (b) 3s 3p 4s 3d
(c) 3s 4s 3p 3d (d) 4s 3s 3p 3d

RE-AIPMT 25.07.2015

Ans. (b) : Ti (22) $\rightarrow 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^2$

33. The species Ar, K^+ and Ca^{2+} contain the same number of electrons. In which order do their radii increase ?
स्पीशीज Ar, K^+ और Ca^{2+} में इलेक्ट्रॉनों की संख्या समान है। किस क्रम में इनकी त्रिज्या बढ़ रही है?

(a) $Ca^{2+} < Ar < K^+$ (b) $Ca^{2+} < K^+ < Ar$
(c) $K^+ < Ar < Ca^{2+}$ (d) $Ar < K^+ < Ca^{2+}$

AIPMT- 03.05.2015

Ans. (b) : Atomic radius and ionic radius $\propto \frac{1}{Z_{(effcetive)}}$

In case of isoelectronic species radius decreases with increase in nuclear charge.
Hence increasing order of their radii —

$$Ca^{2+} < K^+ < Ar$$

34. Which of the following orders of ionic radii is correctly represented?/निम्न में से किसके द्वारा आयनिक त्रिज्या का क्रम सही रूप में प्रदर्शित है?

(a) $H^- > H^+ > H$ (b) $Na^+ > F^- > O^{2-}$
(c) $F^- > O^{2-} > Na^+$ (d) $Al^{3+} > Mg^{2+} > N^{3-}$

AIPMT-06.05.2014

Ans. (*) : None

- For comparisons of ionic radii of cation, neutral atom of same determined the following order is maintained
  anion > neutral > cation

So, option (a) is incorrect. The correct order is -
$H^- > H > H^+$

- For isoelectronic species atomic radii determined as -
  $\text{atomic radii} \propto \frac{1}{\text{atomic no.}}$
  So, for Na^+, F^-, O^{2-} it should be $O^{2-} > F^- > Na^+$
  So both options (b) and (c) are incorrect.
- For Al^{3+}, Mg^{2+}, N^{3-} it should be
  $N^{3-} > mg^{2+} > Al^{3+}$

So, all given options are incorrect.

35. Which one of the following arrangements represents the correct order of least negative to most negative electron gain enthalpy for C, Ca, A1, F and O?

(a) Ca < Al < C < O < F
(b) Al < Ca < O < C < F
(c) Al < O < C < Ca < F
(d) C < F < O < Al < Ca

NEET Karnataka (UG) 18.05.2013

Ans. (a) : As the nuclear charge increases, the force of attraction between the nucleus and the upcoming electron increases and hence the electron gain enthalpy becomes more negative. Across the period from left to right the effective nuclear charge increases.
Thus, the correct order is,

Ca < Al < C < O < F

36. Identify the wrong statement in the following:
निम्न में से असत्य कथन की पहचान कीजिए :

(a) Atomic radius of the elements increases as one moves down the first group of the periodic table/आवर्त सारणी के प्रथम ग्रुप में नीचे की ओर जाने पर तत्वों की परमाणु त्रिज्या बढ़ती है।

(b) Atomic radius of the elements decreases as one-moves across from left to right in the 2nd period of the periodic table/आवर्त सारणी के द्वितीय आवर्त में तत्वों की परमाणु त्रिज्या बायें से दायें की ओर जाने पर घटती रहती है।

(c) Amongst isoelectronic species, smaller the positive charge on the cation, smaller is the ionic radius/समइलेक्ट्रॉनिक स्पीशीजों में धनायन का धनात्मक आवेश जितना ही कम होगा, आयनिक त्रिज्या उतनी ही कम होगी।

(d) Amongst isoelectronic species, greater the negative charge on the anion, larger is the ionic radius./ समइलेक्ट्रॉनिक स्पीशीजों में ऋणायन का आवेश जितना अधिक होगा उनकी आयनिक त्रिज्या उतनी ही बड़ी होगी।

AIPMT (Screening)-2012

Ans. (c) : Atomic radius of the elements decreases from left to right across a period due to increase in effective nuclear charge.
Atomic radius increases in moving down a group because the number of shells increases.

Amongst isoelectronic species, ionic radius increases with increases in negative charge or decrease in positive charge.

$$\text{Positive charge} \propto \frac{1}{(\text{Ionic radius})}$$

37. Which of the following oxide is amphoteric?
निम्न में से कौन-सा ऑक्साइड उभयधर्मी है?

(a) CO_2 (b) SnO_2
(c) CaO (d) SiO_2

AIPMT (Mains)-2011

Ans. (b) : In general, the electropositive character of the oxide's central atom will determine whether the oxide will be acisdic or basic. The more electropositive the central atom, the more basic the oxide. The more electronegative the central atom, the more acidic the oxide. Electropositive character increase from right to left across the periodic table and increases down the column.

$\rightarrow SnO_2$ is an amphoteric oxide because it reacts with acid as well as bases to form corresponding salt.

$$SnO_2 + 2H^+ \rightarrow Sn^{4+} + 2H_2O$$

$$SnO_2 + 6OH^- \rightarrow [Sn(OH)_6]^{2-} \text{ or } SnO_3^{2-}$$

CaO is basic. SiO_2 & CO_2 are acidic in nature. Silicon dioxide has no basic properties as it does not contain ions and it does not react with acid. Instead, It is very weak acid, reacting with strong bases.

38. What is the value of electron gain enthalpy of Na^+ if IE_1 of Na = 5.1 eV?
Na^+ की इलेक्ट्रॉन ग्रहण एन्थैल्पी का मान क्या होगा, यदि IE_1 of Na = 5.1 eV है?

(a) + 10.2 eV (b) –5.1 eV
(c) –10.2 eV (d) + 2.55 eV

AIPMT (Mains)-2011

Ans. (b) : The electron gain enthalpy of sodium cation is equal in magnitude and opposite in sign to the first ionization energy of sodium atom. It is equal to –5.1 eV.

39. Among the elements Ca, Mg, P and Cl, the order of increasing atomic radii is :
Ca, Mg, P तथा Cl तत्वों उनके परमाणु त्रिज्याओं का बढ़ता हुआ क्रम है–

(a) Mg < Ca < Cl < P (b) Cl < P < Mg < Ca
(c) P < Cl < Ca < Mg (d) Ca < Mg < P < Cl

AIPMT (Mains)-2010

Ans. (b) : Atomic radii:- The total distance from the nucleus of an atom to the outermost orbital of its electron is known as its atomic radii.

The atomic radii decreases on moving from left to right in a period, thus order of sizes is Cl, P & Mg is Cl < P < Mg. Down the group size increases. Thus overall order is-

$$[Cl < P < Mg < Ca]$$

40. The correct order of the decreasing ionic radii among the following isoelectronic species is :
निम्न समइलेट्रॉनिय स्पीशीजो में आयनिक त्रिज्याओं के का सही क्रम है –

(a) $Ca^{2+} > K^+ > S^{2-} > Cl^-$
(b) $Cl^- > S^{2-} > Ca^{2+} > K^+$
(c) $S^{2-} > Cl^- > K^+ > Ca^{2+}$
(d) $K^+ > Ca^{2+} > Cl^- > S^{2-}$

AIPMT (Screnning)-2010

Ans. (c) : Ionic radius of the cation is always smaller than that of the parent atom. Ionic radius of the anion is always greater than that of the parent atom. Greater the effective nuclear charge smaller will be the ionic radii. Greater the negative charge, greater will be the size of the anion. Greater the positive charge smaller will be the size of the cation. So, ionic radius increases in the case of anionic species, if negative charge increase.

$$S^{2-} > Cl^- > K^+ > Ca^{2+}$$

41. Which of the following represents the correct order of increasing electron gain enthalpy with negative sign for the elements O, S, F and Cl?
निम्न में से कौनसा, O, S, F व Cl तत्वो के ऋणात्मक चिन्ह के साथ बढ़ती हुइ इलेक्ट्रॉन ग्रहण एन्थेल्पी का सही क्रम है।

(a) Cl < F < O < S (b) O < S < F < Cl
(c) F < S < O < Cl (d) S < O < Cl < F

AIPMT (Screnning)-2010

Ans. (b) : Electron gain enthalpy increases along a period from left to right.

Members of III period have somewhat higher electron gain enthalpy as compared to the corresponding members of second period because of the smaller size.

- O & S belong to VI A (16) group and Cl and F belong to VII A(17) group. Thus the electron gain enthalpy of Cl and F is higher as compared to O and S.

  Cl and F > O and S.
- Between Cl and F, Cl has higher electron gain enthalpy than the F since incoming electrons experience a greater force of repulsion because of small size of F-atom. Similar is true is case of O and S. the electron gain enthalpy of S in higher as compared to O due to its small size. Thus the correct order is –

  O < S < F < Cl

42. Which of the following oxides is not expected to react with sodium hydroxide ?
निम्नलिखित ऑक्साइडों में किसकी, सोडियम हाइड्रॉक्साइड से क्रिया करने की संभावना नहीं है?

(a) BeO (b) B_2O_3
(c) CaO (d) SiO_2

AIPMT-2009

Ans. (c) : CaO is not expected to react with NaOH because NaOH is a base and it can only react with either an acidic oxide or an amphoteric oxide.

- Among given options BeO is an Amphoteric oxide while B_2O_3 and SiO_2 are acidic oxides. Thus all of them react with NaOH to form salt.
- On the other hand CaO is a basic oxide and hence it will not react with NaOH