1. PHYSICAL CHEMISTRY

Some Basic Concepts of Chemistry

Uncertainty in Measurement

- The number of significant figures in value 5.041 is– **4**
- Express the result of (0.582 + 324.65) to the appropriate number of significant figures– **325.23**
- The number of significant figures in value of π are– **∞**
- The correctly reported answer of the addition of 29.4406, 3.2 and 2.25 will have significant figures-**3**

Law's of Chemical Combinations

- The law of conservation of mass can not holds good for.– **Nuclear reaction**
- Hydrogen and oxygen combine to form H_2O_2 and H_2O containing 5.93% and 11.2% hydrogen respectively, the data illustrates– **Law of multiple proportions**
- 36 g of carbon combines with 32 g of oxygen to form 68 g of CO_2 this best explains-
- Atoms combine in the ratio of small whole numbers to form compounds. This explains- **Law of multiple proportion**
- 12 g of carbon combines with 32 g of oxygen to form 44 g of CO_2 this best explains- **Law of conservation of mass**
- The pairs of compounds $SnCl_2$, $SnCl_4$ illustrates- **Law of multiple proportions -99**

Atomic and Molecular Masses, Mole Concept Molar Masses, Empirical & Molecular Formula

- The molecular mass of glucose ($C_6H_{12}O_6$)– **180.162 u**
- 1 g-atom of nitrogen represents–**11.2 L of N_2 at S.T.P**
- The number of oxygen atoms present in 14.6 g of magnesium bicarbonate is– **0.6 N_A**
- If N_A is Avogadro's number, then the number of oxygen atoms in one g-eqivalent of oxygen is– **$N_A/2$**
- 7.5 grams of a gas occupy 5.8 litres of volume at STP, the gas is– **NO**
- Number of Ca^{+2} and Cl^- ion in 111 g of anhydrous $CaCl_2$ are– **N_A, $2N_A$**
- The maximum volume at N.T.P. is occupied by– **1 gm-molecule of CO_2**
- 23g of sodium will react with ethyl alcohol to give– **1/2 mole of H_2**
- One mole of nitrogen gas has volume equal to– **22.4 litre of nitrogen at S.T.P.**
- An element A (at wt = 75) and another element B (at. wt. = 25) combine to form a compound. The compound contains 75% A by weight. The formula of the compound will be– **AB**
- 60 g of a compound on analysis gave 24 g C, 4g H and 32 g O. The empirical formula of the compound is– **CH_2O**
- An oxide of a metal (M) contains 40% by mass of oxygen. Metal (M) has atomic mass of 24. The empirical formula of the oxide is– **MO**
- The percentage of oxygen in NaOH is– **40**
- A hydrocarbon is composed of 75% carbon. The empirical formula of the compound is– **CH_4**
- An alkaloid contains 17.28% of nitrogen and its molecular mass is 162. The number of nitrogen atoms present in one molecule of alkaloid is– **Two**
- Empirical formula of a compound is CH_2O and its molecular mass is 90. The molecular formula of the compound is– **$C_3H_6O_3$**
- A compound is composed of O and Mn in equal weight ratio. The empirical formula of the compound is.– **Mn_2O_7**
- The empirical formula and molecular mass of a compound are CH_2O and 180 g respectively. The molecular formula of the compound is– **$C_6H_{12}O_6$**
- A metal nitride M_3N_2 contains 28% of nitrogen. The atomic mass of metal M is– **24**
- The empirical formula and molecular mass of a compound are CH_2O and 180 g respectively. The molecular formula of the compound will be– **$C_6H_{12}O_6$**

Stoichiometric Calculations

- The moles of O_2 required for reacting with 6.8 g ammonia. (.... NH_3 + ... O_2 →.... NO + ... H_2O) is– **0.5**
- The molarity of pure water is– **55.6 M**

- If 1 ml of water contains 20 drops, then the number of molecules in a drop of water is– **1.673×10^{21}**
- The molar ratio of Cr^{2+} to Cr^{3+} in a mixture of $CrSO_4$ and $Cr_2(SO_4)_3$ having equal number of sulphate ions in both sulphates is– **3 : 2**
- In an organic compound of molar mass 108 g mol^{-1} C, H and N atoms are present in 9 : 1 : 3.5 by weight. Molecular formula can be– **$C_6H_8N_2$**
- In the reaction, $2Al(s) + 6HCl(aq) \rightarrow 2Al^{3+}(aq) + 3H_2(g)$,– **11.2 L H_2(g) at STP is produced for every mole HCl(aq)**
- The molarity of a solution, that contains 5.85 g of NaCl (s) per 500 mL– **0.2 mol L^{-1}**
- The molality of the solution containing 18.25 g of HCl gas in 500 g of water is– **1 m**
- The mass percent of carbon in carbon dioxide is – **27.27%**
- If the density of a solution is 3.12 g mL^{-1}, the mass of 1.5 mL solution in significant figures is– **4.7 g**
- One mole of carbon weighs 12g, the number of atoms in it is equal to– **6.022×10^{23}**
- The number of moles of hydrogen molecules required to produce 20 moles of ammonia through Haber's process is– **30**
- Number of significant figures in 6.62×10^{-34}– **Three**
- The number of significant figures in 2.653×10^4 is– **4**
- Chemical fertilizer are– **Urea, Sodium nitrate, Ammonium sulphate**
- Total number of significant figures present in 0.010100×10^3 are – **5**
- Appropriate significant figures as a result of addition of 3.0223 and 5.041– **8.063**
- Total seconds as there in 3 days– **259200 s**

Law of conservation of mass

- Illustrates the law of multiple proportions, the pairs is– **PbO, PbO_2**
- The main drawback of Dalton's atomic theory is– **It could not explain the law of gaseous volumes, It could not explain how and why atoms combine to form molecules**
- The mass of one mole of a substance in grams is called its– **Molar mass**
- The mass percent of oxygen in ethanol is– **34.78%**
- The mode of concentration that does not change with temperature– **Molality**
- A measured temperature on Fahrenheit scale is 200^0F. This reading on Celsius scale will be– **93.3^0C**

EXAM POINT

Uncertainty in measurement

The units of surface tension and viscosity of a liquid respectively are–	**$N\ m^{-1}$, $kg\ m^{-1}\ s^{-1}$**	**TS-EAMCET-09.08.2021, Shift-I WB-JEE-2015**
The prefix 10^{18} is–	**Exa**	**BITSAT 2015, 2006**
For a A + B products the rate of the reaction is given by Rate = K [A] $[B]^2$. The units of rate constant (K) will be–	**$mol^{-2}\ L^2S^{-1}$**	**AP EAPCET 20.08.2021 Shift-II**
Unit of angular momentum of an electron in an orbital of an atom–	**J-s**	**Kerala-CEE-2019**
The SI unit of electrochemical equivalent is–	**$kg\ C^{-1}$**	**MHT CET-03.05.2019, SHIFT-I**
The absolute zero temperature is 0 Kelvin. In ºC unit the absolute zero temperature is –	**–273.15ºC**	**NDA (II)-2018**
The SI unit of density is–	**$kg\ m^{-3}$**	**MHT CET-2018**
The unit of atomic mass, amu is–	**u**	**MHT CET-2018**
The dimension of $[ML^0T^{-2}]$ is–	**Surface tension**	**WB-JEE-2017**
Dimension of universal gas constant (R) is–	**$[VPT^{-1}n^{-1}]$**	**J & K CET-(2012)**
How is 0.0120 written as a scientific notation–	**1.2×10^{-2}**	**UPTU/UPSEE-2011**
The charge on an electron in Coulombs is–	**1.602×10^{-19}**	**BCECE-2009**
The value of amu is –	**1.66×10^{-27} kg**	**UP CPMT-2003**
The radius of an atomic nucleus is generally expressed in units is –	**Fermi**	**AP-EAMCET (Medical), 2001**
The particles size of colloidal system is –	**10^{-6} m to 10^{-9} m**	**(NEET-1996)**
The dimensions of pressure are the same as that of–	**Energy per unit volume**	**NEET-1995**

Laws of chemical combination

The mass of one mole of electron is– **0.55 mg**	**UP CPMT-2010 UPTU/UPSEE-2006**
The number of moles of oxygen obtained by the electrolytic decomposition of 108 g water is **3**	**JIPMER-2008, JCECE-2007**
The number of moles of $KMnO_4$ reduced by one mole of KI in alkaline medium is– **Two**	**JCECE-2012 JIPMER-2007**
A gas is found to have a formula $[CO]_x$. Its vapour density is 70, the x is– **5.0**	**BCECE-2007 BITSAT-2006**
Number of atoms of He is 100 amu of He (atomic wt. of He is 4) are– **25**	**BITSAT-2012 BCECE-2008**
The number of electron present in 2.3g of NO_2 is– $\mathbf{6.92 \times 10^{23}}$	**Assam CEE-2021**
Number of atom in 5.586 g Fe ($M = 55.86\ g\ mol^{-1}$) is– **Twice of 0.6 g of C**	**Assam CEE-2021**
Number of moles of dichromate needed to oxidizes one mole of Sn^{2+} is– **1/3**	**TS-EAMCET 09.08.2021, Shift-I**
$KMnO_4$ oxidises oxalic acid in acidic medium. The number of CO_2 molecules produced per mole of $KMnO_4$ is **5**	**TS EAMCET 05.08.2021, Shift-I**
The moles of electrons weighs in one kg is – $\mathbf{1.8 \times 10^6}$	**TS EAMCET 10.08.2021, Shift-II**
When oxalic acid is oxidised with acidified $KMnO_4$, the number of moles of CO_2 liberated is (consider balancing the reaction)– **10**	**TS EAMCET 10.08.2021, Shift-I**
The number of sodium ions present in 0.5 mole of sodium ferrocyanide is– $\mathbf{12 \times 10^{23}}$	**TS-EAMCET (Engg.), 05.08.2021 Shift-II**
The volume strength (in L) of 3N H_2O_2 is approximately– **17**	**AP EAPCET 24.08.2021 Shift-II**
The mole elevation constant is the ratio of Elevation in boiling point to– **Molality**	**AP EAPCET 19-08-2021 Shift-I**
One mole of oxygen gas at STP is equal to– $\mathbf{6.022\times10^{23}}$ **molecules of oxygen**	**AP EAMCET (Engg.) 17.09.2020 Shift-I**
Units is useful in relating concentration of solution with its vapour pressure– **Mole fraction**	**AP EAMCET (Engg.) 21.09.2020, Shift-I**
The gram of sodium (atomic mass 23 u) is required to prepare one mole of ethane from methyl chloride by Wurtz reaction– **46**	**MHT CET-02.05.2019, Shift-II**
The volume of 1 mole of any pure gas at standard temperature and pressure is always equal to– $\mathbf{0.022414\ m^3}$	**MHT CET-02.05.2019, Shift-II**
In the reaction of oxalate with permanganate in acidic medium, the number of electrons involved in producing one molecule of CO_2 is– **1**	**[JEE Main 2019, 10 Jan Shift-II]**
Total number of atoms in 44 g of CO_2 is– $\mathbf{1.806\times10^{24}}$	**J & K CET-(2019)**
The amount of water (g) produced by the combustion of 32 g of methane is– **72 g**	**Assam CEE-2019**
100 mL brandy contains 40 mL ethanol. The mole fraction of water is– **0.6**	**CG PET -2018**
Mass % of carbon in ethanol is– **52**	**Kerala-CEE-2018**
The Avogadro number or a mole represents– $\mathbf{6.02 \times 10^{23}}$ **atoms**	**HP CET-2018**
How many moles of electrons will weigh one kilogram– $\mathbf{\frac{1}{9.108\times6.023}\times10^8}$	**WB-JEE-2018**
The number of molecules of 8 g of oxygen gas at NTP is– $\mathbf{\frac{1}{4}\times6.022\times10^{23}}$	**Assam CEE-2018**
Number of electrons present in 3.6 mg of NH_4^+ are– $\mathbf{1.20 \times 10^{20}}$	**AMU-2017**
The yield of acetanilide in the reaction (100% conversion) of 2 moles of aniline with 1 mole of acetic anhydride is– **270 g**	**WB-JEE-2017**

How much CO_2 is produced on heating of 1 kg of carbon– **11/3 kg**	**NDA (II)-2017**
The compound $C_6H_{12}O_4$ contains– **Six times the mass percent of C as compared to the mass percent of H**	**NDA (II)-2017**
The number of moles of H_2O in one litre is– **55.55**	**SRMJEEE – 2015, 2010**
If 27 g of water is formed during complete combustion of pure propene (C_3H_6), the mass of propene burnt is– **21 g**	**Kerala-CEE-2016**
Number of atoms of sulphur in 9.8 grams of H_2SO_4 are– **0.6023×10^{23}**	**BCECE-2016**
For 1 molar solution of NaCl in water at 25^0C and 1-atm pressure show that– **Molarity = normality**	**BCECE-2016**
20 volume of H_2O_2 means– **1 mL of solution liberate 20 mL of O_2 at STP**	**JCECE - 2016**
The number of oxygen atoms in 4.4g of CO_2 is– **1.2×10^{23}**	**Karnataka-CET-2016**
The ions per molecular are produced in the solution, when Mohr salt is dissolved in excess of water– **5**	**Karnataka-CET-2015**
A mixture of gases contains H_2 and O_2 gases in the ratio of 1 : 4 (w/w). The molar ratio of the two gases in the mixture– **4 : 1**	**NEET-2015, cancelled**
The total number of protons in 10g of calcium carbonate is– **3.0115×10^{24}**	**Assam CEE-2014**
The volume strength of 1 molar solution of H_2O_2 is– **11.2**	**JCECE - 2014**
The system that contains the maximum number of atoms is– **2 g of H_2**	**WB-JEE-2014**
The volume occupied by 16 g of oxygen gas at S.T.P. is– **11.2 L**	**AMU-2013**
The mass of 112 cm^3 of NH_3 gas at STP is– **0.085 g**	**Karnataka-CET-2013**
The number of water molecules present in a drop of water weighing 0.018 g is– **6.022×10^{20}**	**Karnataka-CET-2013**
H_2O_2 oxidises MnO_2 is MnO_4^- in basic medium, H_2O and MnO_2 react in the molar ratio of– **3 : 2**	**BCECE-2013**
Number of atoms in 560 cm^3 of oxygen at S.T.P. is– $\mathbf{\frac{1}{20} \times 6.022 \times 10^{23}}$	**COMEDK-2012**
The vapour density of a mixture containing NO_2 and N_2O_4 is 27.6 Mole fraction of NO_2 in the mixture is– **0.8**	**AIIMS-2012**
Avogadro number (6.023×10^{23}) of carbon atoms are present in– **44 grams of $^{12}CO_2$**	**J & K CET-(2012)**
The total number of electrons present in 18 mL of water (density = 1g mL^{-1}) is– **6.02×10^{24}**	**Karnataka-CET-2012**
The mole fraction of methanol is in 4.5 molal aqueous solution is– **0.05**	**Kerala-CEE-2012**
The number of sodium atoms in 2 moles of sodium ferrocyanide is– **48×10^{23}**	**UPTU/UPSEE-2012**
If one mole of a substance is present in 1kg of solvent then its concentration is called– **Molal conc**	**BCECE-2011**
0.1 mol HCl is equal to– **3.65 g**	**JIPMER-2011**
The number of molecules of CO_2 liberated by the complete combustion of 0.1 g atom of graphite in air is– **6.02×10^{22}**	**AP-EAMCET- (Engg.) - 2010**
The number of water molecules is maximum in– **18 moles of water**	**NEET-2013**
The total number of atoms of all elements present in 1 mole of ammonium dichromate is– **114.437×10^{23}**	**AMU – 2010**
In redox reaction 1 g-eq of reducing agent requires P gm-eq. of oxidizing agent. The value of P is– **1**	**BITSAT 2010**
Molality of a solution is equal to– $\mathbf{\frac{\text{number of Moles of solute}}{\text{number of kilogram of solvent}}}$	**CG PET- 2010**
The molecules present in 5.6 L of sulphur dioxide at STP is– **1.5×10^{23}**	**J & K CET-(2010)**
The number of atoms in 0.1 mol of triatomic gas is (N_A=6.02 $\times10^{23}$ mol^{-1}) **1.806×10^{23}**	**NEET-2010**
The moles of helium gas occupy 22.4 L at 0^o C and at 1 atm pressure– **1.0**	**BCECE-2010**
1 mole of CO_2 contains– **6×10^{23} atoms of C**	**BCECE-2009**
If $NO_2(N_2O_4)$ is dissolved in NaOH, we get solution of– **Mixture of $NaNO_2$ and $NaNO_3$**	**CG PET-2009**

If 'F' is Faraday and 'N' is Avogadro number, then charge of electron can be expressed as– **F/N**	**CG PET -2009**
The number of molecules in 18 mg of water in terms of Avogadro number N is– **10^{-3} N**	**J & K CET-(2009)**
The volume of oxygen at STP in litres is required to burn 4 gm of methane gas completely– **11.2**	**J & K CET-(2009)**
The number of electrons required to reduce 4.5×10^{-5} g of Al is– **3.01×10^{18}**	**MHT CET-2009**
Contains greatest number of oxygen atoms– **1 g of O, 1 g of O_2, 1 g of O_3**	**UPTU/UPSEE-2009**
One mole of magnesium nitride on the reaction with an excess of water gives– **Two moles of NH_3**	**UPTU/UPSEE-2008**
2 N HCI solution will have same molar concentration as a– **4.0 N H_2SO_4**	**WB-JEE-2008**
1 mole of methyl amine on reaction with nitrous acid gives at NTP– **22.4 Litre of nitrogen**	**WB-JEE-2008**
80 g of oxygen contains as many atoms as in– **5 g of hydrogen**	**Karnataka-CET, 2008**
The number of moles of lead nitrate needed to coagulate 2 moles of colloidal $[AgI]I^-$ is– **1**	**Kerala-CEE-2008**
The number of electrons in a mole of hydrogen molecule is– **12.046×10^{23}**	**BITSAT 2008**
Maximum number of molecules of CH_3I that can react with a molecule of CH_3NH_2 are– **3**	**Karnataka-CET-2007**
Molarity of a given orthophosphoric acid solution is 3M. It's normality is– **9N**	**Karnataka-CET-2007**
One mole of oxygen at 273 K and one mole of sulphur dioxide at 546 K are taken in two separate containers, then– **Kinetic energy of O_2 < kinetic energy of SO_2**	**Karnataka-CET-2007**
The amount of bromine will be required to convert 2 g of phenol into 2, 4, 6-tribromo phenol– **10.22 g**	**UPTU/UPSEE-2007**
138 g of ethyl alcohol is mixed with 72 g of water. The ratio of mole fraction of alcohol to water is– **3 : 4**	**AP EAMCET (Engg.) -2007**
CO_2 gas obtained by the combustion of 12 mL butane gas is– **48 mL**	**CG PET -2006**
1.25 g NH_3 contains how many atoms– **1.77×10^{23}**	**JCECE - 2006**
Number of atoms of He in 100 amu of He (atomic wt. of He is 4) are– **25**	**UP CPMT-2006**
One mole of CO_2 contains- **6.02×10^{23} atoms of C**	**UPTU/UPSEE-2006**
In the equation $H_2S + 2HNO_3 \longrightarrow 2H_2O + 2NO_2 + S$. The equivalent weight of hydrogen sulphide is– **17**	**BCECE-2006**
Number of moles of $K_2Cr_2O_7$ reduced by one mole of Sn^{2+}– **1/3**	**UP CPMT-2005**
The moles of $Al_2(SO_4)_3$ would be in 50 g of the substance– **0.140 mol**	**UPTU/UPSEE-2005**
The number of moles of proton which can be easily given by butyne-1 (1mole) is– **1**	**CG PET -2005**
1 moles of crystalline NaCl will have how many unit cells– **1.506×10^{23}**	**CG PET -2005**
In 1 mole of NaCl the protons are– **28 moles**	**CG PET -2005**
The number of sodium atoms in 2 moles of sodium ferrocyanide is– **48×10^{23}**	**BITSAT 2005**
Mole fraction of a solute in benzene is 0.2 then find molality of solute– **3.2**	**BCECE-2004**
Vapour pressure of dilute aqueous solution of glucose is 750 mm of mercury at 373 K. The mole fraction of solute is– **1/76**	**J & K CET-(2004)**
One of the mole of a gas at NTP occupies 22.4 litres. This fact was derived from– **Avogadro's hypothesis**	**J & K CET-(2004)**
Number of atoms of oxygen present in 10.6 g of Na_2CO_3 will be– **1.806×10^{23}**	**J & K CET-(2004)**
The numerical value of $\frac{N}{n}$ (where, N is the number of molecules in a given sample of gas and n is the number of moles of the gas) is– **6.02×10^{23}**	**Kerala-CEE-2004**
The mass of 11.2 L of ammonia gas at STP is– **8.5 g**	**Kerala-CEE-2004**
720 g water contain the number of moles– **40**	**JCECE - 2003**

The total number of protons in 10g of calcium carbonate is ($N_0=6.023\times10^{23}$)– **3.01×10^{24}**	**UP CPMT-2003**
The number of moles of $KMnO_4$ that will be needed to react with one mole of sulphite ion in acidic solution is– **2/5**	**AMU-2002**
The volume strength of 1.5 N H_2O_2 solution is– **8.4**	**AMU-2002**
One mole of SO_2 corresponds to– **6.02×10^{23} molecules of SO_2**	
The number of atoms in 0.004 g of magnesium is close to– **10^{20}**	**AMU-2002**
Number of atoms in 560 g of Fe (atomic mass = 56 g mol^{-1}) is– **Twice that of 70 g N_2, half that of 20 g H**	**[AIEEE 2002]**
Weight of 4 L of N_2 gas as N.T.P. is– **5 g**	**J & K CET-(2002)**
One mole of CH_4 contains– **4 g atoms of hydrogen**	**UP CPMT-2002**
120 g of urea is present in 5 L of solution. The active mass of urea is– **0.4**	**UP CPMT-2001**
7.5 g of a gas occupies 5.6 L of volume at S.T.P. The gas is– **NO**	**AP-EAMCET (Medical), 2001**
Temperature does not affect– **Molality**	**AIIMS-1997-2001**
Number of molecules in one litre of water is close to– **$55.5 \times 6.023 \times 10^{23}$**	**J & K CET-(2000)**
The number of moles of hydrogen atoms in 3.2 g of methane is– **0.8**	**J & K CET-(1999)**
The number of atoms in 4.25 g of NH_3 is approximately– **6×10^{23}**	**NEET-1999**
The molar concentration of 20g of NaOH present in 5 litre of solution is– **0.1 mols/litre**	**AIIMS-1998**
Volume of a gas at NTP is 1.12×10^{-7} cc. The number of molecule in it is– **3.01×10^{12}**	**AIIMS-1998**
Ionic compounds contains greater number of ions– **100 g Na_2O (formula mass 62)**	**J & K CET-(1998)**
At STP, the density of a gas (molecular weight 45) is– **2 g/litres**	**J & K CET-(1997)**
Avogadro's number of oxygen atom weight– **16 g**	**AIIMS-1996**
The number of moles of water present in 180 gm of water is– **10**	**AIIMS-1996**
The mole fraction of solute in 20% aqueous H_2O_2 solution is– **0.1168**	**AP EAMCET- 1992**
The number of oxygen atoms in 4.4 g of CO_2 is– **1.2×10^{23}**	**NEET-1989**
At STP the density of CCl_4 vapour of g/L will be nearest to– **6.87**	**NEET-1988**
Components form homogeneous mixture– **Ethyl alcohol + water**	**MHT CET-02.05.2019, SHIFT-III**
Volume of water needed to mix with 10 mL 10N HNO_3 to get 0.1N HNO_3 is **–990mL**	**AIIMS-2017**
The proposition 'equal volumes of different gases contain equal numbers of molecules at the same temperature and pressure' is known as– **Avogadro's hypothesis**	**NDA (II)-2017**
On combustion of x-g of ethanol in bomb calorimeter, y-joules of heat energy is produced. The heat of combustion of ethanol (ΔH_{comb}) is– $\mathbf{\Delta H_{comb} = -\frac{y}{x}\times 44\,Jmol^{-1}}$	**BCECE-2017**
Combination of one volume of nitrogen with three volumes of hydrogen produces– **Two volumes of ammonia**	**NDA (II)-2016**
The formation of CO and CO_2 illustrates the law of– **Multiple proportion**	**BITSAT 2014**
If Avogadro number N_A, is changed from 6.022×10^{23} mol^{-1} to 6.022×10^{20} mol^{-1}, this would change– **The mass of one mole of carbon**	**NEET-2012**
The product of atomic weight and specific heat of any element is a constant, approximately 6.4. This is known as– **Dulong Pettit law**	**BITSAT-2011**
Gram molecular volume of oxygen at STP is– **22400 cm^3**	**Karnataka-CET-2007**
The total number of valence electrons in 4.2 g of N_3^- ion is (N_A is the Avogadro's number)– **1.6 N_A**	**NEET-1994**

Atomic and molecular masses and mole concept and molar mass, empirical and molecular formula	
The highest number of helium atoms is in- **4 mol of helium**	**NEET-05.05.2024**
In acidic medium, the equivalent weight of $K_2Cr_2O_7$ (Mol. wt. = M) is– **M/6**	**WBJEE-2012** **UPTU/UPSEE-2009**
Vapour density of a metal chloride is 83. If equivalent weight of the metal is 6, its atomic weight will be– **24**	**AP EAMCET (Engg.) 21.09.2020, Shift-I**
The mass of one atom of ^{12}C is – **1.9923×10^{-23}g**	**WB-JEE-2020**
In a flask, the weight ratio of $CH_4(g)$ and $SO_2(g)$ at 298 K and 1 bar is 1:2. The ratio of the number of molecules of $SO_2(g)$ and $CH_4(g)$ is– **1:2**	**COMEDK-2020**
Equivalent mass of $K_2Cr_2O_7$ in acidic solution is equal to– **Molecular mass/ 6.**	**COMEDK-2019**
Equivalent weight of $KMnO_4$ is equal to– **One-fifth its molecular weight**	**COMEDK-2019**
In acid medium MnO_4^- is reduced to Mn^{2+}, by a reducing agent. Then the equivalent mass of $KMnO_4$ is given by– **M/5** (M = molecular mass)	**Manipal-2019**
The equivalent weight of oxalic acid in $C_2H_2O_4.2H_2O$ is– **63**	**NDA (I)-2019**
In the standardization of $Na_2S_2O_3$ using $K_2Cr_2O_7$ by iodometry, the equivalent weight of $K_2Cr_2O_7$ is– **Molecular weight/6**	**Manipal-2018**
The masses of oxygen combine with a fixed mass of hydrogen to form H_2O and H_2O_2, respectively, bear the simple ratio 1:2– **Law of multiple proportions**	**COMEDK-2018**
The number of times the comparative mass of a neutron is heavier than an electron is– **~1842**	**J & K CET-(2018)**
The compound Na_2CO_3. xH_2O has 50% H_2O by mass. The value of "x" is– **6**	**Kerala-CEE-2017**
A bivalent metal has an equivalent mass of 32. The molecular mass of the metal nitrate is– **188**	**COMEDK-2016**
Sulphur forms the chlorides S_2Cl_2 and SCl_2. The equivalent mass of sulphur in SCl_2 is– **16 g/mol**	**AIIMS-2015**
3.011×10^{22} atoms of an element weighs 1.15 g. The atomic mass of the element is– **23**	**AP-EAMCET (Engg.)-2015**
The equivalent weight of $Na_2S_2O_3$ in the reaction is $2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$– **M**	**JCECE - 2014**
The ratio of masses of oxygen and nitrogen in a particular gaseous mixture is 1 : 4 The ratio of number of their molecule is– **7:32**	**[JEE Main-2014]**
The mass of one molecule of yellow phosphorus is (Atomic mass, P = 30)– **1.993×10^{-19} mg**	**MHT CET-2014**
Equivalent weight of $(NH_4)_2Cr_2O_7$ in the change is $(NH_4)_2Cr_2O_7 \rightarrow N_2 + Cr_2O_3 + 4H_2O$ – **Mol. wt./6**	**UP CPMT-2013**
The equivalent mass of a certain bivalent metal is 20. The molecular mass of its anhydrous chloride is– **111**	**Karnataka-CET-2012**
A certain gas takes three times as long to effuse out as helium. Its molecular mass will be– **36 u**	**NEET-2012**
Equivalent and molecular masses are same in– **Mohr's salt**	**COMEDK-2011**
The equivalent weight of $MnSO_4$ is half of its molecular weight when it is converted to– **MnO_2**	**CG PET- 2011**
If the equivalent weight of a trivalent metal is 32.7, the molecular weight of its chloride is– **204.6**	**JCECE - 2011**
2g of metal carbonate is neutralized completely by 100 mL of 0.1 N HCl. The equivalent weight of metal carbonate is– **200**	**WB-JEE-2011**

In the reaction of sodium thiosulphate with I_2 in aqueous medium the equivalent weight of sodium thiosulphate is equal to– **Molar mass of sodium thiosulphate**	**WB-JEE-2010**
The number of water molecules differing in molecular mass formed by hydrogen isotopes and oxygen isotopes– **6**	**SCRA-2010**
The vapour density of ozone is– **24**	**BITSAT-2010**
The equivalent weight of Potassium permanganate ($KMnO_4$) in neutral medium will be– $\frac{\textbf{Atomic weight}}{\textbf{3}}$	**MPPET- 2009**
The standard for atomic mass is– $_6C^{12}$	**BCECE-2009**
The equivalent mass of potassium permanganate in alkaline medium is its– **Molar mass itself**	**J & K CET-(2009)**
The formula mass of Mohr's salt is 392. The iron present in it is oxidised by $KMnO_4$ in acid medium. The equivalent mass of Mohr's salt is– **392**	**JCECE - 2009**
A bivalent metal has an equivalent mass of 32. The molecular mass of the metal nitrate is– **188**	**Karnataka-CET, 2009**
Mass of 0.1 mole of methane is– **1.6 g**	**Karnataka-CET, 2008**
Electron density in the yz plane of $3d_{x^2-y^2}$ orbital is– **Zero**	**J & K CET-(2008)**
The milliequivalent in 60 ml 4M H_2SO_4 is– **480**	**[BITSAT – 2007]**
1.520 g of hydroxide a metal on ignition gave 0.995 g of oxide. The equivalent weight of metal is– **9**	**UP CPMT-2006**
The mass of a photon with wave length 3.6 Å is– $\mathbf{6.135\times10^{-29}}$ **kg**	**AMU-2005**
The standard adopted for the determination of atomic weight of elements is based on– C^{12}	**JCECE - 2005**
The mass of carbon anode consumed (giving only carbon dioxide) in the production of 270 kg of aluminium metal from bauxite by the Hall process is– **90 kg**	**NEET-2005**
The ratio of mass of an electron to the mass of a proton is– **1 : 1837**	**UPTU/UPSEE-2004**
Equivalent weight of an acid– **Depends on the reaction involved**	**UPTU/UPSEE-2004**
The number of gram equivalent of H_2SO_4 in 1000 mL 3M solution is– **6**	**JCECE - 2003**
The equivalent weight of $KMnO_4$ in acidic medium is– **31.6**	**UP CPMT-2002**
The oxygen obtained from 72 kg water is– **64 kg**	**UP CPMT-2002**
The weight of a single atom of oxygen is– $\mathbf{2.656\times10^{-23}}$ **g**	**AIIMS-1998**
The molecular mass of a volatile substance may be measured by– **Victor Meyer's method**	**AIIMS-1994**
The molecular formulae for phosgene and tear gas are …. and …. respectively– $COCl_2$ **and** CCl_3NO_2	**GUJCET-2015, 2016**
An organic compound contains 60% C; 4.48% H and 35.5% O. Its empirical formula is– $C_9H_8O_4$	**TS-EAMCET (Engg.), 05.08.2021 Shift-II**
In each molecule of carbon tetrachloride. the mass percent of carbon and chlorine respectively are ______ and ______.– **7.84 & 92.80**	**AP EAPCET 24.08.2021, Shift-I**
A pure compound contains 2.4g of C, 1.2×10^{23} atoms. Its empirical formula is– **CHO**	**Karnataka-CET-2021**
The mass percentage of nitrogen in histamine is– **37.84**	**[JEE Main 2020, 9 Jan Shift-I]**
The formula of dichlorobis (urea) copper (II) is– $[CuCl_2\{O{=}C(NH_2)_2\}_2]$	**COMEDK-2019**
An organic compound is found to contain C= 54.5% , O=36.4% and H=9.1% by mass. Its empirical formula is– C_2H_4O	**COMEDK-2019**
The empirical formula of the compound if M = 68% (atomic mass = 34) and remaining 32% oxygen is– **MO**	**AIIMS 25 May 2019 (Morning)**

Law of Multiple proportion– **H_2O, H_2O_2**	**J & K CET-(2019)**
The percentage of carbon in urea is– **20%** (Atomic mass C = 12, H = 1, N = 14, O = 16)	**MHT CET-02.05.2019, SHIFT-III**
A compound contains 26% nitrogen and 74% oxygen. Its molecular formula will be– **N_2O_5**	**Tripura JEE-2019**
The formulas of the compounds respectively are Bleaching powder; Quicklime; Plaster of Paris; Slaked lime– **$Ca(OCl)_2$, CaO, $CaSO_4 \frac{1}{2} H_2O$, $Ca(OH)_2$**	**Assam CEE-2018**
A metal M (specific heat 0.16) forms a metal chloride with 65% chlorine present in it. The formula of the metal chloride will be– **MCl_2**	**WB-JEE-2018**
Two oxides of an non-metal X contain 50% and 40% of non-metal respectively. If the formula of the first oxide is XO_2, Then the formula of second oxide is– **XO_3**	**AP EAMCET-2017**
An alkane has a C/H ratio (by mass) of 5.1428. Its molecular formula is– **C_6H_{14}**	**COMEDK-2017**
Blister copper contains ____ percentage of copper– **98**	**SRMJEEE-2016**
A compound contain three elements X, Y and Z. The oxidation number. Of X, Y and Z are +3, +5 and –2 respectively. The possible formula of the compound is– **$X_3(YZ_4)_3$**	**BCECE-2016**
The percentage of oxygen in CH_2O is– **53.33%**	**JCECE - 2016**
An organic compound contains C = 40%, H = 13.33% and N = 46.67%. Its empirical formula is– **CH_4N**	**Karnataka-CET-2016**
The empirical formula of a compound is CH_2.One mole of this compound has a mass 42g. Its molecular formula is– **C_3H_6**	**CG PET- 2015**
An organic compound contains 90% carbon and 10% hydrogen by mass. Its empirical formula is– **C_3H_4**	**Kerala-CEE-2015**
The formula for sodium trioxalatoaluminate (III) is– **$Na_3[Al(C_2O_4)_3]$**	**COMEDK-2015**
The molecular formula of Dithionic acid is– **$H_2S_2O_6$**	**SRMJEEE – 2014**
Two oxides of a metal contain 50% and 40% metal (M) respectively. If the formula of first oxide is MO_2, the formula of second oxide will be– **MO_3**	**Assam CEE-2014**
The percentage of water of crystallisation of a sample of blue vitriol is– **36.07%**	**JCECE - 2014**
A compound contains 38.8% C, 16% H, 42.5% N. The formula of compound will be– **CH_3NH_2**	**MPPET-2013**
The arsenic content of an agricultural insecticide was reported as 28% As_2O_5. the percentage of arsenic in this preparation is– **18%**	**AMU-2013**
Analysis shows that a binary compound of X (atomic mass = 10) and Y (atomic mass = 20) contains 50% X. The formula of the compound is– **XY_2**	**AMU-2013**
Empirical formula of a compound is CH_2O and its molecular mass is 90, the molecular formula of the compound is– **$C_3H_6O_3$**	**Karnataka-CET-2013**
An organic compound contains 38.8% carbon, 16% hydrogen & 45.2% nitrogen. Its empirical formula is– **CH_3NH_2**	**MPPET - 2012**
In a hydrocarbon, mass ratio of hydrogen and carbon is 1:3, the empirical formula of hydrocarbon is– **CH_4**	**AIIMS-2012**
The formula of chloral is– **CCl_3CHO**	**JCECE - 2012**
The percentage composition by weight of an aqueous solution of solute (molar mass 150) which boils at 373.26K(k_b=0.52) is– **7**	**CG PET- 2011**
An organic contains 49.3% carbon, 6.84% hydrogen and its vapour density is 73. Molecular formula of the compound is– **$C_6H_{10}O_4$**	**BCECE-2010**
Molecular formula of Glauber's salt is– **$Na_2SO_4 \cdot 10H_2O$**	**JCECE - 2010**
The percentage (by weight) of sodium hydroxide in a 1.25 molal NaOH solution is– **4.76%**	**MHT CET-2009**

An organic compound made of C,H and N contains 20% nitrogen. Its molecular weight is– **70**	**WB-JEE-2009**
The percentage of an element M is 53 in its oxide of molecular formula M_2O_3. Its atomic mass is about– **27**	**Kerala-CEE-2008**
An organic compound contains carbon, hydrogen and oxygen. Its element analysis gave C, 38.71% and H, 9.67%. The empirical formula of the compound would be– **CH_3O**	**NEET-2008**
Composition of azurite mineral is– **$2CuCO_3 \cdot Cu(OH)_2$**	**WB-JEE-2008**
An unknown element forms an oxide. The equivalent wt. of the element if the oxygen content is 20% by wt– **32**	**WB-JEE-2008**
A compound has the empirical formula CH_2O. Its vapour density is 30. Its molecular formula is– **$C_2H_4O_2$**	**CG PET -2007**
In a compound C, H and N are present in 9 : 1 : 3.5 by weight. If molecular weight of the compound is 108, then the molecular formula of the compound is– **$C_6H_8N_2$**	**UP CPMT-2006**
A compound contains 54.55% carbon, 9.09% hydrogen, 36.36% oxygen. The empirical formula of this compound is– **C_2H_4O**	**UPTU/UPSEE-2004**
A petroleum fraction having boiling range 70-200°C and containing 6-10 carbon atoms per molecule is called– **Gasoline**	**UPTU/UPSEE-2004**
The molecular formula of borazole is– **$B_3N_3H_6$**	**AP EAMCET- 2001**
The molecular formula of gypsum is – **$CaSO_4.2H_2O$**	**AP EAMCET- 2000**
The molecular formula of white phosphorus is– **P_4**	**AP EAMCET- 2000**
The empirical formula of a compound is CH_2O. Its molecular weight is 180. The molecular formula of compounds is– **$C_6H_{12}O_6$**	**AIIMS-1999**
The percentage of oxygen in NaOH is– **40%**	**AIIMS-1996**
The mole percentage of oxygen in a mixture of 7.0 g of nitrogen and 8.0 g of oxygen is– **50**	**A-P EAMCET-1995**
An organic compound having carbon, hydrogen and sulphur contains 4% of sulphur. The minimum molecular weight of the compound is– **800**	**VITEEE 2015**
Caffeine has a molecular weight of 194 u. If it contains 28.9% by mass of nitrogen, number of atom of nitrogen in one molecule of caffeine is– **4**	**VITEEE 2015**
The elemental analysis of an organic compound gave C: 38.71%, H: 9.67% .The empirical formula of the compound is – **CH_3O**	**Kerala CEE -03.07.2022**
Stoichiometry Calculation	
An organic compound has an empirical formula CH_2O. Its vapour density is 45. The molecular formula of compound is– **$C_3H_6O_3$**	**A.P.EAMCET-1995, 1991**
The fractions of Fe^{2+} and Fe^{3+} in $Fe_{0.93}O$ respectively are – **0.85, 0.15**	**GUJCET-2020**
An organic compound contains 24% carbon, 4% hydrogen and remaining chlorine. Its empirical formula is– **CH_2Cl**	**Kerala-CEE-2020**
Pink colour of non-stoichiometric LiCl is due to– **Electrons in the lattice**	**CG PET -2018**
The mass of oxygen gas which occupies 5.6 litres at STP would be– **Half of the gram atomic mass of oxygen**	**COMEDK-2015**
A metal oxide has the empirical formula, $M_{0.96}O_{1.00}$. What will be the percentage of M^{2+} ions in the crystal– **91.67**	**AMU-2015**
The number of moles of electrons required to deposit 36g of Al from an aqueous solution of $Al(NO_3)_3$ is (At. wt. of Al = 27)– **4**	**AP EAMCET (Engg.) - 2012**
The ratio of moles of hydrogen produced when two moles of aluminium react with excess HCl and NaOH separately is– **1 : 1**	**AP - EAMCET(Medical)- 2009**
Value of x in potash alum, $K_2SO_4.Al_x(SO_4)_3 \cdot 24H_2O$ is– **2**	**UP CPMT-2007**
The number of molecules of CO_2 spresent in 44g of CO_2 is– **6.0×10^{23}**	**BCECE-2005**
The number of molecules present in 3.5 g of CO at 0ºC and 760 mm pressure is– **$0.125 \times 6.02 \times 10^{23}$**	**AP-EAMCET-1992**

2. Structure of Atom

Sub-Atomic Particles and Atomic Models

- The charge of an electron was discovered by– **Millikan**
- The element used by Rutherford in his famous scattering experiment was– **Gold**
- Be^{2+} is isoelectronic with ions– **Li**
- ($_{32}Ge^{76}$, $_{34}Se^{76}$) and ($_{14}Si^{30}$, $_{16}S^{32}$) are the examples of– **Isobars and isotones**
- The ratio of charge and mass would be greater for– **Electron**
- The nitride ion in lithium nitride is composed of– **7-protons + 10 electrons**
- The ratio of neutrons in C and Si with respective atomic masses 12 and 28 is– **3 : 7**
- If a species has 16 protons, 18 electrons and 16 neutrons, the species and its charge is– $\mathbf{S^2}$
- The compound having number of protons is greater than the number of neutrons but number of protons is less than the number of electrons– **OH**

Developments Leading to The Bohr's Model of Atom

- The scientist that proposed the atomic model based on the quantisation of energy for the first time is– **Neil Bohr**
- The value of Rydberg constant is– **109, 677 cm^{-1}**
- The lowest energy of the spectral line emitted by the hydrogen atom in the Lyman series is– $\mathbf{\frac{3hR_Hc}{4}}$
- A metal surface is exposed to solar radiations– **The emitted electrons have energy less than a maximum value of energy depending upon the frequency of the incident radiation.**
- Bohr's model can explain–**Spectrum of any atom or ion containing one electron only**
- The species, Bohr's theory is not applicable to–$\mathbf{He^{2+}}$
- The quantum of light energy is called– **Photon**

Hydrogen Atom

- The velocity of electron present in first Bohr orbit of hydrogen atom– **2.18 × 10^6 m/s**
- Time taken for an electron to complete one revolution in Bohr orbit of hydrogen atom is– $\mathbf{\frac{4\pi^2mr^2}{nh}}$
- The wavelength and name of series respectively for the emission transition for H-atom if it starts from the orbit having radius 1.3225 nm and ends at 211.6 pm would be– **434 nm, Balmer**
- The emission spectrum of hydrogen atom discovered first and the region of the electromagnetic spectrum is belongs, to– **Balmer, Visible**
- The velocity of electron in second shell of hydrogen atom is– **1.094 × 10^6m/sec**
- If the first ionization energy of H^- atom is 13.6 eV, then the second ionization energy of He^- atom is– **54.4 eV**
- When the electrons of hydrogen atom return to L-shell from shell of higher energy, we get a series of lines in the spectrum. This series is called– **Balmer series**
- The electron of a hydrogen atom jump from n = 4 to n = 1 state, the number of different spectral line emitted are– **6**
- The wave number of the spectral line in the emission spectrum of hydrogen will be equal to 8/9 times the rydberg constant if the electron jumps from– **n = 3 to n = 1**
- The energy ratio of a photon of wavelength 3000Å and 6000Å is– **2:1**
- The first line emission of hydrogen atom spectrum in the Balmer species appears at– **5R/36 cm^{-1}**
- The radius of 2nd Bohr's orbit of hydrogen atom is– **0.2116 nm**
- The maximum energy possessed by an electron is – **At infinite distance from the nucleus**
- The pair where both species have same radius is– $\mathbf{r_2Be^{3+}}$ **and** $\mathbf{r_1H}$
- The ratio of ionization energy of H and Be^{+3} is–**1:16**
- The ratio of the energy of the electron in ground state of hydrogen to the electron in 1st excited state of Be^{3+} is– **1 : 4**
- The transition, one quantum of energy is emitted is– $\mathbf{n_2 = 4 \rightarrow n_1 = 2, n_2 = 3 \rightarrow n_1 = 1, n_2 = 2 \rightarrow n_1 = 1}$

- The wavelength of first line of Balmer spectrum of hydrogen will be– **6569 Å**
- If the radius of 2nd Bohr orbit of hyderogen atom is r_2. The radius of third Bohr orbit will be– $\mathbf{\frac{9}{4} r_2}$
- The ratio of highest possible wavelength of Lyman series is– **4/3**
- Magnitude of kinetic energy in an orbit is equal to– **Half of the P.E.**
- According to Bohr's theory, the angular momentum of an electron in the 4th orbit is– $\mathbf{\frac{2h}{\pi}}$
- If the radius of 1st Bohr orbit be a_0, then radius of 3rd Bohr orbit would be– $\mathbf{9a_0}$

Towards Quantium Mechanical Model of The Atom

- If E_e, E_α and E_p represents the kinetic energy of an electron, α-particle and proton respectively and each moving with same de-broglie wavelength then– $\mathbf{E_e > E_p > E_\alpha}$
- Uncertainty principle was given by– **Heisenberg**
- If uncertainty in position and velocity are equal, then uncertainty in momentum will be– $\mathbf{\frac{1}{2}\sqrt{\frac{mh}{\pi}}}$
- If de-broglie wavelength of mass 'm' is 100 times of its velocity then its value in term of its mass 'm' and planck's constant "h" is– $\mathbf{10\sqrt{\frac{h}{m}}}$
- The wavelength of electron waves in two orbit is in ratio 3:5. The ratio of K.E. of electrons will be–**25:9**
- If uncertainty in position and momentum are equal, then uncertainly in velocity is– $\mathbf{\frac{1}{2m}\sqrt{\frac{h}{\pi}}}$
- The de-broglie wavelength associated with a mass of 1kg having K.E. 0.5J is– $\mathbf{6.626 \times 10^{-34}\ m}$
- For an electron, if the uncertainty in velocity is Δv, the uncertainty in position Δx is given by– $\mathbf{\frac{h}{4\pi \Delta v}}$
- If uncertainty in the position of an electron is zero, the uncertainty in its momentum will be– **infinite**
- de-Broglie wavelength associated with a material particle is– **Inversely proportional to momentum**
- The uncertainty in the position of an electron and proton is equal, the ratio of the uncertainties in the velocity of an electron and proton is– **1836:1**
- The species have the same number of electron in its outermost as well as penultimate shell is– $\mathbf{Ca^{2+}}$
- The number of waves made by an electron moving in an orbit having maximum magnetic quantum number +3 is– **4**
- The set of quantum no. not applicable for an electron– $\mathbf{3, 1, -2, +\frac{1}{2}}$
- The orbital angular momentum of an electron in f-orbital– $\mathbf{\frac{\sqrt{3}h}{\pi}}$
- Given

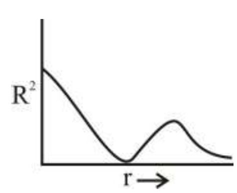
K	L	M	N
2	8	11	2

  The number of electrons present in $l = 2$ is– **3**
- The maximum number of electrons that can be held by subshell with azimuthal quantum number "ℓ" in an atom is given by– $\mathbf{2(2\ell + 1)}$
- The maximum number of electrons that can be associated with a quantum number n = 3, l = 1 and m = –1 is– **2**
- The quantum number "m" of a free gaseous atom is associated with– **Spatial orientation of orbital**
- The element is represented by electronic configuration $1s^2 2s^2 2p_x^1 2p_y^1 2p_z^1$ – **N**
- The atomic number of element is 17. The number of orbital containing electron pair in its valence shell is– **3**
- The total number of electrons present in all the p-orbital of bromine are (Given : Atomic no. of Br = 35)– **17**
- The number of unpaired electron in Fe^{3+}(Z = 26) are– **5**
- The orbital angular momentum of p-electron is given as– $\mathbf{\frac{h}{\sqrt{2}\pi}}$
- The total number of orbitals in a shell with principle quantum number n is– $\mathbf{n^2}$
- The represents set of quantum numbers of a 4d electron is – **4, 2, 1, –1/2**
- Any f-orbital can accommodate upto– **2 electrons with opposite spin**
- The atomic numbers of elements X, Y and Z are 19, 21 and 25 respectively. The number of electrons present in the M shells of these elements follow the order– **Z > Y > X**
- This electronic configuration shows element of–

  [↑↓] [↑↓] [↑↓|↑↓|↑]
  1s 2s 2p

  Fluorine
- The de-broglie wavelength of an electron moving in a circular orbit is λ. The minimum radius of the orbit is given by– $\mathbf{\frac{\lambda}{2\pi}}$
- Last line of Lyman series for H–atom has wavelength λ_1 Å. The 2nd line of Balmer series has wavelength λ_2 Å, then– $\mathbf{\frac{16}{\lambda_2} = \frac{3}{\lambda_1}}$

- The electron having quantum numbers n = 4 & m = 2 is– **the value of ℓ may be 2, The value fo ℓ may be 3, The value of s may be +1/2**
- Change in orbit angular momentum when an electron makes a transition corresponding to 3^{rd} line of Balmer series in Li^{2+} ion is– $\mathbf{\frac{3h}{2\pi}}$
- The ionisation energy of H atom is x J/atom. The wavelength of first Balmer line for He^+ ion is– $\mathbf{\frac{9he}{5x}}$
- The total number of orbitals in the principal shell of He^+ that has energy equal to $\frac{-Rhc}{4}$ (where R is Rydberg's constant) is– **4**
- If ΔE is the energy emitted in eV when an electronic transition occurs from higher energy level to lower energy level in H–atom, the λ of the line produced is approximately equal to– $\mathbf{\frac{12375}{\Delta E}\overset{0}{A}}$
- The energy of a possible excited state of hydrogen is– **–3.4 eV**
- The ratio of area covered in 2^{nd} orbit to first orbit is– **16 : 1**
- An electron in an atom undergoes transition in such a way potential energy will be– $+\frac{3}{2}x$
- The transition in He^+ ion shall have the same wave number as the first line in Balmer series of hydrogen atom is– **6 → 4**
- The maximum number of electrons that can be accomodated in principal number 4 – **32**
- The number of elements would be in the 11^{nd} period of the Periodic Table if the spin quantum numbers could have the value $+\frac{1}{2}, 0, -\frac{1}{2}$– **12**
- In an atom, having 2K, 8L, 18M and 2N electrons in the ground state. The total number of electrons having magnetic quantum number, m = 0 is– **14**
- The probability density curve for 2s electron appears like as–



- If an electron in H atom has an energy of –78.4 kcal/mol. The orbit in the electron is present is– **2^{nd}**
- Difference between n^{th} and $(n + 1)^{th}$ Bohr's radius of H– atom is equal to its $(n - 1)^{th}$ Bohr's radius. The value of n is– **4**
- Light of wavelength λ shines on a metal surface with intensity x and the metal emits Y electrons per second of average energy, Z. The happen to Y and Z if x is doubled– **Y will be doubled but Z will remain same**
- Splitting of spectral lines under the influence of electric field is called– **Stark effect**
- The conclusions could not be derived from Rutherford's α-particle scattering experiment is– **Electrons move in a circular path of fixed energy called orbits.**
- The properties of atom could be explained correctly by Thomson model of atom is–**Overall neutrality of atom**
- Two atoms are said to be isobars if– **Sum of the number of protons and neutrons is same but the number of protons is different**
- The number of radial nodes for 3p orbital is– **1**
- Number of angular nodes for 4d orbital– **2**
- The responsible to rule out the existence of definite paths or trajectories of electrons is– **Heisenberg's uncertainty principle**
- Total number of orbitals associated with third shell will be– **9**
- Orbital angular momentum depends on– ***l***
- Chlorine exists in two isotopic forms. C*l*-37 and C*l*-35 but its atomic mass is 35.5. This indicates the ratio of C*l*-37 and C*l*-35 is approximately– **1 : 3**
- The pair of ions having same electronic configuration is– **Fe^{3+}, Mn^{2+}**
- For the electrons of oxygen atom, is– **The two electrons present in the 2s orbital have spin quantum numbers, m_s but of opposite sign**
- If waves travelling at same speeds, matter waves have the shortest wavelength– **Alpha particle (He^{2+})**
- The number of angular nodes and radial nodes in 3s orbital are– **0 and 2, respectively**
- 4d, 5p, 5f and 6p orbitals are arranged in the order of decreasing energy– **5f > 6p > 5p > 4d**
- The series of transitions in the spectrum of hydrogen atom fall in visible region is– **Balmer series**
- Be^{2+} is isoelectronic with the ions– **Li^+**
- The ion that is isoelectronic with CO is– **CN^-**
- An isotone of $^{76}_{32}Ge$ is– **$^{77}_{33}As$**
- Isoelectronic species are– **CO, CN^-, NO^+, C_2^{2-}**
- .... ions has electronic configuration $[Ar]3d^6$– **Co^{3+}**
- Atomic number and mass number of an element M are 25 and 52 respectively. The number of electrons, protons and neutrons in M^{2+} ion are respectively– **23, 25 and 27**
- The time taken by the electron in one complete revolution in the n^{th} Bohr's orbit of the hydrogen atom is– **Directly proportional to n^3**

- According to the Bohr theory, the transition in the hydrogen atom will give rise to the least energetic photon– **n = 6 to n = 5**
- .... modified Bohr's theory by introducing elliptical orbits for electron path– **Sommerfield**
- The ratio of the energy required to remove an electron from the first three Bohr's orbits of hydrogen is– **36 : 9 : 4**
- The longest wavelength line in Balmer series of spectrum of H-atom– **656 nm**
- Total number of spectral lines in UV regions, during transition from 5^{th} excited state to 1^{st} excited state– **Zero**
- An electron jumps lower orbit to higher orbit, when– **Energy is absorbed**
- Electronic energy is negative because– **Energy is zero at infinite distance from the nucleus and decreases as the electron comes towards nucleus**
- Zeeman effect refers to the– **Splitting of the spectral lines in a magnetic field**
- The principal and azimuthal quantum number of electron in 4f orbitals are– **4, 3**
- In any sub-shell, the maximum number of electrons having same value of spin quantum number is– **$2l + 1$**
- Two electrons occupying the same orbital are distinguished by– **Spin quantum number**
- The orientation of an atomic orbital is governed by– **Magnetic quantum number**
- Maximum number of electrons in a subshell of an atom is determined by– **$4l + 2$**
- The subshell can accommodate as many as 10 electrons is– **d**
- A p-orbital can accommodate upto– **Two electrons**
- The orbital is with the four lobes present on the axis is– **$d_{x^2-y^2}$**
- Any f-orbital can accommodate upto– **2 electrons with opposite spin**
- The angular momentum of a p-electron is given as– $\dfrac{h}{\sqrt{2}\pi}$
- The pairs of d-orbitals will have electron density along the axes– **$d_{z^2}, d_{x^2-y^2}$**
- The total number of atomic orbitals in fourth energy level of an atom is– **16**
- The number of radial nodes in 4s and 3p orbitals are respectively– **3, 1**
- Radial nodes in 3s and 3p-orbitals are respectively– **2, 1**
- The number of lobes in most of the d-orbitals are– **4**
- The total number of subshells in fourth energy level of an atom is– **4**
- A transition element X has a configuration $(Ar)3d^4$ in its +3 oxidation state. Its atomic number is– **25**
- The ratio of charge to mass of an electron in coulombs per gram was determined by J.J. Thomson. He determined this ratio by measuring the deflection of cathode rays in electric and magnetic fields. The value he found for this ratio is– **-1.76×10^8 coulombs/g**
- The experiment that is responsible for finding out the charge on an electron– **Millikan's oil drop experiment**
- An element with mass number 81 contains 31.7% more neutrons as compared to protons. The symbol of the atom– **$^{81}_{35}Br$ –**
- The wavelength of visible light is– **380 nm – 760 nm**
- The spectrum of white light ranging from red to violet is called a continuous spectrum because– **The violet colour merges into blue, blue into green, green into yellow and so on**
- The electron in Bohr's model of hydrogen atom is pictured as revolving around the nucleus in order for it to– **Possess energy**
- The color corresponding to the wavelength of light emitted the electron in a hydrogen atom undergoes transition from n = 4 to n = 2 is– **Blue**
- The series of lines are the only lines in hydrogen spectrum that appear in the visible region– **Balmer**
- The third line of the Balmer series in the emission spectrum of the hydrogen atom is due to the transition from the– **Fifth Bohr orbit to the second Bohr orbit**
- The frequency of radiation absorbed or emitted the transition occurs between two stationary states with energies E_1 (lower) and E_2 (higher) is given by– $\nu = \dfrac{E_2 - E_1}{h}$
- The angular momentum of an electron in a given stationary state can be expressed as $m_e vr = n\dfrac{h}{2\pi}$. Based on this expression an electron can move only in those orbits for which its angular momentum is– **Integral multiple of $\dfrac{h}{2\pi}$**
- According to Bohr's theory, the angular momentum of an electron in 5^{th} orbit is– $\dfrac{2.5h}{\pi}$
- The radius of the stationary state that is also called Bohr radius is given by the expression $\gamma_n = n^2a_0$ where the value of a_0 is– **52.9 pm**
- If the radius of first Bohr orbit is x pm, then the radius of the third orbit would be– **(9 × x) pm**

- The longest wavelength doublet absorption transition is observed at 589 and 589.6 nm. Energy difference between two excited states is– **3.31×10^{-22} J**
- Bohr's theory can also be applied to the ions like– **He^+, Li^{2+}, Be^{3+}**
- According to Bohr's theory, the electronic energy of H-atom in Bohr's orbit is given by–

$$E_n = \frac{2.179 \times 10^{-18} \times Z^2}{\pi^2} \text{ J}$$

- The trend of energy of Bohr's orbits is– **Energy of the orbit increases as we move away from the nucleus**
- The negative electronic energy (negative sign for all values of energy) for hydrogen atom means is– **The energy of an electron in the atom is lower than the energy of a free electron at rest that is taken as zero**
- The energy of the electron in a hydrogen atom has a negative sign for all possible orbits because– **the electron is attracted by the nucleus and is present in orbit n, the energy is emitted and its energy is lowered**
- The probability of finding out an electron at a point within an atom is proportional to the– **Square of the orbital wave function i.e., Ψ^2**
- Two electron present in M shell will differ in– **Spin quantum number**
- The lowest value of n that allows orbital to exist is– **5**
- Total orbitals and electrons are associated with n = 4 are – **16, 32**
- An electron is in of the 3d-orbitals. The possible values of n, *l* and m_l for this electron is– **n = 3, *l* = 2, m_l = –2, –1, 0, + 1, + 2**
- The possible values of n, *l* and m_l for an atomic orbital 4*f* are– **n = 4, l = 3, m_l = –3, –2, –1, 0, + 1, +2, +3**
- Total electrons in an atom having the quantum numbers n= 4 and spin value= –1/2 is– **16**
- Total electrons are associated with the given set of quantum numbers n = 3 and *l* = 1 and m = –1are – **2**
- The orbital angular momentum of an electron in 2s-orbital is– **Zero**
- Two values of spin quantum numbers i.e., +1/2 and –1/2 represent – **Two quantum mechanical spin states which refer to the orientation of spin of the electron**
- The region where probability density function reduces to zero is called– **Nodal surfaces**
- The 3d-orbitals having electron density in all the three axis is– **$3d_{z^2}$**
- The number of radial nodes and angular nodes for d-orbital can be represented as– **(n–3) radial nodes + 2 angular nodes = (n – 1) total nodes**
- An electron can enter into the orbital when– **Value of (n + *l*) is minimum**
- Total number of orbitals in total are associated with n^{th} energy level is– **n^2**
- Effective nuclear charge (Z_{eff}) for a nucleus of an atom is defined as– **The net positive charge experienced by electron from the nucleus**
- The electronic configuration of O^{2-} ion is– **$1s^2\ 2s^2\ 2p^6$**
- The configuration of the valence orbital of an element with atomic number 22 is– **$4s^2\ 3d^2$**
- Three elements 'X', 'Y' and 'Z' have atomic numbers 18, 19 and 20 respectively. Total electrons present in the M shells of these elements are – **8, 8, 8**
- The electronic transition from n = 2 to n = 1 will produce shortest wavelength in– **Li^{2+} ion**
- The number of neutrons and electrons, respectively, present in the radioactive isotope of hydrogen is– **2 and 1**
- A certain orbital has no angular nodes and two radial nodes. The orbital is– **3s**
- The maximum number of electrons in a subshell is given by the expression– **4*l* + 2**

EXAM POINT

Sub–atomic particles and atomic models

The pair, of ions in isoelectronic with Al^{3+} is–	**O^{2-} and Mg^{2+}**	**JEE Main-25.06.2022, Shift-I**
Molecules contains an incomplete octet of the central atom–	**$AlCl_3$**	**Kerala CEE -03.07.2022**
The oxide contains an odd electron at the nitrogen atom is–	**NO_2**	**JEE Main-26.06.2022, Shift-II**
The difference between number of Neutrons and Protons is positive for–	**Tritium atom**	**MPPET-2013**
One atom of $^{39}_{19}K$ contains–	**19p; 20n and $19e^-$**	**AP-EAMCET/1991**

There are six electrons, six protons and six neutrons in an atom of an element. The atomic number of the element is– **6**	**NDA (II)-2016**
The atomic number of the element with symbol Uus is– **117**	**TS-EAMCET-2016**
The sum of the total number of neutrons present in protium, deuterium and tritium is– **3**	**TS-EAMCET (Engg.), 05.08.2021 Shift-II**
$_{20}Ca^{40}$ has magic number of **–** **Protons and Neutrons**	**AP EAMCET (Medical) - 1998**
The species that has the same number of electrons as $^{35}_{17}Cl$ is**–** $^{40}_{18}Ar^{+}$	**NDA (II)-2017**
The characteristics of elements X, Y and Z with atomic numbers, respectively, 33, 53 and 83 are– **X is a metalloid, Y is a non-metal and Z is a metal**	**JEE Main 16.03.2021, Shift-II**
The masses of an electron, a proton and a neutron respectively will be in the ratio– **1836.15 : 1838.68**	**AP EAPCET 20.08.2021 Shift-I**
Elements X and Y belong to the same group. 19, 55 Set of atomic numbers represent– **X and Y**	
The number of protons in a negatively charged atom (anion) is– **Less than the number of electrons in the atom**	**NDA (II)-2011**
Number of protons atomic number of – Element	**NDA (II)-2011**
Isotope used in brain scan is**–** $_6C^{11}$	**SRMJEEE-2010**
The number of electrons and neutrons of an element is 18 and 20 respectively. Its mass number is**–** **38**	**AIIMS-1994**
The number of electrons in $[_{19}K^{40}]^{-1}$ is– **20**	**AIIMS-1994**
Positron is**–** **Electron with positive charge**	**AIIMS-1998**
The nitride ion in lithium nitride is composed of– **7 protons + 10 electrons**	**CG PET -2018**
Isoelectronic pair**–** CN^{-}, O_3	**JCECE - 2013**
N_2 and CO are– **Isoelectronic**	**J & K CET-(2002)**
The symbol of the species with number of electrons, protons and neutrons as 18, 16 and 16 respectively is– $^{32}_{16}S^{2-}$	**AMU-2014**
Atomic number equal to the**–** **Number of the protons in the nucleus**	**AMU–2001**
The ratio of electron, proton and neutron in tritium is– **1 : 1 : 2**	**Assam CEE-2014**
The number of electrons, protons and neutrons in phosphide ion (P^{3-}) is**–** **18, 15, 16**	**Assam CEE-2021**
The energy released in an atom bomb explosion is mainly due to**–** **Lesser mass of products than initial material**	**BCECE-2006**
n/p ratio during positron decay**–** **Increases**	**CG PET- 2015**
If the de-Broglie wavelength of the electron in n^{th} Bohr orbit in a hydrogenic atom is equal to $1.5\pi a_0$ (a_0 is Bohr radius), then the value of n/Z is– **0.75**	**[JEE Main 2019, 12 Jan Shift-II]**
The introduction of a neutron into the nucleus of an atom would lead to a change in– **Atomic mass**	**CG PET -2019**
The element with atomic number 55 belongs to block of the periodic table is– ***s*-block**	**CG PET -2004**
Neutrons are found in atoms of all elements except in– **Hydrogen**	**CG PET -2004**
The triad of the nuclei that is isotonic**–** $_6C^{14}$, $_7N^{15}$, $_9F^{17}$	**HP CET-2018**
Three elements X, Y and Z are in the 3rd period of the periodic table. The oxides of X, Y and Z, respectively, are basic, amphoteric and acidic. The order of the atomic number of X, Y and Z is**–** **X < Y < Z**	**(JEE Main 2020, 2 Sep Shift-II)**
The group having isoelectronic species is– O^{2-}, F^{-}, Na^{+}, Mg^{2+}	**(JEE Main-2017)**
Sets of ions represents a collection of isoelectronic species– K^{+}, Cl^{-}, Ca^{2+}, Sc^{3+}	**Assam CEE-2020 (AIEEE 2006)**
According to the periodic law of elements, the variation in properties of elements is related to their– **Atomic numbers**	**(AIEEE 2003)**
The group number, number of valence electrons and valency of an element with atomic number 15, respectively, are– **15, 5 and 3**	**(JEE Main 2019, 12 April Shift-I)**
The isoelectronic set of ions is– N^{3-}, O^{2-}, F^{-} and Na^{+}	**(JEE Main 2019, 10 April Shift-I)**

The size of the iso-electronic species Cl^-, Ar and Ca^{2+} is affected by– **nuclear charge**	**(JEE Main 2019, 8 April Shift-I)**
The atomic number of unnilunium is– **101**	**(JEE Main 2020, 6 Sep Shift-II)**
Constitutes a group of the isoelectronic species are– NO^+, C_2^{2-}, CN^-, N_2	**JEE Main-09.10.2018**
Atoms with identical atomic number but different atomic mass number are known as– **Isotopes**	**J & K CET-(2014)**
Negatively charged particles are called– **Electrons**	**J & K CET-(2014)**
Mass number of an atom is the sum of– **Number of protons + number of neutrons**	**J & K CET-(2014)**
Mass of a proton is– **1.00727 amu.**	**J & K CET-(2014)**
$^{39}_{19}$**K** and $^{40}_{20}$**C** are– **Isotones**	**J & K CET-(2001)**
The specific heat of a metal is 0.11 and its equivalent weight is 18.61. Its exact atomic weight is– **55.83**	**J & K CET-(1998)**
Species is isotonic with $_{37}Rb^{86-}$ $_{38}Sr^{87}$	**J & K CET-(1997)**
Atoms with same atomic number and different mass numbers are called– **Isotopes**	**JCECE - 2009**
The number of electrons, neutrons and protons in a species are equal to 10,8 and 8 respectively. The proper symbol of the species is– $^{16}_{8}O^{2-}$	**JIPMER-2011**
In long form of periodic table the properties of the elements are a periodic function of their– **Atomic number**	**JIPMER-2010**
If two atoms have equal number of electron it is called– **Isoelectronic**	**JIPMER-2019**
The number of electrons, protons and neutrons in a species are equal to 10, 11 and 12 respectively. The proper symbol of the species is– $^{23}_{11}Na^+$	**Kerala-CEE-2020**
1 u (amu) is equal to– 1.492×10^{-10} **J**	**MHT CET-2010**
The number of protons, neutrons and electrons in $^{175}_{71}Lu$, respectively, are– **71, 104and 71**	**NEET-2020**
Isoelectronic speicies are– **CO,** CN^-, NO^+, C_2^{2-}	**AMU-2011** **NEET-2000**
Atomic number of an element is equal to the number of– **Protons**	**UP CPMT-2005**
Unit positive charge and 1 amu mass is– **Proton**	**UP CPMT-2003**
The atomic number of an element is 17. The number of orbitals containing electron pairs in its valence shell is– **3**	**UP CPMT-2001**
The binding energy of an atom is 128 MeV. The binding energy per nucleon is 8, the number of nucleon is– **16**	**UP CPMT-2001**
Rutherford's alpha-particle scattering experiment was responsible for the discovery of– **Nucleus**	**NDA (I)-2017**
The number of periods present in the long form of the periodic table is– **7**	**AP-EAMCET (Med.)-1999**
The discovery of cathode rays are made up of electrons– **J. J. Thomson**	**MPPET- 2009**
When 4p orbital in any atom is filled completely, the next electron goes in– **5s**	**AP-EAMCET-1991**
According to Aufbau principle, the sub-shell is occupied by the electron, first has– **Lower energy**	**AP-EAMCET-1993**
Rutherford's experiment on scattering of α-particles showed for the first time that the atom has– **Nucleus**	**AP-EAMCET-1995**
In Rutherford's α-ray scattering experiment, the alpha particles are detected using a screen coated with– **Zinc sulphide**	**AP-EAMCET-1999**
The nucleus of an atom contains– **Proton and neutron**	**MPPET-2008**
"The properties of elements are periodic functions of their atomic weights." This periodic law was given by– **Mendeleev**	**AP EAMCET (Engg.) 17.09.2020 Shift-I**

The number of protons , neutrons and electrons in ${}^{13}_{6}C$ respectively are– **6, 7, 6**	**AP EAPCET 20.08.2021 Shift-I**
The wavelength of a spectral line emitted by hydrogen atom in the Lyman series is $\frac{16}{15R}$ cm. the value of n_2 (R = Rydberg constant)– **4**	**AIIMS-2011**
According to Moseley, a straight line group is obtained on plotting– **The square root of the frequencies of characteristics X-rays of elements against the atomic numbers**	**SRMJEEE – 2008**
Television picture tube is basically– **Cathode ray tube**	**AMU-2014**
The charge on an electron was discovered by– **Neil Bohr**	**BCECE-2004**
Rutherford's famous experiment with α- particles used this metal– **Au**	**BCECE-2009**
Transition of an electron in H-atom will emit maximum energy– $\mathbf{n_3 \longrightarrow n_2}$	**BCECE-2017**
The energy of an electron in n^{th} orbit of hydrogen atom is– $\mathbf{-\frac{13.6}{n^2} eV}$	**CG PET -2007**
For d-electron, the orbital angular momentum is– $\mathbf{\frac{\sqrt{6}\, h}{2\pi}}$	**J & K CET-(2004)**
Rutherford's experiment on the scattering of α-particles showed for the first time that the atom has– **Nucleus**	**UPTU/UPSEE-2005**
Development leading to the Bohr's model of atom	
The longest wavelength present in Balmer series lines is [Given Rydberg constant = 1.097 x 10^7 m^{-1}]– **656 nm**	
The energy of an electromagnetic radiation is 19.875×10^{-13} erg. its wave number in cm^{-1} is – **10000** (h=6.625×10^{-27} erg-s; c=3×10^{10} cm s^{-1})	**AP-EAMCET-2002**
The energy of a photon is 3×10^{-12} erg. its wavelength in nm is – **662** (h = 6.62×10^{-27} erg-s, c = 3×10^{10} cm s^{-1})	**AP-EAMCET-2006**
The velocities of two particles A and B are 0.05 and 0.02 ms^{-1} respectively. The mass of B is five times the mass of A. The ratio of their de-Broglie's wavelength is– **2:1**	**AP-EAMCET-2008**
Two particles of masses m & 2m have equal kinetic energies. The de-Broglie wavelength are in the ratio of– $\mathbf{\sqrt{2} : 1}$	**AP EAPCET 23-08-2021 Shift-I**
With velocity must an electron travel so that its momentum is equal to that of a photon of wavelength 663 nm– **1098 m/s**	**AP EAPCET 23-08-2021 Shift-I**
The relation between the stopping potential (V_0) and frequency (ν) is correctly represented in [ϕ = Work function]– $\mathbf{V_0 = \frac{h\nu}{e} - \frac{\varphi}{e}}$	**TS-EAMCET (Engg.), 05.08.2021 Shift-II**
de Broglie was awarded the Nobel Prize in the year– **1929**	**TS EAMCET 10.08.2021, Shift-I**
One mole of alkene X on ozonolysis gave one mole of acetaldehyde and one mole of acetone. The IUPAC name of X is– **2-methyl-2butene**	**AP EAMCET (Engg.)-2009**
If the wavelength (λ) is equal to the distance travelled by the electron in one second h is the Planck's constant and m is the mass of electron $\mathbf{\lambda = \sqrt{h/m}}$	**TS EAMCET 04.08.2021, Shift-I**
If the energies of two light radiations E_1 and E_2 are 25 eV and 100 eV respectively, then their respective wavelength λ_1 and λ_2 would be in the ratio $\lambda_1 : \lambda_2$ = **4 : 1**	**AP EAPCET 19-08-2021, Shift-II**
De Broglie relationship has no significance for– **An iron ball.**	**SRMJEEE – 2009**
The wavelength associated with a particle of mass 3.313×10^{-31} kg moving with velocity 10^3 m/s is– $\mathbf{2 \times 10^{-6}}$ **m**	**SRMJEEE – 2010**

Frequencies of radiation (in Hz) has a wavelength of 600 nm– **5.0×10^{14}**	**AP-EAMCET- (Engg.)- 2011**
If the kinetic energy of a particle is reduced to half, de-Broglie wavelength becomes– **$\sqrt{2}$ times**	**AP-EAMCET (Engg.) 2015**
The frequency of radiation emitted, when an electron falls from n = 3 to n = 1. in a hydrogen atom would be– **$2.92\times10^{15}s^{-1}$**	**AP- EAPCET- 07-09-2021, Shift-I**
Transitions of an electron in hydrogen atom emits radiation of the lowest wavelength **$n_2 = 2$ to $n_1 = 1$**	**AP-EAMCET- (Engg.) - 2010**
The basis of quantum mechanical model of an atom is– **Dual nature of electron**	**AP-EAMCET (Engg.) 2013**
The wave number of 4th line in Balmer series of hydrogen spectrum is– ($R = 1{,}09{,}677\ cm^{-1}$) **$24{,}372\ cm^{-1}$**	**AP - EAMCET (Medical) - 2007**
The wavelengths of two photons are 2000Å and 4000Å respectively. The ratio of their energies– **2**	**VITEEE 2019**
The wavelengths of electron waves in two orbits is 3 : 5. The ratio of kinetic energy of electrons will be– **25 :9**	**VITEEE- 2009**
Ratio of energy of photon of wavelength 3000Å and 6000Å is– **2 : 1**	**AIIMS-2012**
The de Broglie wavelength associated with a ball of mass 1 kg having kinetic energy 0.5 J is– **6.626×10^{-34} m**	**AIIMS-2006**
The de- Broglie wavelength of an electron in the ground state of hydrogen atoms is– **0.3328nm** (K.E.= 13.6eV; $1ev=1.602\times10^{-19}$ J)	**AIIMS-2000**
The wavelength of visible light is– **3800Å–7600Å**	**AIIMS-1998**
The de-Broglie wavelength of a particle with mass 1 g and velocity 100 m/s is– **6.63×10^{-33} m**	**NEET-1999**
If the Planck's constant $h = 6.6\times10^{-34}$ Js, the de Broglie wavelength of a particle having momentum of $3.3\times10^{-24}\ kg\ ms^{-1}$ will be– **2Å**	**BITSAT 2018**
The energy of one mole of photons of radiation whose frequency is 5×10^{14} Hz will be– **$199.51\ KJ\ mol^{-1}$**	**AMU-2015, 2007**
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]– **211.6 π pm**	**NEET-Odisha 2019**
The mass of a photon with wavelength 3.6Å shall be– **61.35×10^{-34} kg**	**AMU-2006**
The de-Broglie wavelength (λ) associated with a photoelectron varies with the frequency (ν) of the incident radiation as, [ν_0 is threshold frequency]– **$\lambda\ \mu\ \frac{1}{(\nu-\nu_0)^{\frac{1}{2}}}$**	**[JEE Main 2019, 11 Jan Shift-II]**
The wavelength of a ball of mass 100 g moving with a velocity of 100 ms^{-1} be– **6.626×10^{-35} m**	**Assam CEE-2020**
The energy ratio of a photon of wavelength 3000 Å and 6000 Å is– **2 : 1**	**BCECE-2007**
The increasing order of wavelength for He^+ ion, neutron (n) and electron (e) particles, moving with the same velocity is– **$\lambda_{He^+} < \lambda_n < \lambda_e$**	**BCECE-2016**
The relationship between energy (E) of wavelengths 2000 Å and 8000 Å, respectively is– **$E_1 = 4E_2$**	**BCECE-2016**
Equations represent de- Broglie relation– **$\lambda = \frac{h}{mv}$**	**CG PET -2008 WB-JEE-2008 J & K CET-(1999) AIIMS-1994**
The wavelength of associated wave of a particle moving with a speed of one-tenth that of light is 7Å. The particle must be– **Electron**	**CG PET -2017**
A gas absorbs photon of 355 nm and emits at two wavelengths. If one of the emission is at 680 nm, the other is at– **743 nm**	**[AIEEE-2011]**

For emission line of atomic hydrogen from $n_i = 8$ to $n_f = n$, the plot of wave number (ν) against $\left(\frac{1}{n^2}\right)$ will be (The Rydberge constant, R_H is in wave number unit)– **linear with slope R_H**	**[JEE Main 2019, 9 Jan Shift-I]**
The de Broglie wavelength of particle is– **Inversely proportional to its momentum**	**J & K CET-(2012)**
If the de-Broglie wavelength of a particle of mass m is 100 times its velocity, then its value in terms of its mass (m) and planck's constant (h) is– $\mathbf{10\sqrt{\frac{h}{m}}}$	**J & K CET-(2009)**
The de-Broglie wavelength of helium atom at room temperature is– $\mathbf{7.34 \times 10^{-11}}$ **m**	**JCECE - 2013**
Dual nature of particle was given by– **de-Broglie equation**	**J&K CET (2010)** **JIPMER-2005**
The number of photons emitted per second by a 60 W source of monochromatic light of wavelength 663 nm is ($h = 6.63 \times 10^{-34}$ Js)– $\mathbf{2\times 10^{20}}$	**Kerala-CEE-2009**
The relationship between the energy E_1 of the radiation with a wavelength 8000 Å and the energy E_2 of the radiation with a wavelength 16000 Å is– $\mathbf{E_1 = 2E_2}$	**Kerala-CEE-2005**
The de Broglie wavelength of the matter wave associated with an object dropped from a height x, when it reaches the ground is proportional to– $\mathbf{\frac{1}{\sqrt{x}}}$	**Kerala-CEE-2020**
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– $\mathbf{\lambda_1 = 2\lambda_2}$	**NEET-2011**
Time period of a wave is 5×10^{-3} sec what is the frequency– $\mathbf{2\times10^2\ s^{-1}}$	**UPTU/UPSEE-2008**
If the uncertainty in velocity of a moving object is 1.0×10^{-6} ms^{-1} and the uncertainty in its position is 58 m, The mass of this object is approximately equal to that of– **electron** ($h = 6.626\times10^{-34}$ Js)	**AP EAMCET (Medical) - 2013**
If the uncertainty in momentum and uncertainty in the position of a particle are equal. then the uncertaintiy in its velocity would be given by– $\mathbf{\Delta v \geq \frac{1}{2m}\sqrt{\frac{h}{\pi}}}$	**AP EAPCET 24.08.2021, Shift-I** **CG PET -2019**
Both the position and exact velocity of an electron in an atom cannot be determined simultaneously and accurately. This is known as– **Heisenberg uncertainty principle**	**TS-EAMCET 09.08.2021, Shift-I**
Heisenberg's uncertainty principle is in general significant to– **Micro particles having a very high speed**	**TS EAMCET 04.08.2021, Shift-I**
The Heisenberg uncertainty principle may be stated as– $\mathbf{\Delta x.\Delta v \geq h/4\pi m}$	**WB-JEE-2012, AMU-2004**
The de Broglie wavelength of an electron in the 4th Bohr orbit is– $\mathbf{8\pi a_0}$	**[JEE Main 2020, 9 Jan Shift-I]**
The energy of a photon is 3×10^{-12} erg. Its wavelength in nm is – **662**	**JCECE - 2009**
The de-Broglie wavelength of a particle with mass 1 kg and velocity 100 m/s is– $\mathbf{6.6 \times 10^{-36}}$ **m**	**JIPMER-2008, JCECE - 2007** **AP-EAMCET (Engg.) 1997, 1996** **AP – EAMCET - (Medical)-1997** **NEET-1999**
Uncertainty principle is valid for– **Proton**	**Kerala-CEE-2017**
The ratio of de-Broglie wavelengths for electrons accelerated through 200 V and 50 V is– **1 : 2**	**Manipal-2020**

If uncertainty in position and velocity are equal, then uncertainty in momentum will be– **$\frac{1}{2}\sqrt{\frac{mh}{\pi}}$**	**Manipal-2018**
If uncertainty in position and momentum are equal, then uncertainty in velocity is– **$\frac{1}{2m}\sqrt{\frac{h}{\pi}}$**	**NEET-2008**
If E_e, E_α and E_p represent the kinetic energies of an electron, α-particle and a proton respectively each moving with same de-Broglie wavelength then– **$E_e > E_p > E_\alpha$**	**UP CPMT-2011**
Series of lines is found in the UV region of atomic spectrum of hydrogen– **Lyman**	**AP-EAMCET-1991**
Among the first lines of Lyman, Balmer, Paschen and Brackett series in hydrogen atomic spectra, the highest energy has – **Lyman**	**AP-EAMCET-1999**
The values of n_1 and n_2 for the 2^{nd} line in the Lyman series of hydrogen atomic spectrum is – **1 and 3**	**AP-EAMCET-2000**
The wavelength of spectral line emitted by hydrogen atom in the Lyman series is $\frac{16}{15R}$ cm. The value of n_2 (R=Rydberg constant)– **4**	**AP-EAMCET-2007**
The ratio of the highest to the lowest wavelength of Lyman series is– **4 : 3**	**TS-EAMCET (Engg.) 05.08.2021 Shift-II**
Extracted through alloy formation– **Silver**	**SCRA - 2009**
The spectrum of Helium is expected to be similar to that of– **Li^+**	**AP EAPCET 19-08-2021 Shift-I** **NEET-1998**
Electron transitions in the H-atom will release the largest amount of energy– **n=2 to n=1**	**COMEDK-2012**
The first emission line on hydrogen atomic spectrum in the Balmer series appears at (R = Rydberg constant)– **$\frac{5R}{36}cm^{-1}$**	**AP-EAMCET (Medical), 2006** **AP EAMCET (Medical) - 1998** **AP-EAMCET (Engg.) - 1998**
The values of n_1 and n_2 respectively for H_β line in the Lyman series of hydrogen atomic spectrum are– **1 and 3**	**AP-EAMCET (Medical), 2006**
The frequency of light emitted for the transition n = 4 to n = 2 of He^+ is equal to the transition in H atom corresponding– **n = 2 to n = 1**	**AIEEE-2011**
Orbitals will have zero probability of finding the electron in the yz plane– **p_x**	**WB-JEE-2010**
$\left({}_{32}Ge^{76}, {}_{34}Se^{76}\right)$ and $({}_{14}Si^{30}, {}_{16}S^{32})$ are examples of– **isobars and isotones**	**WB-JEE-2014**
${}_{19}K^{40}$ and ${}_{20}Ca^{40}$ are known as– **isobars**	**UP CPMT-2002**
O_2 and O_3 are– **allotropes**	**UP CPMT-2010**
An isobar of ${}_{20}Ca^{40}$ is– **${}_{18}Ar^{40}$**	**MHT CET-2008**
Isotones have– **same number of neutrons**	**UP CPMT-2010**
Isoelectronic is– **CN^-, CO**	**NEET-2002**
Cl^-, Ar, Ca^{2+}, Ti^{4+} clement represents is– **Isoelectronic sequence**	**AP-EAMCET (Medical), 2006**

Hydrogen Atom

If the radius of the 3rd Bohr's orbit of hydrogen atom is r_3 and the radius of 4th Bohr's orbit is r_4. Then:– $\mathbf{r_4 = \frac{16}{9} r_3}$	**JEE Main-26.06.2022, Shift-I**
The hydrogen line spectrum provides evidence for the– **Quantized nature of atomic energy states**	**SCRA-2012**
The energy of an electrons in the 3rd orbit of an atom is –E. The energy of an electron in the first orbit will be– **–9E**	**MPPET- 2009**
The velocity of an electron in the first Bohr orbit is v_1. Its velocity in the third Bohr's orbit is– $\mathbf{v_1/3}$	**SCRA-2010**
The energy of the electron in the hydrogen atom is given by the expression :– $\mathbf{\frac{-2\pi^2 Z^2 e^4}{n^2 h^2}}$	**AP-EAMCET-1991**
The basic assumption of Bohr's model of hydrogen atom is that : **the angular momentum of the electron is quantised**	**AP-EAMCET-1994**
The radius of the second Bohr's orbit is :– **0.212 nm**	**AP-EAMCET-1995**
In the Bohr hydrogen atom, the electronic transition emiting light of longest wavelength is:– **n = 4 to n = 3**	**AP-EAMCET-1997**
The energy of an electron present in Bohr's second orbit of hydrogen atom is :– **– 328 kJ mol^{-1}**	**AP EAMCET (Engg.) 2001**
An electron is moving in Bohr's fourth orbit. Its de-Broglie wavelength is λ. The circumference of the fourth orbit is– **4λ**	**VITEEE-2014**
The energy (in ev) associated with the electron in the 1st orbit of Li^{2+} is– **– 122.4**	**TS-EAMCET (Engg.), 07.08.2021 Shift-II**
If the wavelength of the first line of Balmer series is 656 nm, then the wavelengths of its second line and limiting line respectively are ——— **485.9 nm & 364.4 nm**	**AP EAPCET 25.08.2021, Shift-II**
The electron in the hydrogen jump on absorbing 12.75 eV of energy would jump to ____orbit– **4**	**AP EAPCET 24.08.2021 Shift-II**
On the basis of Bohr's model. The radius of the 3rd orbit is– **9 times the radius of 1st orbit**	**AP EAPCET 19-08-2021 Shift-I**
Energy associated with the first orbit of He^+ is– **-8.72×10^{-18} joules**	**COMEDK-2015 AMU-2015**
Assuming Rydberg constants are equal, the ground state energy of the electron in hydrogen atom is equal to– **the first excited state energy of the electronic He^+**	**COMEDK-2020**
The wavelength (in Å) of an emission line obtained for Li^{2+} during an electronic transition from $n_2 = 2$ to $n_1 = 1$ is (R = Rydberg constant)– $\mathbf{\frac{4}{27R}}$	**AP-EAMCET (Medical), 2008**
The ratio of potential energy (PE) and total energy of an electron in a Bohr orbit of the hydrogen atom is– 2	**TS-EAMCET 09.08.2021, Shift-I**
The maximum energy is possessed by an electron, when it is present– **at infinite distance from the nucleus**	**AIIMS-1996**
In second orbit of H atom the velocity of e^- is:– **10.9×10^5 m/sec**	**AIIMS-27 May, 2018 AIIMS-2001**
In hydrogen atomic spectrum, a series limit is found at 12186.3 cm^{-1}. Then, it belongs to– **Paschen series**	**AIIMS-2014**
If velocity of an electron in the first Bohr orbit of H is v_1 then velocity in second orbit will be– $\mathbf{\frac{v_1}{2}}$	**SRMJEEE – 2007**
If the energy of an electron in the second Bohr orbit of H-atom is –E, the energy of the electron in the Bohr's first orbit is– **–4E**	**SRMJEEE – 2010**
In a hydrogen atom, the electron is at a distance of 4.768 Å from the nucleus. The angular momentum of the electron is– $\mathbf{\frac{3h}{2\pi}}$	**AP- EAMCET(Medical) - 2010**

According to Bohr's theory, the angular momentum for an electron of 3rd orbit is– **$3\hbar$**	**VITEEE 2014**
In the hydrogen transition spectrum would have the same wavelength as the Balmer transition, n = 4 to n = 2 of He^+ spectrum– **n = 2 to n = 1**	**VITEEE-2013**
The degeneracy of the level of H-atom that has energy $\left(-\frac{R_H}{9}\right)$ is– **9**	**VITEEE 2013**
The energy of electron in n^{th} orbit of hydrogen atom is– **$-\frac{13.6}{n^2}$ eV**	**AMU EXPLORER-2002** **Karnataka-CET-2016**
The spectrum of H^+ is expected to be similar to that of– **He^+**	**AMU EXPLORER-2002**
The ratio of energy of the electron in ground state of hydrogen to the electron in first excited state of Be^{3+} is– **1 : 4**	**Assam CEE-2014**
The energy of an electron in second Bohr orbit of hydrogen atom is– **-5.44×10^{-19} J**	**AIIMS 26 May 2019 (Evening)** **BITSAT 2017** **BCECE-2010**
The wave number of the spectral line in the emission spectrum of hydrogen will be equal to 8/9 times the Rydberg's constant if the electron jumps from– **n = 3 to n = 1**	**BCECE-2014**
The wave number of the limiting line in Lyman series of hydrogen is 109678 cm^{-1}. The wave number of the limiting line in Balmer series of He^+ would be:– **109678 cm^{-1}**	**BITSAT-2014**
If the radius of H is 0.53 Å, then the radius of $_3Li^{2+}$ is– **0.17 Å**	**BITSAT-2012**
The first emission line in the atomic spectrum of hydrogen in the Balmer series appears at– **$\frac{5R}{36}$ cm^{-1}**	**BITSAT-2016**
Bohr's radius of 2^{nd} orbit of Be^{3+} is equal to that of– **first orbit of hydrogen**	**CG PET -2009**
The radius of the second Bohr orbit in terms of the Bohr radius, a_0, in Li^{2+} is– **$\frac{4a_0}{3}$**	**[JEE Main 2020, 8 Jan Shift-II]**
Bohr model of hydrogen atom was unable to explain– **Heisenberg's uncertainty principle**	**J & K CET-(2012)**
Energy of one mole of photons of radiation whose frequency is 5×10^{14} Hz is– **199.51 kJ mol^{-1}**	**J & K CET-(2014)**
The value of Rydberg constant is– **109678 cm^{-1}**	**J & K CET-(2007)**
The wavelength of a spectral line in Lyman series, when electron jumping back to 2^{nd} orbit, is– **1216**	**J & K CET-(2007)**
The value of n_l in the relationship is $\frac{1}{\lambda} = R_H\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$ is correct when $n_2 > n_1$ corresponds to Paschen lines in the Hydrogen spectrum– **3**	**J & K CET-(2001)**
Transition from n=4, 5, 6 to n = 3 in hydrogen spectrum gives– **Paschen series**	**J & K CET-(2000)**
The expression of angular momentum of an electron in a Bohr's orbit is:– **$\frac{nh}{2\pi}$**	**JCECE - 2003**
Ratio of kinetic energy of hydrogen and helium gas at 300 K is :– **1 : 1**	**JCECE - 2006**
When an electron in hydrogen spectrum jumps from n = 7 to n = 2, the total number of spectral lines possible are– **15**	**JCECE - 2016**
An electron is moving in Bohr's fourth orbit. Its de-Broglie wave length is λ. The circumference of the fourth orbits is– **4λ**	**JIPMER-2014**
The ratio of the difference in energy between the first and the second Bohr orbit to that between the second and the third Bohr orbit is– **27/5**	**JIPMER-2012**
Ratio of radii of second and first Bohr orbits of H atom is– **4**	**JIPMER-2005**
The number of waves formed by a Bohr electron in one complete revolution in its second orbit is– **Two**	**JIPMER-2016**

If the energies of the two photons in the ratio of 3 : 2, their wavelength will be in the ratio of– **2 : 3**	**Karnataka-CET-2011**
The radius of the first Bohr orbit of hydrogen atom is 0.529Å. The radius of the third orbit of H^+ will be– **4.29Å**	**Kerala-CEE-2007**
The ratio of frequency corresponding to the third line in Lyman series of hydrogen atomic spectrum to that of the first line in Balmer series of Li^{2+} spectrum is– $\mathbf{\frac{3}{4}}$	**Kerala-CEE-2012**
The shortest wavelength of the line in hydrogen atomic spectrum of Lyman series when R_H = 109678 cm^{-1} is– **911.7 Å**	**Kerala-CEE-2014**
In the hydrogen atom spectrum, the emission of the least energetic photon taken place during the transition from n= 6 energy level to n = ...energy level.– **5**	**Kerala-CEE-2016**
The energy of an electron is the 3s orbital (excited state) of H – atom is– **–1.5eV**	**Kerala-CEE-2017**
In the atomic spectrum of hydrogen, the spectral lines pertaining to electronic transition of n = 4 to n = 2 refers to :– **Balmer series**	**Manipal-2018**
If r is the radius of the first orbit, the radius of n^{th} orbit of H-atom is given by– $\mathbf{rn^2}$	**NEET-1988**
The energy of an electron in the n^{th} Bohr orbit of hydrogen atom is– $\mathbf{-\frac{13.6}{n^2}\,eV}$	**NEET-1992**
The modified Bohr's theory by introduction elliptical orbits for electrons path– **Sommerfeld**	**NEET-1999**
The energy of second Bohr orbit of the hydrogen atom is –328 kJ mol^{-1}. hence the energy of fourth Bohr orbit would be– **–82 kj mol^{-1}**	**NEET-2005**
Number of spectral lines of Lyman series of electron when it jumps from 6 to first level (in Lyman series), is– **15**	**UP CPMT-2009**
The wave number of 4^{th} line in Balmer series of hydrogen spectrum is– (R = 1,09,677 cm^{-1})– **24,372 cm^{-1}**	**UP CPMT-2008**
The energy of second Bohr orbit of the hydrogen atom is – 328 kJ mol^{-1}; hence the energy of fourth Bohr orbit would be– **–82 kJ mol^{-1}**	**UPTU/UPSEE-2007**
The wavelength of the radiation emitted, when in a hydrogen atom electron falls from infinity to stationary state, would be (Rydberg constant = 1.097×10^7 m^{-1})– **91 nm**	**UPTU/UPSEE-2007**
The radius of hydrogen atom in the ground state is 0.53Å.The radius of Li^{2+} ion (atomic number = 3) in a similar state is:– **0.176Å**	**UPTU/UPSEE-2014, 2005**
For a Bohr atom angular momentum M of the electron is : (n=0,1,2,....)– $\mathbf{\frac{nh}{2\pi}}$	**UPTU/UPSEE-2005**
The ratio of the difference in energy between the first and second Bohr orbit to that between the second and third Bohr orbit is– $\mathbf{\frac{27}{5}}$	**UPTU/UPSEE-2013**
An electron from one Bohr stationary orbit can go to next higher orbit– **by absorption of electromagnetic radiation of particular frequency**	**UPTU/UPSEE-2008**
For the Paschen series the values of n_1 and n_2 in the expression $\Delta E = R_H c\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$– **$n_1$=3,$n_2$=4,5,6,…**	**WB-JEE-2009**
In Sommerfeld's modification of Bohr's theory, the trajectory of an electron in a hydrogen atom is– **a perfect ellipse**	**WB-JEE-2010**
The electronic transitions from n = 2 to n = 1 will produce shortest wavelength in (Where n = principal quantum state)– **Li^{2+}**	**WB-JEE-2011**
The energy of an electron in first Bohr orbit of H-atoms is 13.6 eV. the possible energy value of electron in the excited state of Li^{2+} is– **–30.6 eV**	**WB-JEE-2011**
The emission spectrum of hydrogen discovered first and the region of the electromagnetic spectrum in it belongs, respectively are– **Balmer, visible**	**WB-JEE-2014**

The time taken for an electron to complete one revolution in Bohr orbit of hydrogen atom is– $\mathbf{\frac{4\pi^2mr^2}{nh}}$	**WB-JEE-2016**
The ratio of the shortest wavelength of two spectral series of hydrogen spectrum is found to be about 9. The spectral series are– **Lyman and Paschen**	**[JEE Main 2019, 10 April Shift-II]**
The shortest wavelength of H atom in the Lyman series is λ_1. The longest wavelength in the Balmer series of He^+ is– $\mathbf{\frac{9\lambda_1}{5}}$	**[JEE Main 2020, Sep Shift-II]**
The values of n_1 and n_2 respectively for H_β line in the Lyman series of hydrogen atomic spectrum 44 are– **1 and 3**	**JIPMER-2009**
X-rays are electromagnetic radiation whose wavelengths are of the order of:– $\mathbf{10^{-10}}$ **metre**	**NDA (II)-2015**
The shortest wavelength in hydrogen spectrum of Lyman series when R_H = 109678 cm^{-1}, is– **911.7Å**	**Kerala-CEE-2010**
The longest wavelength line in Balmer series of spectrum is– **656 nm**	**NEET-1996**
The wave number of hydrogen atom in Lymen series is 82200 cm^{-1}. The electron goes from– $\mathbf{n_2 \rightarrow n_1}$	**UPTU/UPSEE-2013**
Splitting of spectrum lines in magnetic field is– **Zeeman effect**	**UPTU/UPSEE-2008**
In hydrogen spectrum, the series of lines appearing in ultra violet region of electromagnetic spectrum are called :– **Lyman lines**	**Manipal-2017**

Towards quantum mechanical model of the atom.

The electronic configuration of Pt (atomic number 78) is– **[Xe] $\mathbf{4f^{14}\ 5d^9\ 6s^1}$**	**JEE Main-29.06.2022, Shift-I**
The number of nodal planes present in *s antibonding orbitals is– **1**	**Karnataka-CET, 2008**
Mg^{2+} is isoelectronic with– $\mathbf{Na^+}$	**Karnataka-CET-2007**
How many electrons are present in the M shell of the atom of an element with atomic number 24– **13**	**AP-EAMCET (Med.)-1999**
The symbol of the element 'Tungeston' is– **W**	**NDA (II)-2015**
Electronic configuration of potassium is– $\mathbf{1s^2,2s^2,2p^6,3s^2,3p^6,4s^1}$	**AP EAMCET- 1992**
Chlorine atom, in its third excited state, reacts with fluorine to form a compound X. The formula and shape of X are– $\mathbf{ClF_7}$**, pentagonal bipyramidal**	**AP EAMCET- 2003**
The electronic configuration of curium (Z = 96) is– **[Rn] $\mathbf{5f^7\ 6d^1\ 7s^2}$**	**JHARKHAND – 2019**
The number of unpaired electrons in carbon atom is– **Two**	**MPPET- 2009**
In the change of NO^+ to NO, the electron is added to a– **π* orbital**	**SCRA 2010**
The maximum number of electrons that can be accommodated in all the orbitals for l = 3, is– **14**	**AP-EAMCET-1991**
The rule that explains the reason for chromium to have [Ar] $3d^5$, $4s^1$ configuration instead of [Ar] $3d^4$, $4s^2$, is– **Hund's rule**	**AP-EAMCET-1996**
The electronic configuration of sodium is– **[Ne] $\mathbf{3s^1}$**	**AP-EAMCET-1999**
In the ground state, an element has 13 electrons in M shell. The element is– **Chromium**	**AP-EAMCET-2001**
If the electron of a hydrogen atom is present in the first orbit, the total energy of the electron is– $\mathbf{\frac{-e^2}{2r}}$	**AP-EAMCET-2003**
Elements have least number of electrons in its M shell– **K**	**AP-EAMCET-2004**
The atomic numbers of elements X, Y and Z are 19, 21 and 25 respectively. The number of electrons present in the M shell of these elements, the order is– **Z > Y > X**	**AP-EAMCET-2005**
The maximum number of sub-levels, orbitals and electrons in N shell of an atom are respectively– **4, 16, 32**	**AP-EAMCET-2007**
Orbital has zero radial nodes and 2 angular nodes– **3d**	**AP EAPCET 23-08-2021 Shift-I**

Pair are the ions isoelectronic– **Na^-, O^{2-}**	**NDA (I)-2019**
The element with the electronic configuration $1s^22s^22p^63s^23p^63d^{10}4s^1$ is– **Cu**	**TS-EAMCET-2016**
The number of unpaired electrons in Co^{2+}, is– **3**	**TS-EAMCET (Engg.), 07.08.2021 Shift-II**
$[Ar]3d^{10}4s^1$ electronic configuration belongs to– **Cu**	**MPPET-2008**
The electronic configuration of Cs is – **$[Xe]6s^1$**	**AP EAMCET (Engg.) 21.09.2020, Shift-II**
The element with atomic number 12 belongs to .... group and .... period– **II A, third**	**AP EAMCET (Engg.) 2001**
Electronic configuration of X is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$. It belongs to– **thirteenth group and third period**	**COMEDK-2017**
An orbital with n=3, ℓ=1 is designated as– **3p**	**COMEDK-2014**
The total number of orbitals in the fifth energy …….is– **25**	**AP-EAMCET (Medical), 2006**
The atomic number of an element is 35. What is the total number of electrons present in all the p-orbitals of the ground state atom of that element– **17**	**AP-EAMCET (Medical), 2003**
The total number of electrons present in all the ‘s’ orbitals, all the ‘p’ orbitals and all the ‘d’ orbitals of cesium ion are respectively– **10, 24, 20**	**AP-EAMCET (Medical), 2003**
An orbital with one angular node shows three maxima in its radial probability distribution curve, the orbital– **4p**	**TS EAMCET 05.08.2021, Shift-I**
Spectrum of Li^{2+} is similar to that of– **H**	**AIIMS-2002**
Element is represented by electronic configuration– $1s^2 2s^2 2p_x^1\ 2p_y^1 2p_z^1$ **Nitrogen**	**AIIMS-2001**
The outermost configuration of most electronegative element is– **$ns^2\ np^5$**	**AIIMS-2000**
The configuration $\mathbf{1s^2, 2s^2 2p^5, 3s^1}$ shows:– **Excited state of neon atom**	**AIIMS-1997**
Transition metal elements exhibit general electronic configuration– **$ns^{1-2}\ (n-1)\ d^{1-10}$**	**AP- EAPCET- 07-09-2021, Shift-I**
The atomic number of an element 'M' is 26. How many electrons are present in the M-shell of the element in its M^{3+} state– **13**	**AP - EAMCET (Medical) - 2007**
The orbital angular momentum of an electron in 2p orbital is– **$\sqrt{2}\ h/2\pi$**	**Assam CEE-2019**
The orbital angular momentum of a p-electron given as– **$\frac{h}{\sqrt{2}\pi}$**	**NEET-Mains 2012**
Orbital having 3 angular nodes and 3 total nodes to– **4f**	**Odisha NEET-2019**
The number of radial nodes of 3s and 2p orbitals are respectively– **2, 0**	**BITSAT-2017**
The element whose electronic configuration is $1s^2\ 2s^2\ 2p^6\ 3s^2$ is a– **metal**	**AMU-2004**
The electronic configuration of P in $H_3\ PO_4$– **$1s^2 2s^2, 2p^6, 3s^2 3p^6$**	**CG PET- 2011**
The pair having the similar shape is– **$BF_4^-$and NH_4^+**	**CG PET- 2011**
Quantum numbers ℓ = 2and m = 0 represent the orbital– **d_{z^2}**	**CG PET- 2016**
Electronic configuration of H^+ is– **$1s^0$**	**CG PET- 2010**
The electronic configuration of bivalent europium and trivalent cerium are (atomic number : Xe = 54, Ce = 58, Eu = 63)– **$[Xe]4f^7$ and $[Xe]4f^1$**	**(JEE Main 2020, 9 Jan Shift-I)**
In the sixth period, the orbitals that are filled are– **6s, 4f, 5d, 6p**	**(JEE Main 2020, 5 Sep Shift-I)**
Outermost electronic configuration of a group-13 element E is $4s^2\ 4p^1$. The electronic configuration of an element of p-block period-five placed diagonally to element, E is– **$[Kr]4d^{10}5s^25p^2$**	**(JEE Main 2021, 20 July Shift-II)**

According to Aufbau principle, the order of energy of 3d, 4s and 4p orbitals is– **4s <**	**J & K CET-(2006)**
Electronic configuration of deuterium atom is– **$1s^1$**	**J & K CET-(2005)**
Two nodal planes are present in– **$\pi^* 2p_x$**	**J & K CET-(2004)**
Ground state electronic configuration of nitrogen atom can be represented as– [↑↓] [↑↓] [↑ | ↑ | ↑]	**J & K CET-(2003)**
A 3p-orbital has– **one spherical and one non-spherical node**	**J & K CET-(1998)**
The element with the electronic configuration as [Ar] $3d^{10}4s^24p^3$ represents a– **metalloid**	**JCECE - 2010**
The electronic configuration of element with atomic number 24 is– **$1s^2, 2s^22p^6, 3s^23p^63d^5, 4s^1$**	**JCECE - 2010**
The outermost electronic configuration of the most electronegative element is– **ns^2np^5**	**JCECE - 2014**
If n=6, the sequence for filling of electrons will be.– **ns →(n-2) f→(n-1)d→np**	**JIPMER-2014**
The total number of orbitals in the fifth energy level is– **25**	**JIPMER-2009** **UP CPMT-2008**
The orbital nearest to the nucleus is– **4s**	**Karnataka-CET-2018**
The number of naturally occurring p-block elements that are diamagnetic is– **18**	**Karnataka-CET-2011**
The number of spherical nodes in 3p orbitals are/is– **one**	**NEET-1988**
The orientation of an atomic orbital is governed by– **magnetic quantum number**	**NEET-2006**
The total number of atomic orbitals in fourth energy level of an atom is– **16**	**NEET-2011** **UPTU/UPSEE-2004**
The stable electronic configuration of chromium is– **$3d^5\ 4s^1$**	**J & K CET-(2007)**
The ground state term symbol for an electronic state is governed by:– **Hund's rule**	**UPTU/UPSEE-2004**
The electronic configuration of the oxide ion is much most similar to the electron configuration of the– **nitride ion**	**UPTU/UPSEE-2009**
The electronic configuration $1s^22s^22p^63s^23p^63d^9$ represents a– **Metallic cation**	**WB-JEE-2008**
The number of unpaired electrons in Ni (atomic number = 28) are– **2**	**WB-JEE-2018**
For n=3 energy level the number of possible orbitals (all kinds) are– **9**	**CG PET -2005**
The number of radial nodes for 4p is– **2**	**SCRA-2015**
The magnetic quantum number m for the outermost electron in the Na atom is– **0**	**AP-EAMCET-1991**
"No two electrons in an atom can have the same set of all four quantum numbers". This principle of called– **Pauli's exclusion principle**	**AP EAMCET (Engg.) 18.09.2020, Shift-I**
How many emission spectral lines are possible when hydrogen atom is excited to nth energy level– **$\frac{(n-1)n}{2}$**	**TS EAMCET-2017**
A subshell n = 3, l = 2 can accommodate maximum of______– **10 electrons**	**AP EAPCET 20.08.2021 Shift-II**
The number of angular and radial nodes of 4d orbital respectively are– **2, 1**	**AP EAMCET (Engg.) -2014**
An electron having spin quantum number, s = –1/2 and magnetic quantum number, m=+3 can be present in– **f-orbital only**	**COMEDK-2012**
The number of radial nodes in 3s and 2p orbitals, respectively are– **2 ; 0**	**TS-EAMCET (Engg.), 06.08.2021**
The orbital with 4 radial and 1 angular nodes is– **$6p_z$**	**TS EAMCET 05.08.2021, Shift-I**
The orbital having two radial as well as two angular nodes is:– **5d**	**JEE Main 26.02.2021, Shift-I**
With increasing Principal Quantum number, the energy difference between adjacent energy levels in H-atom______– **Decreases**	**AP EAPCET 20.08.2021 Shift-II**
The maximum number of electrons, present in an orbit that is represented by azimuthal quantum number (l) = 3, will be– **14**	**AIIMS-1996**
Azimuthal quantum number defines– **angular momentum of electron**	**AIIMS-2002**

The quantum number 'm' of a free gaseous atom is associated with:– **the spatial orientation of the orbital**	**AIIMS-1998**
For principle quantum number n=4, the total number of orbitals having l=3 is:– **7**	**AIIMS-2004**
Quantum numbers of an atom can be defined on the basis of– **Pauli's exclusion principle**	**AIIMS-2002**
The total number of orbitals in a shell with principal quantum number 'n' is:– $\mathbf{n^2}$	**AIIMS-1997**
The number of angular and radial nodes of 4d orbital respectively are– **2, 1**	**AP-EAMCET (Engg.) - 2014**
The values of four quantum numbers of valence electron of an element are n = 4, l = 0, m = 0 and $\mathbf{s = +\frac{1}{2}}$. The element is :– **K**	**AP-EAMCET (Engg.)-2004**
The number of radial nodes of 3s and 2p orbitals respectively are– **2, 0**	**AP-EAMCET (Engg.) 2013**
With increase in principal quantum number n, the energy difference between adjacent energy levels in hydrogen atom– **decreases**	**AP - EAMCET(MEDICAL) - 2009**
The Balmer series in atomic hydrogen is observed in the spectral region– **visible**	**AMU-2014**
For the 19th electron of K the values of quantum number will be– $\mathbf{4, 0, 0, +\frac{1}{2}}$	**AMU-2010**
An electron with values 4,1,0 and +1/2 for the set of four quantum numbers n, l, m_l and m_s respectively, belongs to– **4p - orbital**	**AMU-2006**
An electron with values 4, 2,–2 and +1/2 for the set of four quantum numbers n, l, m_l and m_s, respectively, belongs to– **4d-orbital**	**AMU-2005**
The ion that is isoelectronic with CO is– $\mathbf{CN^-}$	**Assam CEE-2018** **UP CPMT-2012** **JCECE - 2006** **J & K CET-(1998)** **NEET-1997**
Azimuthal quantum number determines the– **angular momentum of orbitals**	**BCECE-2011**
An e^- has magnetic quantum number as –3, its principal quantum number is – **4**	**BITSAT 2016**
A particle of mass nearly equal to proton is moving with a velocity nearly equal to the velocity of light. The wavelength of wave associated with it is– **directly proportional to its velocity**	**CG PET -2018**
The number of orbitals associated with quantum number n = 5, $m_s = +\frac{1}{2}$ is– **25**	**[JEE Main 2020, 7 Jan Shift-I]**
The number of subshells associated with n = 4 and m = –2 quantum number is– **2**	**[JEE Main 2020, 2 Sep Shift-II]**
Maximum number of electrons in a shell principle quantum number n is given by– $\mathbf{2n^2}$	**J & K CET-(2012)**
The total number of orbitals associated with the principal quantum number n = 3, is– **9**	**J & K CET-(2014)**
The number electrons accommodated in an orbit with principal quantum number 2 is– **8**	**J & K CET-(2007)**
The total number of orbital's possible for principal quantum number n is– $\mathbf{n^2}$	**J & K CET-(2004)**
The maximum number of electrons in all those orbitals for principal quantum number is 3 and azimuthal quantum number 2, is– **10**	**J & K CET-(1997)**
The shape of the orbital with the value of *l* =2 and m = 0 is– **dumb-bell**	**JCECE - 2009**
The orbital angular momentum of an electron is 2s orbital is– **zero**	**JCECE - 2015**
The shape of an orbital is determined by– *l*	**JIPMER-2004**
Azimuthal quantum number (*l*) defined– **shape of orbitals**	**JIPMER-2019**
The set of quantum number for the unpaired electrons of chlorine atom is– **3, 1, 1, ±**	**Karnataka-CET-2017**
The set of four quantum numbers for the outermost electron of sodium (Z = 11) is– $\mathbf{3, 0, 0, \frac{1}{2}}$	**Karnataka-CET-2012**

The set of quantum numbers for the outermost electron for copper in its ground state is– **4, 0, 0, + $\frac{1}{2}$**	**Karnataka-CET, 2010**
The set of four quantum number for outermost electron of potassium (Z = 19) is–**4,**	**Karnataka-CET, 2009**
The azimuthal quantum number has the value of 2, the number of orbitals possible are– **5**	**Karnataka-CET, 2008**
The number of angular and radial nodes in 3p orbital respectively are– **1, 1**	**Kerala-CEE-29.08.2021** **Karnataka-CET-2021**
The number of electrons with azimuthal quantum number $l = 1$ and $l = 2$ for Cr in ground state respectively are– **12, 5**	**Kerala-CEE-2015**
The magnetic quantum number for d-orbital is given by :– **0, ±1, ±2**	**Manipal-2019**
For f-orbital the values of m are :– **–3, –2, –1, 0, +1, +2, +3**	**Manipal-2017**
The orbital angular momentum of an electron in 'f' orbital is– $\frac{\sqrt{3}h}{\pi}$	**MHT CET-2014**
The maximum number of electrons in a subshell is given by the expression– **$4l + 2$**	**NEET-1989**
The total number of electrons that can be accommodated in all the orbitals having principal quantum number 2 and azimuthal quantum number *1* are– **6**	**NEET-1990**
For azimuthal quantum number $l = 3$, the maximum number of electrons will be– **14**	**NEET-1991**
If n = 6, the sequence for filling of electrons will be– **ns → (n-2)f → (n-1)d → np**	**NEET-2011**
Maximum number of electrons in a subshell of an atom is determined by– **$4l +2$**	**NEET-2009**
The angular momentum of electron in 'd' orbital is equal to– $\sqrt{6}\frac{h}{2\pi}$	**NEET-2015, cancelled**
The maximum number of orbital's that can be identified with the quantum numbers are n= 3, l =1, m_1 = 0– **1**	**NEET-2014**
The maximum numbers of electrons that can be associated with the set of quantum numbers are n = 3, l = 1 and m = –1 **2**	**NEET-2013**
Two electrons occupying the same orbital are distinguished by– **spin quantum number**	**NEET-I 2016**
Maximum number of electrons in a subshell with l = 3 and n = 4 is– **14**	**NEET-2012**
The set of quantum number for 19^{th} electron of chromium (Z = 24) is– **4, 0, 0, + $\frac{1}{2}$**	**UP CPMT-2011**
No two electron can have the same values of …..quantum numbers.– **Four**	**UPTU/UPSEE-2004**
'No two electrons in an atom can have the same set of quantum numbers.' This principle is known by– **Pauli's exclusion principle**	**UPTU/UPSEE-2011**
The difference between orbital angular momentum of an electron in a 4f-orbital and another electron in a 4s-orbital is– **$2\sqrt{3}$**	**WB-JEE-2020**
Wave nature of electrons was demonstrated by– **Davisson and Germer**	**UP CPMT-2004** **J & K CET-(1999)**
The observation that the ground state of nitrogen atom has 3 unpaired electrons in its electronic configuration and not otherwise is associated with:– **Hund's rule of maximum multiplicity**	**JCECE - 2005**
The scientist who proposed the atomic model based one the quantization of energy for the first time was– **Neils Bohr**	**J & K CET-(2008)**
The quantum theory for the first time to explain the structure of satom by– **Bohr**	**J & K CET-(2005)**
The Pauli exclusion principle applies to– **H^-**	**Manipal-2016**

3. Chemical Thermodynamics

Thermodynamic Terms and Applications, Measurement of ΔU and ΔH Calorimetry

- The state function is an extensive property of system is– **Volume**
- A cup of tea placed in the room eventually acquires rom temperature by losing heat. The process may be considered close to– **Reversible process**
- A thermally isolated gaseous system can exchange energy with the surroundings. The mode of transference of energy can be– **Work**
- The expression for isothermal expansion of ideal gas is– $\mathbf{W_{rev} > W_{irr}}$
- A well stoppered thermos flask contains some ice cubes. This is an example of– **Isolated system**
- A gas expands isothermally and reversibly, the work done by a gas is– **Maximum**
- 4L - atm is equal to– **96 cal**
- The ammonium chloride is dissolved in water, the solution becomes cold. The change is– **Endothermic**
- The internal energy of one mole of an ideal gas is– $\mathbf{\frac{3}{2}RT}$
- Internal energy does not include– **Energy arising by gravitational pull**
- For the gaseous reaction ($N_2O_4 \rightarrow 2NO_2$)– $\mathbf{\Delta H > \Delta U}$
- A monoatomic neon possesses– **Only potential energy**
- In a change from state A to state B– **ΔU depends only on the initial and final state**
- The heat of combustion of solid benzoic acid at constant vlume is –321.30 kJ at 27°C. The heat of combustion at constant pressure is– **–321.30 – 150 R**
- The heat absorbed in a reaction at constant temperature and constant volume is– **ΔU**
- For hypothetical reaction $A_{(g)} + B_{(g)} \rightarrow C_{(g)} + D_{(g)}$ is– $\mathbf{\Delta H = \Delta U}$
- The value of ΔH for cooling 2 moles of an ideal monoatomic gas from 225°C to 125°C at constant pressure will be (Given, $C_p = 5R/2$)– **–500 R**
- The heat absorbed at constant volume is equal to the system's change in– **Internal energy**

Work Done & Enthalpy Change, ΔH of a Reaction

- The enthalpies of elements in their stadard states are taken as zero. The enthalpy of formation of a compound.– **may be positive or negative**
- Enthalpy of sublimation of a substance is equal to– **enthalpy of funsion + enthalpy of vaporisation**
- "X" gm of ethanal was subjected to combustion in a bomb calorimeter and the heat produced is "Y" Joules. Then– $\mathbf{\Delta U_{(combustion)} = -44Y/X\ J\ mol^{-}}$
- For an endothermic reaction, energy of activation is E_a and enthalpy of the reaction is ΔH (both of these in kJ/mol) minimum value of E_a will be– **More than ΔH**

Spontaneity, Entropy, Gibbs Energy Change and Equilibrium

- A reaction can occur spontaneously if– **TΔS > ΔH and both ΔH and ΔS are positive**
- The enthalpies of combustion of carbon and carbon monoxide are –393.5 and –283 kJ mol^{-1} respectively. The enthalpy of formation of carbon monoxide per mole is– **573 J**
- The relationship between standard free energy change in a reaction and the corresponding equilibrium constant K_c is– $\mathbf{-\Delta G° = RTIn\ K_c}$
- The intensive property is– **Mass/Volume**
- According to the second law of thermodynamics, a process (reaction) is spontaneous, if during the process– $\mathbf{\Delta S_{universe} > 0}$
- The thermodynamics property provides a measures of randomness in the system?– **Entropy**
- According to third law of thermodynamics, the entropy at 0 K is zero for– **Perfectly crystalline solids**
- An ideal gas is allowd to expand under adiabatic conditions, the term zero for such a process is– **ΔS = 0**
- In any natural process is– **The entropy of universe tends towards maximum**
- The unit of entropy is– $\mathbf{JK^{-1}\ mol^{-1}}$

- Entropy of system depends upon– **Temperature, pressure and volume**
- For the gaseous reaction, involving the complete combustion of isobutane– **$\Delta H > \Delta U$**
- For a hypothetical reaction $A + B \rightarrow C$ if $\Delta G° > 0$– **A and B predominate in the reaction mixture**
- The conditions, for reaction will be always spontaneous– **$\Delta H < 0$ and $\Delta S > 0$**
- The for adiabatic expansion of ideal gas is– **$PV^{\gamma} =$ constant**
- For a sample of perfect gas when its P is changed isothermally from P_i to P_f, the entropy change is given by– **$\Delta S = nR \ln\left(\frac{P_i}{P_r}\right)$**
- For an isothermal free expansion of an ideal gas into vacuum is– **$\Delta U = 0, q = 0, w = 0$**
- If the reaction achieves equilibrium at 298 K & one bar pressure i.e., standard conditions, then equilibrium constant is– **1**
- The heat of vaporisation & heat of fusion of H_2O are 540 cal/g & 80 cal/g. The ratio of $\frac{\Delta S_{vap}}{\Delta S_{fusion}}$ for H_2O is– **4.94**
- For a particular reversible reaction at temperature T, ΔH and ΔS were found to be both +ve. If T_e is the temperature at equilibrium, the reaction would be spontaneous when– **$T > T_e$**
- Equal volumes of two monoatomic gases, A and B, at same temperature and pressuer are mixed. The ratio of specific heats (C_P/C_V) of the mixture will be– **1.67**
- An ideal gas with $C_V = 3R$ expands adiabatically into a vacuum thus doubling its volume. The final temperature is given by– **T_2 T_1**
- One mole of an ideal gas at 450K is expanded isothermally & reversibly from an initial volume of 5L to 20L. Then, ΔU for the process is– **Zero**
- Thermodynamics is not concerned about– **the rate at reaction proceeds**
- The state of a gas can be described by quoting the relationship between:– **Pressure, volume, temperature, amount**
- The volume of gas is reduced to half from its original volume. The specific heat will be– **remain constant**
- During complete combustion of one mole of butane, 2658 kJ of heat is released. The thermo-chemcial reaction for above change is–

$$\mathbf{C_4H_{10}(g) + \frac{13}{2}O_2(g) \rightarrow 4CO_2(g) + 5H_2O(l);}$$

$$\mathbf{\Delta_c H = -2658.0\ kJ\ mol^{-1}}$$

- $\Delta_r U^0$ of formation of $CH_4(g)$ at certain temperature is -393 kJ mol^{-1}. The value of $\Delta_r H$ is– **$<\Delta_r U^0$**
- The pressure-volume work for an ideal gas can be calculated by using the expression $W = -\int_v p_{ex} dV$. The work can also be calculated from the pV – plot by using the area under compressed (a) reversibly or (b) irreversibly from volume V_i to V_f the– **W(reversible) < W (irreversible)**
- The right relationship between C_p and C_v for one mole of idal gas is– **$C_P - C_V = R$**
- For irreversible expansion of an ideal gas under isothermal condition, is– **[2021]** **$\Delta U = 0, \Delta S_{total} \neq 0$**
- For the reaction, $2Cl(g) \rightarrow Cl_2(g)$, is– **$\Delta_r H < 0$ and $\Delta_r S_{total} = 0$**
- Tea placed in thermos flask is an example of– **Isolated system**
- Gaseous system is placed with pressure P_1, Volume V_1 and temperature T_1, it has undergone thermodynamic changes the temperature is remaining constant, it is– **Isothermal process**
- The respective examples of extensive and intensive properties are– **Entropy, Temperature**
- A thermally isolated, gaseous system can exchange energy with the surroundings. The mode of energy may be– **Work**
- If 'r' is the work done on the system and 's' is heat evolved by the system then– **$\Delta E = r - s$**
- A system absorbs 10 kJ of heat and does 4 kJ of work. The internal energy of the system– **Increases by 6 kJ**
- In thermodynamics a process is called reversible– **The surroundings are always in equilibrium with the system**
- An ideal gas is compressed adiabatically and reversibly, the final temperature– **Higher than the initial temperature**
- The .... can be zero for isothermal reversible expansion– **$\Delta E, \Delta H, \Delta T$**
- Two atoms of hydrogen combine to form a molecule of hydrogen gas the energy of the H_2 molecule is– **Lower than that of separate atoms**
- Set of intensive properties is– **Viscosity, refractive index, specific heat**
- For stretched rubber, Entropy– **Decreases**
- The least random state of H_2O is– **Ice**
- ΔS for the reaction : $MgCO_3(s) \rightarrow MgO(s) + CO_2(g)$– **+ve**
- The sole criterion for the spontaneity of a process is– **Tendency to acquire maximum stability**
- ΔS^o will be highest for the reaction– **$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$**

- In an irreversible process, the value of ΔS_{system} + ΔS_{surr} is– **+ve**
- The .... pairs of a chemical reaction is certain to result in a spontaneous reaction– **Exothermic and increasing disorder**
- For a reaction to occur spontaneously– **($\Delta H - T\Delta S$) must be negative**
- In a reaction, all reactant and products are liquid, then– **$\Delta H = \Delta E$**
- The correct option for free expansion of an ideal gas under adiabatic condition is– **q = 0, ΔT = O and w = 0**
- System in which there is no exchange of matter, work or energy from surroundings is– **Isolated**
- When the system does not exchange heat with the surroundings, the process is– **Adiabatic**
- $\Delta U = q + w$, is mathematical expression for– **First law of thermodynamics**
- If w is the amount of work done by the system and q is the amount of heat supplied to the system. The type of the system is– **Closed system**
- A process is called reversible when– **Surrounding is always in equilibrium with system**
- In an adiabatic expansion of ideal gas is– **$w = \Delta U$**
- For the reaction of one mole of zinc dust with one mole of sulphuric acid in a bomb calorimeter, ΔU and w correspond to– **$\Delta U < 0, w = 0$**
- Hess's law is applicable for the determination of heat of– **Transition, Formation, Reaction**
- In general, for exothermic reactions to be spontaneous– **Temperature should be low**
- In endothermic reactions– **Reactants have less energy than products**
- The total change (ΔS_{total}) for the system and surrounding of a spontaneous process is given by– **$\Delta S_{total} = \Delta S_{system} + \Delta S_{surr} > 0$**
- The signs of ΔH and ΔS when NaOH is dissolved in water, will be– **– +**
- For a reaction to be spontaneous at any temperature, the conditions are– **ΔH = –ve, ΔS = +ve**
- At absolute zero, the entropy of a pure crystal is zero. This is– **Third law of thermodynamics**
- The relationship between ΔG^0 and equilibrium constant K_p is– **$K_p = e^{-\Delta G^\circ/RT}$**
- The state of a gas can be described by quoting the relationship between– **Pressure, volume, temperature, amount**
- The volume of gas is reduced to half from its original volume. The specific heat will– **Remain constant**
- The enthalpies of elements in their standard states are taken as zero. The enthalpy of formation of a compound– **May be positive or negative**
- Enthalpy of sublimation of a substance is equal to– **Enthalpy of fusion + enthalpy of vapourisation**
- The set of parameters that represents path function, is– **q, w**

EXAM POINT

Thermodynamics terms and application measurement of ΔU and ΔH calorimetry.

Solubility of a gas in a liquid increases with– **increase of P and decrease of T**	**Karnataka CET-17.06.2022, Shift-II**
For spontaneity of a cell is – **ΔG = –ve**	**Karnataka CET-17.06.2022, Shift-II**
The processes is associated with decrease in entropy– **Crystallization of a salt from its saturated solution**	**MPPET - 2012**
At constant temperature and pressure, if ΔG < 0 the process is called– **spontaneous**	**(AP-EAMCET-1992)**
The reactions does the heat change represent the heat of formation of water is– $\mathbf{H_2 + \frac{1}{2}O_2 \rightarrow H_2O;\ \ \Delta H = -58\,kcal}$	**(AP-EAMCET-1991)**
The reaction proceeds with evolution of heat is called– **exothermic reaction**	**(AP-EAMCET-1993)**
In the complete combustion of butanol $C_4H_9OH(l)$, if ΔH is enthalpy of combustion at constant pressure and ΔE is the heat of combustion at constant volume, then– **ΔH < ΔE**	**(AP-EAMCET-1997)**

The endothermic reaction is– **$N_2(g)+O_2(g)+180.8\,kJ \rightarrow 2NO(g)$**	**AP-EAMCET-2004**
$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$, $\Delta H = 110$ kJ The pressure of CO_2**–** **Increases if T is raised**	**MPPET-2013**
For the formation of $NH_3(g)$ from its constituent elements, the favourable conditions for its formation are– **High pressure and low temperature**	**TS-EAMCET (Engg.), 07.08.2021 Shift-II**
The substances has highest value of standard molar enthalpy of formation at 298 K is – **NaF(s)**	**JEE Main-2019**
If, $\Delta H > 0$ and $\Delta S > 0$, the reaction can proceed spontaneously at ....– **high temperature**	**AP EAMCET (Engg.) 21.09.2020, Shift-I**
The formation of $NH_3(g)$ from its constituent elements at constant temperature and pressure is– **$\Delta H < \Delta U$**	**TS EAMCET 10.08.2021, Shift-II**
The state function is not a – **Work**	**AP EAMCET (Engg.) 17.09.2020, Shift-II MPPET-2008**
Isochores are drawn at ....– **constant volume, pressure vs temperature**	**AP EAMCET (Engg.) 17.09.2020 Shift-I**
The extensive property is an- **Volume**	**AP EAMCET (Engg.) 17.09.2020 Shift-I**
The change in entropy (ΔS) is negative– **Freezing of water**	**AP EAMCET (Engg.) 21.09.2020, Shift-II**
An intensive property is– **boiling point**	**COMEDK-2011**
The all gases, at any given pressure, the graph of volume vs temperature (in celsius) is a straight line. This graph is called– **isobar**	**COMEDK-2014**
The value of ΔG for ice at 8ºC temperature is– **Positive**	**GUJCET-2008**
The relation is:– **$\Delta G = -RT \ln K/Q$**	AIIMS 25 May 2019 (Morning)
The regarding entropy is– **at absolute zero temperature, entropy of a perfect crystalline substance is taken to be zero**	**AIIMS-1994**
The characteristic of a reversible reaction is – **It can be influenced by a catalyst**	**AIIMS-1996**
The increase always for spontaneous process is – **$\Delta S - \frac{\Delta H}{T}$**	**AIIMS-26 May, 2018 (M)**
The extensive properties is an – **V & E**	**AIIMS-26 May, 2018 (M)**
The reaction ΔH is not equal to ΔU an– **$C_2H_4(g) + H_2(g) \rightarrow C_2H_6(g)$**	**AIIMS-2016**
ΔS_{surr} for an exothermic reaction is– **always positive**	**AIIMS-2007**
For a spontaneous process, it means that:– **Total entropy change is always positive**	**AIIMS-2006**
For a phase change, $H_2O(l) \xrightleftharpoons{0^\circ C,\ 1bar} H_2O(s)$ **–** **$\Delta G = 0$**	**AIIMS-2006**
In the exothermic reaction, the enthalpy of reaction is always:– **negative**	**AIIMS-2001**
The internal energy of a substance:– **increases with increase in temperature**	**AIIMS-2001**
For a spontaneous process, entropy:– **Increases**	**AIIMS-1998**
Internal energy does not include:– **Energy due to gravitational pull**	**AIIMS-1999**
At a constant volume the specific heat of a gas is 0.075 and its molecular weight is 40. The gas is :– **Monoatomic**	**AIIMS-1998**
The enthalpy change of a reaction does not depend on:– **different intermediate reactions.**	**AIIMS-1997**

A spontaneous process is one in the system suffers :– **a lowering of free energy**	**VITEEE- 2008**
Condition for spontaneity in an isothermal process is– **$\Delta A + W < 0$**	**VITEEE- 2007**
The reaction, $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$ is an example of a– **spontaneous process**	**VITEEE- 2006**
The conditions lead to a spontaneous process is – **Both ΔH and $T\Delta S$ are + ve but $T\Delta S > \Delta H$**	**SRMJEEE – 2013**
A chemical reaction cannot occur at all if its– **ΔH and ΔS are (+)ve but $\Delta H > T\Delta S$**	**AP - EAMCET(MEDICAL) - 2009**
Density of carbon monoxide is maximum at– **4 atm and 500 K**	**Karnataka-CET-2014**
A better criterion for ideality of a gas than $\left(\frac{\partial U}{\partial V}\right)_T = 0$ is– **$\left(\frac{\partial H}{\partial P}\right)_T = 0$**	**AMU-2017**
The isolated system, $\Delta U = 0$, then– **$\Delta S > 0$**	**AMU-2012**
An adiabatic process occurs in– **isolated system**	AMU – 2009
A reaction is spontaneous at high temperatures if– **ΔH and ΔS both are positive**	AMU – 2007
A process is spontaneous at high temperature if– **$\Delta H > 0$ and $\Delta S > 0$**	AMU-2004
Enthalpy of formation of a compound– **can be either positive or negative**	**Assam CEE-2014**
The gaseous reaction $N_2O_4(g) \rightarrow 2NO_2(g)$– **$\Delta H > \Delta U$**	**Assam CEE-2014**
If temperature of a liquid is raised surface tension of the liquid– **decreases**	**Assam CEE-2019**
An equilibrium mixture of ice and water is under constant pressure, where ice melts if heat is supplied. For this process– **Entropy increases**	**Assam CEE-2018**
Unit of entropy is– **$JK^{-1}mol^{-1}$**	**BCECE-2012**
The variation of viscosity coefficient (η) with temperature (T) is– **$\eta = Ae^{E/RT}$**	**BCECE-2014**
Compounds with high heat of formation are less stable because– **Energy rich state leads to instability**	**BITSAT 2006**
A spontaneous reaction is impossible if– **ΔH is positive and ΔS is negative**	**BITSAT 2015**
The units of energy, represents maximum amount of energy is– **Calorie**	**CG PET -2008**
The adiabatic process is an – $q = 0$	**CG PET -2006**
In a reversible isothermal process, the change in internal energy is– **zero**	**CG PET- 2010**
At the equilibrium position in the process of adsorption :– **$\Delta H = T\Delta S$**	**HP CET-2018**
The process with negative entropy change is– **Synthesis of ammonia from N_2 and H_2**	**JEE Main-2019, Shift-II**
Heat required to raise the temperature of 1 mole of a substance by 1^o is called– **molar heat capacity**	**AIEEE-2002**
During spontaneous discharge of an electrochemical cell, Gibb's free energy will– **decrease**	**J & K CET-(2012)**
The thermochemical property is always takes up negative values an– **Enthalpy of combustion**	**J & K CET-(2016)**
The enthalpy change accompanying a reaction is called– **reaction enthalpy**	**J & K CET-(2014)**
The spontaneity of a reaction if $\triangle H$ and $\triangle S$ both are negative – **Low temperature**	**J & K CET-(2018)**
The intensive property of a system is an – **Temperature**	**J & K CET-(2019)**
PV value decreases with increases in P at constant temperature when– **attractive forces between molecules are predominant**	**J & K CET-(2015)**
The pairs, both variables as intensive variable is– **P, T**	**J & K CET-(2015)**

The process to occur under adiabatic condition is– **$\Delta q = 0$**	**J & K CET-(2015)**
In thermodynamics, a quantity whose value simply depends upon the initial and final states of the system is called– **a state function**	**J & K CET-(2013)**
If ΔH and ΔS are positive for a reaction, the reaction will be spontaneous only when– **$T\Delta S > \Delta H$**	**J & K CET-(2013)**
The pairs does not represent example for intensive property is – **Heat capacity and enthalpy**	**J & K CET-(2011)**
All naturally occurring process proceed spontaneously in a direction, leads to– **decrease of free energy**	**J & K CET-(2013, 2007)**
The free energy change (ΔG) is negative. The reaction is–**a spontaneous reaction**	**J & K CET-(2006)**
ΔG for a spontaneous reaction is– **negative**	**J & K CET-(2005)**
The endothermic reaction is not an– **combustion of propane**	**J & K CET-(2005)**
A process the system does not exchange heat with the surroundings is known as– **adiabatic**	**JIPMER-2013** **J & K CET-(2005)**
In a reversible process, $\Delta S_{sys} + \Delta_{Surr}$ is– **= 0**	**J & K CET-(2004)**
A tightly closed dessicator in action is an example of– **closed system**	**J & K CET-(2002)**
In the reaction milk → cheese, ΔS is– **negative**	**J & K CET-(2001)**
The state function is not an– **$P \Delta V$**	**J & K CET-(1997)**
In an isothermal expansion of an ideal gas:– **$\Delta E = 0$**	**JCECE - 2003**
Human body is an example of:– **open system**	**JCECE - 2004**
The reaction to be spontaneous at all temperatures– **ΔG and ΔH should be negative**	**JCECE - 2009**
The chemical reaction is certain to result in a spontaneous reaction is –**Exothermic**	**JCECE - 2012, CG PET - 2007** **JIPMER-2007, NEET-2005**
The value of compression factor, Z for critical constants is– **$\frac{3}{8}$**	**JCECE - 2014**
The enthalpy change for a reaction does not depend upon the– **nature of intermediate reaction steps**	**JCECE - 2015** **AIEEE-2003**
A reaction occurs spontaneously if– **TΔS > ΔH and both ΔH and ΔS are + ve**	**JIPMER-2007** **NEET-2005**
In an isothermal process– **$\Delta H = W$**	**JIPMER-2005**
The internal energy of a substance– **Increase with increase in temperature**	**JIPMER-2005**
The enthalpies of all elements in their standard states are– **Zero**	**JIPMER-2004**
The Conversion of oxygen into ozone is non-spontaneous at– **all temperature**	**JIPMER-2018** **Karnataka-CET-2014**
The reaction in ΔH > ΔU is– **$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$**	**Karnataka-CET-2019**
For an ideal binary liquid mixture– **$\Delta S_{(mix)} > 0; \Delta G_{(mix)} < 0$**	**Karnataka-CET-2014**
The value of entropy of solar system is– **increasing**	**Karnataka-CET-2013**
For the reaction, $A(g) + B(g) \rightleftharpoons C(g) + D(g); \Delta H = Q kJ$ The equilibrium constant cannot be disturbed by**–** **increasing of pressure**	**Karnataka-CET-2021**
The relation between ΔH and ΔU is– **$\Delta H = \Delta U + \Delta nRT$**	**Karnataka-CET-2007**
The Entropy of universe is– **continuously increasing**	**Karnataka-CET-2007**
The enthalpy of a monoatomic gas at T Kelvin is:– **$\frac{5}{2}RT$**	**Kerala-CEE-2004**
Thermal decomposition of ammonium dichromate gives– **N_2, H_2O and Cr_2O_3**	**Kerala-CEE-2016**

A gas will approach ideal behavior at– **High temperature and low pressure**	**Kerala-CEE-2017**
The Electrophile involved in the Sulphonation of benzene is :– **SO_3**	**Manipal-2019**
For a process to be spontaneous:– **ΔG must be –ve**	**Manipal-2018**
C_p/C_v for noble gases is :– **1.66**	**Manipal-2017**
The adsorption of krypton on activated charcoal at low temperature:– **$\Delta H < 0$ and $\Delta S < 0$**	**Manipal-2016**
Mathematical equation of first law of thermodynamics for isochoric process is– **$\Delta U = q_v$**	**MHT CET-2016**
The relation between solubility of a gas in liquid at constant temperature and external pressure is stated by law is an – **Henry's law**	**MHT CET-2016**
The equation that represents general Van't Hoff equation is– **$\pi = \frac{n}{V}RT$**	**MHT CET-2016**
The feature of adiabatic expansion is an – **$\Delta T = 0$**	**MHT CET-2015**
According to Hess's law, the heat of reaction depends upon– **initial and final conditions of reactants**	**MHT CET-2011**
The equation is– **$H_2 – H_1 – E_2 + E_1 = n_2RT – n_1RT$**	**MHT CET-2010**
Kirchhoff's equation is– **$\Delta C_p = \frac{\Delta H_2 - \Delta H_1}{T_2 - T_1}$**	**MHT CET-2009**
In .... process, work is done at the expense of internal energy.– **Adiabatic**	**MHT CET-2009**
Hess's law is based on– **Law of conservation of energy**	**MHT CET-2007**
The path function is an – **Work**	**MHT CET-2007**
For a sample of perfect gas when its pressure is changed isothermally from p_i to p_f, the entropy change is given by– **$\Delta S = nR\ln\left(\frac{P_i}{P_f}\right)$**	**NEET-II 2016**
The irreversible expansion of an ideal gas under isothermal condition is– **$\Delta U = 0$, ΔS_{total} ¹ 0**	**NEET-2021**
The reaction $2Cl_{(g)} \rightarrow Cl_{2(g)}$,is– **$\Delta_r H < 0$ and $\Delta_r S < 0$**	**NEET-2020**
In a closed insulated container a liquid is stirred with a paddle to increase the temperature is – **$\Delta E = W \neq 0$, $q = 0$**	**NEET-2008, UP CPMT-2006**
The occurrence of reaction is impossible if– **ΔH is +ve, ΔS is –ve**	**UP CPMT-2011** **J & K CET-(2003)**
The isothermal expansion of ideal gas is – **enthalpy remains unchanged**	**UP CPMT-2007** **NEET-1994, 1991**
The endothermic reaction is – **ΔH is positive**	**UP CPMT-2003**
The relation of ΔH and ΔE is represented as– **$\Delta H = \Delta E + \Delta nRT$**	**UP CPMT-2002**
The law states entropy of all pure crystalline solids is zero at absolute zero – **Third law of thermodynamics**	**UP CPMT-2001**
In an isochoric process, ΔH for a system is equal to:– **ΔE**	**UPTU/UPSEE-2006**
For a spontaneous process, is- **$(\Delta G_{system})_{T, p} < 0$**	**WB-JEE-2014**
The condition for a reaction to occur spontaneously is– **$(\Delta H – T\Delta S)$ must be negative**	**WB-JEE-2016**
At constant pressure, the heat of formation of a compound is not dependent on temperature, when– **$\Delta C_p = 0$**	**WB-JEE-2019**
For spontaneous polymerization is not an – **ΔS is negative**	**WB-JEE-2020**
Work done by an ideal gas at a constant volume is ....– **0**	**AP EAMCET (Engg.) 21.09.2020, Shift-I** **WB-JEE-2013**

The represents the first law of thermodynamics is – **$\Delta U = q + W$**	**CG PET-2012**
Based on the first law of thermodynamics is - **For a cyclic process q = – w**	**Karnataka-CET, 2011, 2010**
According to the first law of thermodynamics quantities is represents the change in a state function is – **$q_{rev} + W_{rev}$**	**JIPMER-2011 Kerala-CEE-2010**
The first law of thermodynamic is expressed as:– **$q = \Delta E - W$**	**Kerala-CEE-2006**
The ideal gas behaviour of a gas can be expressed as :– **$Z = \frac{PV}{nRT}$**	**Manipal-2018**
"The mass and energy both are conserved in an isolated system is" – **modified first law of thermodynamics**	**MHT CET-03.05.2019, Shift-I**
Work done by 1 mole of an ideal gas for its adiabatic reversible change when temperature attains T_2 from T_1 is'– **$C_V (T_2 - T_1)$**	**Tripura JEE-2022**
The changes entropy decreases is a –**Crystallization of sucrose from solution**	**UPTU/UPSEE-2018**
Pressure-volume (PV) work done by an ideal gaseous system at constant volume is (where E is internal energy of the system)– **zero**	**WB-JEE-2013**

Work done and enthalpy change ΔH of a reaction.

The enthalpy change of a reaction does not depend on– **Different intermediate states**	**SCRA-2015**
The compounds has the highest hydration energy is – **$BeSO_4$**	**TS-EAMCET 09.08.2021, Shift-I**
The increasing order of enthalpy of vaporisation is – **PH_3, AsH_3, NH_3**	**AIIMS-2004**
ΔH_f° (298K) of methanol is given by the chemical equation:– $\mathbf{C(graphite) + \frac{1}{2}O_2(g) + 2H_2(g) \rightarrow CH_3OH(l)}$	**AIIMS-2005**
Heat of formation, ΔH_f° of an explosive compound like NCl_3 is– **Positive**	**VITEEE- 2011**
Enthalpy of a compound is equal to its– **Heat of formation**	**VITEEE- 2010**
Enthalpy of neutralization of all strong acids and bases has same value, because– **Neutralization leads to the formation of a salt and water**	**Assam CEE-2014**
The neutralization reactions, the heat of neutralization is highest an – **HCl and NaOH**	**Assam CEE-2014 SRMJEEE-2008**
The heat of neutralisation of any strong acid and a strong base is nearly equal to :– **–57.3 kJ**	**BCECE-2005**
ΔU° of combustion of methane is –X k J mol^{-1}. The value of ΔH° is– **< ΔU°**	**BCECE-2012**
The reaction $CO_2(g) + H_2(g) \rightarrow CO(g) + H_2O(g)$ ΔH = 40 kJ; ΔH represents is : **– Heat of reaction**	**BITSAT 2005**
At 25^0C and 1 bar has a non-zero ΔH_f^0 is – **$O_3(g)$**	**BITSAT 2009**
The heats of neutralisation of CH_3COOH, HCOOH, HCN and H_2S are – 13.2, –13.4, –2.9 and –3.8 k cal per equivalent respectively. Arrange the acids in increasing order of acidic strength.– **HCOOH > CH_3COOH > H_2S > HCN**	**BITSAT 2014**
The reactions, standard entropy change (ΔS^0) is positive and standard Gibb's energy change (ΔG^0) decreases sharply with increasing temperature is – **C(graphit**	**BITSAT 2012**
Energy of activation of an endothermic reaction is– **positive**	**CG PET- 2011**
Heat of neutralization of HCl and NaOH is– **–13.7 kcal**	**CG PET- 2012**

For the equilibrium reaction, $2SO_2(g)+O_2(g) \rightleftharpoons 2SO_3(g)+\Delta H$ the increase in temperature– **favours the decomposition of SO_3**	**CG PET- 2012**
The role of a catalyst in a catalysed reaction is – **Lowers the activation energy**	**CG PET -2005**
The hydrogen halides has the least bond dissociation enthalpy is– **HI**	**J & K CET-(2016)**
The order of lattice energy values is alkali halides is LiCl, KI, KCl and NaCl–**LiCl**	**J & K CET-(2017)**
The heat of neutralisation will be highest in– **HC*l* +NaOH**	**J & K CET-(2019)**
The standard enthalpy of formation of all elements in their standard state is– **zero**	**J & K CET-(2019)**
Changes in a system from an initial state to the final state were made by a different manner that remains **ΔH** remains same but q changes because– **ΔH is a state function and q is a path function**	**J & K CET-(2010)**
The factor does not affect the heat of reaction is– **whether the reaction is carried out directly or indirectly**	**J & K CET-(2002)**
The gaseous reaction involving complete combustion of isobutane (assuming all products and reactants are in gaseous state). The relation between ΔH and ΔE will be– **$\Delta H > \Delta E$**	**JCECE - 2016**
The combustion gives maximum energy is – **Butane**	**MHT CET-2012**
Hess's law is used to calculate:– **enthalpy of reaction**	**UPTU/UPSEE-2005**
Enthalpy of solution of NaOH (solid) in water is – 41.6 kJ mol^{-1}. When NaOH is dissolved in water, the temperature of water:– **Increases**	**UPTU/UPSEE-2004**
The heat evolved in neutralisation of HF is highest is– **Due to high hydration energy of F^- ion**	**UPTU/UPSEE-2018**

Enthalpies of different types of reaction

$N_2(g)+3H_2(g) \rightleftharpoons 2NH_3(g)$ Then ΔH is equal to : **$\Delta U - 2RT$**	**CG PET-22.05.2022**
The reactions defines ΔH_f^o is – $\mathbf{\frac{1}{2}H_2(g)+\frac{1}{2}F_2(g) \rightarrow HF(g)}$	**JCECE - 2014**

Spontaneity, entropy, Gibbs Energy change and equilibrium.

The spontaneity of chemical reaction there should be:– **increase in entropy and decrease in free energy**	**MPPET - 2012**
For an adiabatic change in a system – **q = 0**	**COMEDK-2015**
A piece of ice kept at room temperature melts of its own. This reaction is governed by law is – **Second law of Thermodynamics**	**GUJCET-2008**
The intensive property is not an – **Entropy**	**TS EAMCET 05.08.2021, Shift-I**
The change of Gibbs energy for a system (ΔG_{system}) at constant temperature and pressure– **If ΔG_{system} =0, the system has attained equilibrium**	**CG PET -2007**
Entropy of a perfectly crystalline solid at 0 K is– **zero**	**J & K CET-(2012)**
Entropy change in a process where 1 litre of liquid. He is poured into ice cold water is– **finite and positive**	**J & K CET-(2012)**
The water is cooled to its entropy– **decreases**	**J & K CET-(2010)**
The units of entropy is – **cal.K^{-1}**	**J & K CET-(2006)**
The entropy of crystalline substances at absolute zero going by the third law of thermodynamics should be taken as– **Zero**	**J & K CET-(2005)**
If one mole of ammonia and one mole of hydrogen chloride are mixed in a closed container to form ammonium chloride gas, then– **$\Delta H < \Delta U$**	**KARNATAKA-CET, 2008**

For a process, entropy change of a system is expressed as– **$-\frac{q_{rev}}{T}$**	**MHT CET-02.05.2019, SHIFT-III WB-JEE-2013**
The second law of thermodynamics says that in a cyclic process– **heat cannot be completely converted into work**	**WB-JEE-2009**
The arrangements shows the bonds H–H, C–C and Si–Si in order of increasing bond energy is – **Si–Si < C–C < H–H**	**SCRA 2012**
The order for the bond energies of halogen molecules is– **$Cl_2 > Br_2 > I_2$**	**AP EAMCET (Engg.) 2001**
The decreasing order of bond dissociation energies of C–C, C–H and H–H bonds in– **H – H > – C – H > – C – C –**	**AP EAMCET (Engg.) -2007**
The bond energies of F_2, Cl_2, Br_2 and I_2 are 155, 244, 193 and 151kJ/mol. The weakest bond will be in– **I_2**	AMU 2002
Internal energy is sum of– **all types of energy of the system**	**BCECE-2008**
The C–C bond dissociation energy in kcal/mol is– **81**	**BCECE-2009**
The energy that opposes dissolution of a solvent is– **lattice energy**	**BITSAT 2006**
The bond energy is the energy required to– **break one mole of similar bonds**	**MHT CET-2007**
An endothermic reaction is found to have +ve entropy change. The reaction will be– **possible at high temperature**	**COMEDK-2015**
For a reaction to be spontaneous at all temperatures,– **$\Delta G = -ve, \Delta H = -ve$ and $\Delta S = +ve$**	**AIIMS-2008**
The standard Gibb's free energy change, ΔG° is related to equilibrium constant, K_p as– **$K_p = e^{-\Delta G°/RT}$**	**VITEEE- 2010**
For a cell reaction to be spontaneous, the standard free energy change of the reaction must be– **negative**	**CGPET-2007 VITEEE- 2006**
For a reaction at equilibrium,– **ΔG = 0 but not ΔG°**	**SRMJEEE – 2008**
In the process of ice melting at –15°C at atmospheric pressure,– **ΔG > 0**	AMU – 2008
For a process to occur spontaneously– **(ΔH – TΔS) must be negative**	**Assam CEE-2014**
For a system in equilibrium– **ΔG = 0**	**BCECE-2009**
For a chemical reaction, ΔG is always less than zero (ΔG <0) if– **ΔH is negative and TΔS is positive**	**CG PET -2019**
Cell reaction is spontaneous when– **ΔG° is negative**	**CG PET -2007**
The free energy change in a reaction and the corresponding equilibrium constant K_c is– **$-\Delta G° = RT\ 1nK_c$**	**AIEEE-2003**
A process will be spontaneous at all temperature if– **ΔH < 0 and ΔS > 0**	**JEE Main-2019, Shift-I**
The Gibb's Helmholtz equation is – **$\Delta S = \frac{1}{T}[\Delta H - \Delta G]$**	**JCECE - 2003**
In equilibrium state the value of ΔG is– **zero**	**Karnataka-CET-2007**
The standard Gibbs free energy of reaction (ΔG) is known is – **Equilibrium constant**	**Kerala-CEE-2018**
The criterion for a spontaneous process is– **ΔG < 0**	**MHT CET-2016**
$PbO_2 \rightarrow PbO$, $\Delta G_{298} < 0$ $SnO_2 \rightarrow SnO$, $\Delta G_{298} > 0$ Most probable oxidation state of Pb and Sn will be– **Pb^{2+}, Sn^{4+}**	**NEET-2001**
A reaction having equal energies of activation for forward and reverse reactions has– **ΔH = 0**	**NEET, 2013**
The value of ΔG and ΔG^0 for the reaction, $A + B \rightleftharpoons C + D$ at 27^0C for the K = 10^2 is – **$\Delta G = -11.48$ kj mol^{-1}; $\Delta G^0 = 0$**	**UPTU/UPSEE-2018**

4. States of Matter

The Gas Laws

- At temperature, the volume of a gas would become zero– **273.15°C**
- In order to increase the volume of a gas by 10%, the pressure of the gas should be– **decreased by 10%**
- Graph between p and V at constant temperature is– **Straight, Curved increasing, Straight line with slope**

Ideal Gas Equation

- The expression is true regarding gas laws? (W = weight, M = molar mass)– $\mathbf{\frac{T_1}{T_2} = \frac{M_1W_2}{M_2W_1}}$
- A cylinder is filled with a gaseous mixture containing equal masses of CO and N_2. The partial pressure ratio is– $\mathbf{P_{N_2} = P_{CO}}$
- For n moles of ideal gas, the equation of state may be written as– **P/T = nR/V**
- The numerical value of universal gas constant (R) depends upon– **The units of measurement**
- If p, V, M, T and R are the symbol of pressure, volume, molecular weight, temperature and gas constant respectively, what is the equation of density of ideal gas?– $\mathbf{\frac{pM}{RT}}$

Kinetic Energy and Molecular Speeds & Kinetic Molecular Theory of Gases

- The ratio of kinetic energies of 3 g of hydrogen and 4 g of oxygen at T(K)– **12 : 1**
- The root mean square velocity of ideal gas at constant pressure varies with density (d) as– $\mathbf{1/\sqrt{d}}$
- Average K.E. of CO_2 at 27°C is E. The average K.E. of N_2 at the same temperature will be– **E**
- The kinetic energy of one mole of any gas depend upon– **Absolute temperature of gas**
- The ratio of root mean square speed, average speed and most probable speed is– **3π : 8 : 2π**

Deviation From Ideal Gas Behaviour and Liquefaction of Gases

- The critical temperatures of O_2, N_2, H_2 and CO_2 are 154.3 K, 126 K, 33.2 and 304 K. The extent of adsorption on tungsten may be highest in case of– $\mathbf{CO_2}$
- Maximum deviation from ideal gas is expected from– $\mathbf{NH_3(g)}$
- The compressibility factor (Z) of one mole of a van der waal's gas of negligible 'a' value is– $\mathbf{1+\frac{bP}{RT}}$
- The gases can be liquefied easily is– **Chlorine**
- The compressibility factor for an ideal gas is– **= 1**
- The temperature at real gases obey the ideal gas laws over a wide range of pressure is called– **Boyle temperature**
- At relatively, high pressure, van der waal's equation reduces to– **PV = RT + Pb**
- In vander waal's equation of state of the gas, the constant b' is a measure of– **Volume occupied by the molecules**
- The real gas most closely approaches the behaviour of an ideal gas at– **0.5 atm and 500 K**
- A gas can be liquefied– **Below its critical temperatue**
- In van der Waal's equation of state for a non-ideal gas, the term that accounts for intermolecular force is– $\mathbf{\left(\frac{a}{V^2}\right)}$
- The van der Waal's constants "a" for gases P, Q, R and S are 4.17, 3.59, 6.71 and 3.8 atm L^2 mol^{-2}. Therefore, the ascending order of their liquefaction is– **Q < S < P < R**

Liquid State

- The surface tension of the liquid is maximum in– $\mathbf{H_2O}$
- The S.I. unit of surface tension is– **Newton/metre**

- A water drop is spherical in shape due to ________ **Surface tension**
- Viscosity of liquid _________ with rise in temperature.– **Decreases**
- The temperature at vapour pressure of liquid is equal to the external pressure is called– **Boiling temperature**
- With increase in altitude, atmospheric pressure– **Decreases**
- The properties of liquids is a measure of resistance to flow– **Viscosity**
- Dipole-induced dipole interactions are present in pairs is – **HC*l* and He atoms**
- The rms velocity of hydrogen in $\sqrt{7}$ times the rms velocity of nitrogen. If T is the temperature of the gas, then– $\mathbf{T_{(H_2)} < T_{(N_2)}}$
- The vander Waals constant 'a' for the gases CH_4, N_2, NH_3 and O_2 are 2.25, 1.39, 4.17 and 1.3 L^2 atm. mol^{-2} respectively. The gas which shows highest critical temperature is– $\mathbf{NH_3}$
- A person living in Shimla observed that cooking food without using pressure cooker takes more time. The reason for this observation is that at high altitude– **Pressure decreases**
- The property of water can be used to explain the spherical shape of rain droplets is– **Surface tension**
- The interaction energy of London force is inversely proportional to sixth power of the distance between two interacting particles but their magnitude depends upon– **Polarisability**
- The is SI unit of viscosity coefficient (η)– $\mathbf{Nsm^{-2}}$
- Increase in kinetic energy can overcome intermolecular forces of attraction. The viscosity of liquid be affected by the increase in temperature is– **Decrease**
- The he surface tension of a liquid vary with increase in temperature– **Decreases**
- A mixture of N_2 and Ar gases in a cylinder contains 7 g of N_2 and 8 g of Ar. If the total pressure of the mixture of the gases in the cylinder is 27 bar, the partial pressure of N_2 is– **15 bare**
- The minimum pressure required to compress 600 dm^3 of a gas at 1 bar to 150 dm^2 at 40°C is– **4.0 bar**
- "One gram molecules of a gas at N.T.P occupies 22.4 litres"– **Avogadro's hypothesis**
- The molecular velocities of two gases at the same temperature are u_1 and u_2 and their molar masses are m_1 and m_2 respectively. The expression is– $$\mathbf{m_1u_1^2 = m_2u_2^2}$$
- At constant volume for a fixed number of a moles of a gas, the pressure of the gas increases with the rise in temperature due to– **Increase in average molecular speed**
- The root mean square velocity of an ideal gas at constant pressure varies with density as– $\mathbf{\frac{1}{\sqrt{d}}}$
- Pressure exerted by a perfect gas is equal to– **Two thirds of mean kinetic energy per unit volume**
- A gas such as carbon monoxide would be most likely to obey the ideal gas law of– **High temperatures and low pressures**
- If a gas expands at constant temperature, it indicates that– **Kinetic energy of molecules remains the same**
- Temperature at which gas behave ideally over a wide range of pressure is called as– **Boyle's temperature**
- Van der Waal's constant 'a' and 'b' are related with _______ respectively– **Attractive force and volume of molecules**
- At high temperature and low pressure van der Waal's equation can be expressed as– **PV = RT**
- Van der Waal's constant 'a' has the dimension has the dimension of– $\mathbf{atm\ L^2mol^{-2}}$
- Relation for 1 mole real gases– $\mathbf{\left(P+\frac{a}{V^2}\right)=\frac{(R+T)}{(V-b)}}$
- For a real gas, Z shows– **PV≠nRT, for real gas**
- The compressibility factor 'Z' for the gas is given by– $$\mathbf{Z=\frac{PV_{obs}}{nRT}}$$
- The .... gas always shows positive deviation from ideal gas behaviour– $\mathbf{N_2}$
- For non-zero value of force of attraction between gas molecules, gas equation will be– $\mathbf{PV = nRT - \frac{n^2a}{V}}$
- When there can be more deviation in the behaviour of a gas from the ideal gas equation PV = nRT– **At low temperature and high pressure**
- The beans are cooked earlier in pressure cooker because– **Boiling point increases with increasing pressure**
- Van der Waal's real gas acts as an ideal gas, at which conditions– **High temperature, low pressure**
- The Critical temperature, Boyle's temperature and Inversion temperature respectively are– $$\mathbf{\frac{8a}{27Rb}, \frac{a}{Rb}, \frac{2a}{Rb}}$$
- Boyle's temperature and inversion temperature are related as– $\mathbf{T_i = 2T_b}$
- The critical temperature of a gas is related to van der Waal's constants as– $\mathbf{T_c = \frac{8a}{27bR}}$
- Boyle's temperature T_b is equal to– $\mathbf{\frac{a}{bR}}$
- The point at densities of a substance in gaseous as well as in liquid state are same called– **Critical point**
- The surface tension of the .... liquid is maximum– $\mathbf{H_2O}$
- An ideal gas, obeying kinetic theory of gases can not be liquefied, because– **Forces acting between in molecules are negligible**

- If saturated vapours are compressed slowly at constant temperature to half the initial volume, the vapour pressure will– **Remains unchanged**

- The types of attractive forces between a polar molecule and a non-polar molecule are– **Dipole-induced dipole forces**
- Boiling point of hydrogen fluoride is highest amongst HF, HC*l*, HBr and HI. The type of intermolecular forces present in hydrogen fluoride is– **H–F has highest dipole moment hence has dipole-dipole, London forces and hydrogen bonding**
- The effect on chemical properties and physical properties of water when temperature is changed.– **Chemical properties of water remain same but the physical state changes with change in temperature**
- Representing P, V and T as pressure, volume and temperature. The correct representation of Boyle's law is– $\mathbf{V \propto \frac{1}{p}}$ **(T constant)**
- The effect on the pressure of a gas if its temperature is increased at constant volume is– **The pressure of the gas increases**
- Absolute zero can be defined as the temperature at which– **Volume becomes zero**
- The value of the gas constant 'R' is close to– **0.082 litre-atmosphere K^{-1} mol^{-1}**
- Value of gas constant R in the ideal gas equation, PV = nRT depends upon– **Units in P, V and T are measured**
- For an ideal gas, number of moles per litre in terms of its pressure, temperature and gas constant is– **P/RT**
- Ideal gas equation is also called equation of states because – **It is a relation between four variables and describes the state of any gas**
- At any particular time, different particles in the gas– **Have different speeds and hence different kinetic energies**
- According to kinetic theory of gases, the collisions between molecules of a gas occur in a – **Straight line**
- A gas that follows Boyle's law, Charles' law and Avogadro's law is called an ideal gas. Under what conditions a real gas behaves as ideal gas– **Under low pressure and high temperature**
- In van der Waals' equation for a non-ideal gas, the term that accounts for intermolecular force is– $\mathbf{\left(p + \frac{a}{v^2}\right)}$
- The expressions that represents the value and unit of van der Waals constant a– $\mathbf{a = \frac{PV^2}{n^2}}$**, atm L^2 mol^{-2}**
- Van der Waals constant b in corrected equation for real gases represents– **Measure of effective size of gas molecules**
- In the corrections made to ideal gas equation for real gases, the reductions in pressure due to forces of attractions between the molecules is directly proportional to– $\mathbf{n^2/V^2}$
- A real gas obeying van der Waals equation will resemble ideal gas, if the– **Constants a and b both are small**
- Under conditions gases generally deviate from ideal behaviour– **At low temperature and high pressure**
- At Boyle's temperature, compressibility factor Z for a real gas is– **1**
- It is observed that H_2 and He gases always show positive deviation from ideal behaviour i.e., Z > 1. This is because– **The weak intermolecular forces of attraction due to is very small and a/V^2 is negligible**
- The most favourable conditions to liquefy a gas are– **Low temperature and high pressure**
- It is easier to liquefy ammonia than oxygen because– **NH_3 has a higher value of van der Waals constant a and higher critical temperature than oxygen**
- Liquids are similar to gases because– **Both diffuse and take the shape of the containers**
- Vapour pressure of a liquid increases with– **Increase in temperature**
- Surface tension does not vary with– **Size of the surface**
- Relation between viscosity and liquid flow is– **Greater the viscosity, more slowly the liquid flows**
- Dipole-dipole forces act between the molecules possessing permanent dipole. Ends of dipoles possess 'partial charges'. The partial charge is– **Less than unit electronic charge**
- As the temperature increases, average kinetic energy of molecules increases. The effect of increase of temperature on pressure provided the volume is constant would be– **Increases**
- The predominant intermolecular forces present in ethyl acetate, a liquid, are– **London dispersion and dipole-dipole**
- The relative strength of interionic/intermolecular forces in decreasing order is– **ion-ion > ion-dipole > dipole-dipole**
- By what factor does the average velocity of a gaseous molecule increase when the temperature (in Kelvin) is doubled– **1.4**

EXAM POINT

A given mass of a gas obeys Boyle's law at certain temperature. The graph representation of Boyle's law- **P vs V**	**A-P EAMCET 1995**
The representation of Charles' law– $\mathbf{V_1T_2 = V_2T_1}$	**A-P EAMCET 1995**
n moles of an ideal gas at temperature, T (in Kelvin) occupy V L of volume, exerting a pressure of P atmospheres. The concentration (in mol/L) is – $\mathbf{\frac{P}{RT}}$	**A-P EAMCET 2001**
At 27°C, a closed vessel contains a mixture of equal weights of helium, (mol. wt. = 4), methane (mol. wt. = 16) and sulphur dioxide (mol. wt. = 64). The pressure exerted by the mixture is 210 mm. The partial pressures of helium, methane and sulphur dioxide are P_1, P_2 and P_3 respectively– $\mathbf{p_1 > p_2 > p_3}$	**A-P EAMCET 2002**
A and B are ideal gases. The molecular weights of A and B are in the ratio of 1 : 4. The pressure of a gas mixture containing equal weights A and B is p atm. The partial pressure (in atm) of B in the mixture– $\mathbf{\frac{p}{5}}$	**A-P EAMCET 2005**
A person living in Shimla observed that cooking food without using pressure cooker takes more time. The reason is that at high altitude– **Pressure decreases**	**AP EAPCET 23-08-2021 Shift-I**
The ratio of rates of diffusion of gases X and Y is 1 : 5 and that of Y and Z is 1 : 6. The ratio of rates of diffusion of Z and X is– **30 : 1**	**AP EAMCET (Engg.) -2014**
The value of the gas constant R is close to– **0.082 L atm $\mathbf{K^{-1}}$ $\mathbf{mol^{-1}}$**	**COMEDK 2019**
The rate of diffusion of SO_2, CO_2 PCl_3 and SO_3 are in the order– $\mathbf{CO_2 > SO_2 > SO_3 > PCl_3}$	AIIMS 25 May 2019 (Evening)
A bottle of dry ammonia and a bottle of dry hydrogen chloride connected through a long tube are opened simultaneously at both ends. The white ammonium chloride ring first formed will be– **near the hydrogen chloride bottle.**	**AIIMS-2014**
In P versus V graph, the horizontal line is found in _____exists.– **Equilibrium between gas and liquid**	**AIIMS-2007**
If P is pressure and ρ is density of a gas, then P and ρ are related as– $\mathbf{P \propto p}$	**AIIMS-2002**
On the top of a mountain, water boils at :– **low temperature**	**AP-EAMCET (Engg.) 2015**
When a perfect gas a 27° is heated at a constant pressure, to a final temperature of 327°C, then the volume of the gas increases to _____ times the original– **2**	**AP- EAPCET- 07-09-2021, Shift-I**
CH_4 diffuses two times faster than a gas X. The number of molecules present in 32 g of gas X is (N is Avogadro number)– $\mathbf{\frac{N}{2}}$	AP-EAMCET- (Engg.) - 2010
The variable determining the state of a system– **Volume, pressure, and temperature**	AMU–2003
Standard boiling point of a liquid is– **The boiling point at 1 atm pressure**	**Assam CEE-2019**
Slope between PV and P at constant temperature is :– **zero**	**BCECE-2004**
At a constant volume the specific heat of a gas is 0.05 and its molecular weights is 40. The gas is :– **Monoatomic**	**BITSAT 2010**
The predominant intermolecular forces present in ethyl acetate, a liquid, are:– **London dispersion and dipole-dipole**	**[JEE Main 2020, 8 Jan Shift-I]**
The volume of gas A is twice than that of gas B. The compressibility factor of gas A is thrice than that of gas B at same temperature. The pressures of the gases for equal number of moles are– $\mathbf{2p_A = 3p_B}$	**[JEE Main 2019, 12 Jan Shift-I]**
The intermolecular interaction that is dependent on the inverse cube of distance between the molecules is– **ion-dipole interaction**	**[JEE Main 2015]**
The relative strength of interionic /intermolecular forces in decreasing order is– **ion-ion>ion-dipole>dipole-dipole**	**[JEE Main 2020, 7 Jan Shift-I]**

The theory proposed by Gay Lussac's was– **When gases combine or reproduced in a chemical reaction they do so in a simple ratio by volume provided all gases are at the same T and P**	[JEE Main 2020, 7 Jan Shift-I]
If rate of diffusion of CH_4 is twice than that of a gas *x*, then its molecular mass is :– **64 g**	**JCECE - 2006**
Avogadro's hypothesis states that:– **Under the same conditions of temperature and pressure, equal volumes of gases contain the same number of molecules**	**JCECE - 2005**
A gas mixture contains O_2 and N_2 in the ratio of 1 : 4 by weight. The ratio of their number of molecules is– **7 : 32**	**JIPMER-2008**
In order to increase the volume of a gas by 10%, the pressure of the gas should be– **decreased by 10%**	**KARNATAKA-CET, 2008**
The ratio of rate of diffusion of SO_2 (M = 64) and oxygen (M = 32) is :– **1 : 1.414**	**Manipal-2019**
In liquid gas equilibrium, the pressure of vapours above the liquid is constant at– **Constant temperature**	**AIPMT-1995**
The beans are cooked earlier in pressure cooker because– **boiling point increase with increasing pressure**	**NEET-2011** **BITSAT -2009**
At STP, 0.50 mol H_2 gas and 1.0 mol He gas– **have equal average kinetic energies**	**NEET-1993**
The gas equation is– $\frac{P_1V_1}{P_2V_2} = \frac{T_1}{T_2}$	**NEET-1989**
Pressure remaining the same, the volume of a given mass of an ideal gas increase for every degree centigrade rise in temperature by definite fraction of its volume at– **0^oC**	**NEET-1989**
The total energy of an isolated system is- **constant**	**UP CPMT-2014**
Boyle's temperature- $T_B = \frac{a}{bR}$	**UP CPMT-2011**
A mixture of gases having different molecular weights is separated by–**Atmolysis**	**UP CPMT-2010**
The relation for diffusion of gases– $r \propto \frac{1}{\sqrt{d}}$	**UP CPMT-2005**

Ideal Gas Equation

If the pressure and the absolute temperature of a given mass of gas are doubled, the new volume will be …….. of the initial volume– **same**	**A-P EAMCET 1991**
The molecular weight of a gas that diffuses twice as rapidly as a gas with molecular weight 64, is– **16**	**A-P EAMCET 1994**
A contains 16 g of oxygen, 28 g of nitrogen and 8g of CH_4. Total pressure of mixture is 740 mm. The partial pressure of nitrogen in mm?– **370**	**A-P EAMCET 1999**
A gas deviates most from ideal behavior when it is subjected to – **Low temperature & high pressure**	**AP-EAMCET 25-08-2021 Shift - I**
The expression relating changes of entropy for an ideal gas at constant temperature is – $\Delta s = nR\ln\frac{P_1}{P_2}$	**MPPET-2008**
Equal masses of methane and oxygen are introduced into a vessel at 27ºC. The fraction of total pressure due to oxygen is – $\frac{1}{3}$	**A-P EAMCET 1995**
The volume of a given mass of a gas is directly proportional to its Kelvin temperature at constant pressure. The above statement is known as ....– **Charle's law**	**AP EAMCET (Engg.) 21.09.2020, Shift-II**

The average kinetic energy of one molecule of an ideal gas at 27°C and 1 atm pressure is– **$6.21 \times 10^{-21} JK^{-1}$ molecule^{-1}**	**AP EAMCET (Engg.)-2009**
The density of an ideal gas can be given by——where P, V, M, T and R respectively denote pressure, volume, molar-mass, temperature and universal gas constant.– $\mathbf{\frac{PM}{RT}}$	**AP EAPCET 19-08-2021 Shift-I**
The mixture forming an ideal solution – $\mathbf{n\text{-}C_6H_{14} + n\text{-}C_7H_{16}}$	**TS-EAMCET (Engg.), 06.08.2021**
The rate of diffusion of SO_2,CO_2,PCl_3 and SO_3 are in order is– $\mathbf{CO_2 > SO_2 > SO_3 > PCl_3}$	**AIIMS-2013**
Berthelot equation is – $\mathbf{\left(P + \frac{a}{TV^2}\right)(V - b) = RT}$	**AIIMS-2000**
The transport of matter in the absence of bulk flow is known as:– **diffusion**	**AIIMS-1999**
Van der Waal's equation; $\left[P + \frac{a}{V^2}\right](V - b) = nRT$ is applicable for:– **non- ideal gas**	**AIIMS-1998**
When ideal gas expands in vacuum, the work done by the gas is equal to– **0**	**VITEEE- 2006**
The ratio of rates of diffusion of hydrogen chloride and ammonia gases is– **1:1.46**	AMU – 2010
An ideal gas is undergoing from an initial volume, isothermal and adiabatic expansion from an initial volume, V_i and pressure, P_i to a common final volume of V_f, then– $\mathbf{P_{adiabatic} < P_{isothermal} : V_{adiabatic} < V_{isothermal}}$	**AMU–2006**
Two litres of an ideal gas at a pressure of 10 atm expands isothermally into a m vacuum until its total volume is ten litres During this process– **no work is done; no heat is absorbed**	**Assam CEE-2019**
A gas has a vapour density 11.2. The volume occupied by 1g of the gas at NTP is:– **1 L**	**BCECE-2004**
If the pressure and absolute temperature of 2L of carbon dioxide gas are doubled, the value of the gas would become– **2L**	**BCECE-2011**
The inversion temperature (T_i) for a gas is given by– **2a/Rb**	**BITSAT 2005**
The temperature, at a gas shows maximum ideal behaviour, is known as– **Boyle's temperature**	**CG PET -2009**
For an ideal gas, number of moles per liter in terms of its pressure P, temperature T and gas constant R is– $\mathbf{\frac{P}{RT}}$	**[AIEEE 2002]**
The gases diffuse at the same rate through a porous plug – $\mathbf{N_2O}$ **,** $\mathbf{CO_2}$**, NO,** $\mathbf{C_2H_6}$	**J & K CET-(2011)**
If the ratio of the rates of diffusion of two gases A and B is 4 : 1. Then the ratio of their densities in the same order is– **1 : 16**	**J & K CET-(2009)**
A, B and C are ideal gases. Their molecular weights are 2, 4 and 28 respectively. The rate of diffusion of these gases follow the order– **A > B > C**	**J & K CET-(2006)**
The rate of diffusion of a gas is proportional to– $\mathbf{P/\sqrt{d}}$	**J & K CET-(2004)**
Measurement of the dry gas from the volume of moist gas is based on– **Dalton's law of partial pressure**	**J & K CET-(2001)**
At constant temperature, in a given mass of an ideal gas– **the product of pressure and volume always remains constant**	**JCECE - 2011**
For an ideal binary liquid solution with $p_x^0 > p_y^0$ in relation between X_x (mole fraction of X in liquid phase) and Y_x (mole fraction of X in vapour phase) is correct, X_y and Y_y are mole fraction of Y in liquid and vapour phase respectively– $\mathbf{\frac{X_x}{X_y} < \frac{Y_x}{Y_y}}$	**JIPMER-2015**

Temperature of a gas is t K. The temperature at volume and pressure, both will reduced to half of the initial values–	**t/4**	**JIPMER-2016**
For an ideal gas, compressibility factor is –	**1**	**Karnataka-CET-2018**
A gas deviates from ideal behavior at a high pressure because its molecules–	**attract one another**	**KARNATAKA-CET, 2008**
When the absolute temperature of ideal gas is doubled and pressure is halved the volume of gas–	**will be 4 times the original volume**	**Kerala-CEE-29.08.2021** **Karnataka-CET-2021** **Kerala-CEE-2005**
Pressure of ideal and real gases at 0 K are–	**0 and > 0**	**Kerala-CEE-2017**
4 L-atm is equal to–	**96 cal**	**MHT CET-2010**
For an ideal gas, the heat of reaction at constant pressure and constant volume are related as–	$q_p = q_v + \Delta nRT$	**MHT CET-2007**
When a deviation more in the behaviour of a gas from the ideal gas equation PV = nRT–	**At low temperature and high pressure**	**NEET-1993**
A gas such as carbon monoxide would be most likely to obey the ideal gas law at–	**high temperature and low pressure**	**NEET-2013**
If P, V, M, T and R are pressure, volume, molar mass, temperature and gas constant respectively, then for an ideal gas, the density is given by–	$\frac{PM}{RT}$	**NEET-1989**
The compressibility factor of an ideal gas is–	**1**	**UP CPMT-2003**
For an ideal gas, Joule-Thomson coefficient is–	**zero**	**UP CPMT-2001**
Van der Waals' real gas, acts as an ideal gas at the condition of –	**High temperature, low pressure**	**UPTU/UPSEE-2015** **BCECE-2012** **NEET-2002**
Avogadro's law is valid for–	**ideal gas**	**WB-JEE-30.04.2022**
Mixing of two different ideal gases under isothermal reversible condition will lead to–	**increase of entropy of the system**	**WB-JEE-2013**

Kinetic energy and molecular speeds and kinetic molecular theory of gases

Real gases show ideal behaviour at–	**low pressure and high temperature**	**A-P EAMCET 1996**
The compressibility factor (Z) of a gas is < 1 at STP. Therefore–	$V_m < 22.4L$	**TS EAMCET 10.08.2021, Shift-II**
A real gas would be most likely to obey the ideal gas laws at ———	**high temperature and low pressure**	**AP EAPCET 25.08.2021, Shift-II**
A low pressure, the van der Waal's equation is reduced to–	$Z = \frac{PV_m}{RT} = 1 - \frac{a}{VRT}$	**VITEEE-2019**
In Van der Waals' equation of state of the gas law, the constant 'b' is a measure of–	**Volume occupied by the molecules**	**[AIEEE 2004]**
The compressibility factor for a real gas at high pressure is–	$1 + \frac{pb}{RT}$	**AIEEE-2012**
If Z is a compressibility factor, van der Waals' equation at low pressure can be written as–	$Z = 1 - \frac{a}{VRT}$	**[JEE Main 2014]**
The behavior of real gas approaches ideal behavior at–	**high temperature, low pressure**	**J & K CET-(2013, 2003, 2000)** **COMEDK 2016**
The units of van der Waals constants a and b respectively are–	L^2 **atm** mol^{-2} **and** mol^{-1} **L**	**J & K CET-(2008)**
In Van der Waals' equation of state of the gas law, the constant 'b' is a measure of–	**volume occupied by the molecules**	**JCECE – 2008** **Manipal-2016** **JCECE - 2010**

If a gas expands at constant temperature, it indicates that– **kinetic energy of molecules remains same**	**JCECE - 2013**
The compressibility of a gas is less than unity at STP, therefore– **V_m < 22.4 L**	**JIPMER-2017**
a/V^2 given in Van der Waal's equation is for– **inter molecular attraction**	**JIPMER-2005**
The pressure of real gases is less than that of ideal gas because of– **Intermolecular attraction**	**Karnataka-CET-2017**
The type of attractive forces that operate between gaseous HCl molecules is– **dipole-dipole forces**	**Kerala-CEE-2020**
In van der Waals' equation of state for a non-ideal gas, the term that accounts for intermolecular forces is– $\left(\mathbf{P}+\frac{\mathbf{a}}{\mathbf{V}^2}\right)$	**NEET-1990**
At low pressure and high temperature, the van der waal's equation is finally reduced (simplified) to– **pV_m=RT**	**UPTU/UPSEE-2017**
A Van der Waals' gas may behave ideally when– **the pressure is very low**	**WB-JEE-2013**
For a van der Waals' gas, the term $\left(\frac{ab}{V^2}\right)$ represents some– **energy**	**WB-JEE-2019**
The Kinetic energy of one mole of any gas depends upon ______– **absolute temperature of the gas**	**AP EAPCET 24.08.2021, Shift-I**
Three flasks of equal volumes contain CH_4, CO_2 & Cl_2 gases respectively. They will contain equal number of molecules if_______– **Temperature & Pressure of all the flasks are same**	**AP EAPCET 20.08.2021 Shift-II**
The kinetic energy of 4 moles of nitrogen gas at 127°C is….. cals. $\left(R = 2\text{cal mol}^{-1}\text{K}^{-1}\right)$ – **4800**	**AP-EAMCET (Medical), 2003**
At critical state, the compressibility factor (Z) for a real gas is equal to– $\mathbf{\frac{3}{8}}$	**AIIMS-26 May, 2018 (M)**
The compressibility factor of an ideal gas is:– **1**	**AIIMS-1997**
Above the Boyle temperature, the compressibility factor of the real gases, Z is– **Z > 1**	**AMU-2013**
The kinetic energy of one mole of a gas is– $\mathbf{\frac{3}{2}RT}$	AMU 2002
Magnitude of kinetic energy in an orbit is equal to:– **half of the potential energy**	**BCECE-2005**
According to the kinetic theory of gases, in an ideal gas, between two successive collisions a gas molecule travels– **In a straight line path**	**[AIEEE 2003]**
According to kinetic theory of gases– **the absolute temperature is a measure of kinetic energy of molecules**	**J & K CET-(2001)**
The kinetic energy of a gas molecule is .... temperature– **directly proportional to**	**Manipal-2019**
Internal energy and pressure of a gas per unit volume are related as– $\mathbf{P = \frac{2}{3}E}$	**NEET-1993**
If a gas expands at constant temperature, it indicates that– **Kinetic energy of molecules remains the same**	**NEET-2008**
Average molar kinetic energy of CO and N_2 at same temperature is– **$KE_1 = KE_2$**	**NEET-2000**
The order of interactions – **Van der Waal's < Hydrogen bonding < Dipole-dipole < Covalent**	**NEET-1993**
The rate of diffusion of a gas in a diffusion tube is $\frac{1}{2\sqrt{7}}$. Molecular weight of the gas (in g mol^{-1})– **28**	**A-P EAMCET 1992**

At 27ºC, the ratio of root mean square velocities of ozone to oxygen is– $\sqrt{\frac{2}{3}}$	**A-P EAMCET 1992**
The root mean square velocity of a gas is doubled when the temperature is– **increased four times**	**AP – EAMCET - (Medical)-1997** **A-P EAMCET 1996**
The R.M.S. velocity of CH_4, He and SO_2 are in the ratio of– **2:4:1**	**COMEDK 2012**
If the density ratio of O_2 and H_2 is 16:1, then ration of their V_{rms} will be– **1 : 4**	**Assam CEE-2014** **AIIMS-1994** **BITSAT 2008**
The gas molecules having equal total kinetic energy and translational kinetic energy – **He**	**AIIMS-1996**
For the diffusion of a gas at pressure P, the rate of diffusion is expressed by:– $\mathbf{r \propto \frac{1}{\sqrt{M}}}$	**AIIMS-1998**
The root mean square velocity of an ideal gas at constant pressure varies with density (d) as– $\sqrt{\frac{1}{d}}$	**AMU-2015** **WB-JEE-2008**
The temperature of a gas is raised from 27^{o}C to 927^{o}C, the root mean square velocity is– **doubled**	**Assam CEE-2020** **AP EAPCET 20.08.2021 Shift-II**
The average kinetic energy of an ideal gas per molecule in SI unit at 25^{0}C will be– $\mathbf{6.17\times10^{-21}}$ **J**	**BITSAT 2016** **NEET-1996**
Increasing order of rms velocities of H_2, O_2, N_2 and HBr is– $\mathbf{HBr < O_2 < N_2 < H_2}$	**BITSAT 2013** **AMU – 2008** **NEET-1991**
The molecular velocity of any gas is– **Directly proportional to square root of temperature**	**[AIEEE 2011]**
The average velocity (in cm/s) of hydrogen molecule at **27°C** will be– $\mathbf{17.6 \times 10^4}$	**JIPMER-2009**
The rms velocity of hydrogen is $\sqrt{7}$ times the rms velocity of nitrogen. If T is the temperature of the gas, then – $\mathbf{T_{N_2} = 2T_{H_2}}$	**Karnataka-CET-2011**

Deviation from ideal gas behavior and liquefaction of gases

Real gases approach the ideal gas behaviour at– **High temperature and low pressure**	**AP-EAMCET- (Engg.)-2011**
An ideal gas can't be liquefied because– **forces operated between its molecules are negligible**	**BITSAT 2012** **BCECE-2010**
When the temperature is raised, the viscosity of liquid decreases this is because– **increased attraction between molecules**	**BITSAT 2010**
A gas at high temperature is cooled. The highest temperature at which liquefaction of gas first occurs is called.– **critical temperature**	**J & K CET-(2015)**
The surface tension of liquids is determined by – **single capillary method**	**J & K CET-(2007)**
A gas can be liquefied– **below its critical temperature**	**UP CPMT-2009**
A gas can be liquefied at temperature T and pressure P provided– $\mathbf{T < T_C}$ **and** $\mathbf{P > P_c}$	**WB-JEE-2015**

5. Equilibrium

Equilibrium in Physical Processes

- For the physical equilibrium $H_2O(s) \rightleftharpoons H_2O(l)$ is true– **More of ice melts if pressure on the system is increased**
- A reaction reaches a state of equilibrium only when– **The products react together at the same rate at they are formed**
- Attainment of equilibrium in a coloured gaseous reversible reaction is detected by the constancy of– **Colour**
- Is not a general characteristic of equilibrium involving physical processes– **Measurable properties of the system keep changing**
- The characteristic of a reversible reaction is – **It can never proceed to completion**
- A reaction is said to be in equilibrium when– **The rate of transformation of reactants to products is equal to the rate of transformation of products to the reactants**
- The irreversible reaction is a – $\mathbf{2KClO_3 \rightarrow 2KCl + O_2}$
- The reversible reaction is a:– **$CaCO_3$ heated in a closed vessel**

Law of Chemical Equilibrium and Equilibrium Constant (K)

- In the dissociation of PCl_5 are– $PCl_5(g) \rightarrow PCl_2(g) + Cl_2(g)$, If the degree of dissociation is α at equilibrium pressure "P", then the equilibrium constant for the reaction is– $\mathbf{K_p = \frac{\alpha^2 p^2}{1-\alpha^2}}$
- For the equilibrium. $2NO(g) + Cl_2(g) \rightleftharpoons 2NOCl(g)$
  K_P is related to K_c by the reaction– $\mathbf{Kp = \frac{K_c}{RT}}$
- the reaction $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ goes to completion in lime kiln because of the – **CO_2 escapes continuously**
- For reactions involving gaseous reactants and products the equilibrium constant K_P is written in terms of– **The partial pressures of the gases**
- The value of K_c for the reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ depends on– **Temperature**
- K_c for the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_2$ is K then the value of K_c for the reaction $2NH_3 \rightleftharpoons N_2 + 3H_2$ will be– **1/K**
- In the reaction $H_2(g) + I_2(g) \rightarrow 2HI(g)$– $\mathbf{K_p = K_c}$
- K_P for the reaction $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ is– $\mathbf{K_P = P_{CO_2}}$
- The equilibrium constant for the reaction $A \rightleftharpoons B$ is K. The equilibrium constant for the reaction $mA \rightleftharpoons mB$ is– $\mathbf{K^m}$
- For the homogeneous reaction $4NH_3(g) + 5O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(g)$ the equilibrium constant K_c has the unit of– **Conc**
- The unit of K_p for the reaction is – $CS_2(g) + 4H_2(g) \rightleftharpoons CH_4(g) + 2H_2S(g)$– $\mathbf{atm^{-2}}$
- The degree of dissociation of PCl_5– **Decreases with increasing pressure**
- The gaseous reactions K_P is less than K_c–$\mathbf{2SO_2 + O_2 \rightleftharpoons 2SO_3}$
- The unit of equilibrium constant (K_c) in general is– $\mathbf{(Mole/lit)^{\Delta n}}$
- For the reaction $CO(g) + Cl_2(g) \rightleftharpoons COCl_2(g)$, K_p/K_c is equal to– **1/RT**
- $NH_2COONH_4(s) \rightleftharpoons 2NH_3(g) + CO_2(g)$ If equilibrium presure is 3 atm for the above reaction, K_p will be– **4**
- The K_p of the reaction is $NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$, it the total pressure at equilibrium is 30 atm– $\mathbf{225\ atm^2}$

Application of Equilibrium Constant

- Predict the effect of increased pressure on reaction's equilibrium.
  $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$–

- The conditions will favour maximum formation of the product in the reaction,
  $A_2(g) + B_2(g) \rightleftharpoons X_2(g)$ $\Delta_rH = -X$ kJ
  Low temperature and high pressure
- .... causes the change in the value of equilibrium constant of any equilibria– **Decreasing the temperature**
- In melting ice, the conditions will be more favourable– **High temperature and high pressure**
- For the reversible reaction,
  $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + \text{heat}.$
  The equilibrium shifts in forward direction– **By increasing pressure and decreasing temperature**
- The value of ΔH for the reaction
  $X_2(g) + 4Y_2(g) \rightleftharpoons 2XY_4(g)$ is less than zero. Formation of $XY_4(g)$ will be favoured at– **High pressure and low temperature**
  Equilibrium shift to the right
- Given exothermic reaction
  $CoCl_4^{2-} + 6H_2O_{(l)} \rightleftharpoons [Co(H_2O)_6]^{2+} + 4Cl^-$
  the one of will decrease the equilibrium concentration of $CoCl_4^{2-}$ –
  The solution is diluted with water
- Reaction, $2BaO_2(g) \rightleftharpoons 2BaO(s) + O_2(g)$; $\Delta H = +ve$
  In equilibrium condition, pressure of O_2 depends upon–
  Increased temperature of equilibrium
- The reaction favored at low pressure is–
  $\mathbf{PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)}$
- For a reversible reaction, if the concentrations of the reactants are doubled, then the equilibrium constant value– **Remains the same**
- An increase in pressure would favour the forward reaction– $\mathbf{2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)}$
- In the reaction $NH_4SH(s) \rightleftharpoons NH_3(g) + H_2S(g)$ on doubling the concentration of ammonia the equilibrium concentration of H_2S is–
  Reduced to half to its initial value
- With increase in temperature, the value of equilibrium constant– **May increase or decrease**
- The equilibrium constants of a reaction at 298 K and 308 K are 1.0×10^{-2} and 2×10^{-2} respectively, the reaction is– **Endothermic**
- The reaction goes to more completion– $\mathbf{K_c = 10^{10}}$
- For a system to be in equilibrium, $\Delta G = 0$ under conditions of constant– **Temperature and pressure**
- Law of mass action cannot be applied to– **Transition of Rhombic Sulphur to Monoclinic sulphur**
- In a system: $A(s) \rightleftharpoons 2B(g) + 3C(g)$. If the concentration of C at equilibrium is increased by a factor 2, it will cause the equilibrium concentration of B to change to– $\mathbf{\frac{1}{2\sqrt{2}}}$ **time of its original value**
- A catalyst is introduced into a reversible reaction– **Attains equilibrium quickly**
- The equilibrium constant of a reaction is 300, if the volume of the reaction flask is tripled, the equilibrium constant will be– **300**

Acids, Bases and Salts, Ionization of Acids and Bases, Buffer Solutions

- The strongest acid in the- $\mathbf{HClO_4}$
- The order of basic strength is–
  $\mathbf{H_2O < CH_3OH < OH^- < CH_3O^-}$
- $H_3O^+ + OH^- \rightarrow 2H_2O$ is– **Bronsted neutralisation**
- The no. of conjugate acid-base pairs present in the aqueous solution of H_3PO_3 is– **3**
- The conjugate base of $H_2PO_4^-$ is– $\mathbf{HPO_4^{2-}}$
- The conjugate base is not a – **Oxide ion**
- In the reaction $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$, the conjugate acid-base pair is– $\mathbf{NH_4^+}$ **and** $\mathbf{NH_3}$
- The conjugate base of hydrazoic acid is– $\mathbf{N_3}$
- Conjugate base of $[Al(H_2O)_6]^{3+}$ is– $\mathbf{[Al(H_2O)_5OH]^{2+}}$
- The Bronsted acid that has the weakest conjugate base is– **HCl**
- The strong elecrolyte is a – $\mathbf{BaCl_2}$
- Degree of dissociation of 0.1N CH_3COOH is ($K_{acid} = 1 \times 10^{-5}$)– $\mathbf{10^{-2}}$
- Extent of ionisation depends upon– **Dilution**
- If NaOH is added to a solution of acetic acid– $\mathbf{[CH_3COO^-]}$ **increases**
- 100 ml of HCl + 35 ml of NaOH, colour of methyl orange in the solution will be– **Red**
- For anionic hydrolysis, pH is given by–
  $\mathbf{\frac{1}{2}pK_w + \frac{1}{2}pK_a + \frac{1}{2}\log c}$
- The salts will not change the pH of pure water on dissociation– **KCl**
- The happens to ionic product of H_2O as temperature increases – **Increases**
- The aqueous solution of HCOONa, $C_6H_5NH_3^+Cl^{-1}$ and KCN are respectively– **Basic, acidic, basic**
- At 25°C, the $[H^+]$ of a solution is 2×10^{-9} M. The nature of the solution is– **Basic**
- The pair will show common ion effect is–
  $\mathbf{NH_4OH + NH_4Cl}$
- The pairs constitutes a buffer is –
  $\mathbf{HNO_2}$ **and** $\mathbf{NaNO_2}$
- The combinations will constitute buffer solution is–
  $\mathbf{CH_3COOH/CH_3COONa}$