1. SOME BASIC CONCEPTS IN CHEMISTRY

1 OMQ + 2 VSAQ + 1SAQ [1 M + 2M + 2M+ 4M = 9 M]

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. The drug Azidothymidine (AZT) is used in the treatment of **[MAR-26]** [2]
   1) Cancer **2) AIDS** 3) Bronchitis 4) Ulcer

2. Which one of the following pairs of the compounds illustrate the law of multiple proportions? **[BMP1]** [4]
   1) H_2O & Na_2O 2) MgO & Na_2O 3) Na_2O & BaO **4) $SnCl_2$ & $SnCl_4$**

3. Chemical equation is balanced according to the law of [3]
   1) Multiple proportions 2) Reciprocal proportions
   3) Conservation of mass 4) Definite proportion

4. If the abundances of isotopes of iron, ^{54}Fe, ^{56}Fe and ^{57}Fe are 5%, 90% and 5% respectively, the atomic mass of Fe can be [2]
   1) 55.85 **2) 55.95** 3) 55.75 4) 56.05

5. The density of gas at STP is 1.25 gL^{-1}. The molecular mass of the gas is [2]
   1) 14 u **2) 28 u** 3) 16 u 4) 32u

6. 2.4×10^{22} atoms of a diatomic element weighs 1.32 g. It's molecular mass is [3]
   1) 33 u 2) 16.5u **3) 66 u** 4) 40u

7. Two elements X and Y form two compounds X_2Y_3 and X_2Y. 0.5 mole of X_2Y_3 weighs 38 g and 0.1 mole X_2Y weighs 4.4 g. The atomic mass of X and Y could be [3]
   1) 20 u, 15 u 2) 31 u, 16 u **3) 14 u, 16 u** 4) 16 u, 27 u

8. Which of the following contain more number of molecules? [1]
   1) 448 L of O_2 at STP 2) 440 L of CO_2
   3) 22.4 L of water at STP 4) 2.24 L of H_2 at STP

9. Which one of the following will have the largest number of atoms? [3]
   1) 1g $Au_{(S)}$ 2) 1g $Na_{(S)}$ **3) 1g $Li_{(S)}$** 4) 1g $Cl_{2\,(g)}$

10. The empirical formula of an organic compound is CH_2. The mass of 1 mole of it is 42 g. The molecular formula of the compound is [3]
    1) C_4H_8 2) C_2H_4 **3) C_3H_6** 4) CH_2

11. The volume (in litre) of CO_2 liberated at STP when 10 g of 90% pure limestone is heated completely is [4]

1) 22.4 2) 2.24 3) 20.16 **4) 2.016**

12. The mole fraction of NaCl in a solution containing 1 mole of NaCl in 1000g of water is [1]

1) 0.0177 2) 0.001 3) 0.5 4) 0.244

13. 3.42 g of a substance of molecular mass 342 g is present in 250 g of water. Molality of this solution is [2]

1) 0.4m **2) 0.04m** 3) 0.8m 4) 4m

14. The number of moles of NaOH required to make a 0.2 M solution of 1 litre [1]

1) 0.2 2) 0.5 3) 1 4) 2

15. At present "amu" has been replaced by [3]

1) Molar mass 2) Atomic mass **3) Unified mass** 4) Formula mass

[☞ Answers for MCQ are kept in **bold font**] ☛ **Right Key for Q8 is (1), Q14 is (1)**

II. FILL IN THE BLANKS(FIB)

1. One amu is numerically equal to **1.66×10^{-24} g** .
2. The numerical value of Avogadro number is **6.022×10^{23}** .
3. The number of atoms present in 64 g of sulphur (S_8) is **$2N_A = 1.204\times10^{24}$**
4. The molar volume of any gas at STP is **22.4 Litres**.
5. When 20 grams of sugar ($C_{12}H_{22}O_{11}$) is dissolved in water to make a final volume of 2 litres, the molarity of sugar solution is **0.0292 M**.

III. ONE WORD ANSWER Q'S

1. How many litres are present in 1 mL?

A: 0.001L [$\because$1L = 1000mL]

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2. What is the basicity of hypophosphorous acid (H_3PO_2)?

A: Basicity of H_3PO_2 is **1.** [Basicity is the number of replaceable H^+ ions]

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3. In the given reaction, $NaOH + H_2SO_4 \rightarrow NaHSO_4 + H_2O$; what is the equivalent weight of H_2SO_4?

A: 98 $\left[\text{Equivalent weight} = \frac{\text{GMW}}{\text{Basicity}} = \frac{98}{1}\right]$

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4. Write the relation between Kelvin scale and Celsius scale of temperature.

A: K = °C + 273.15

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5. How many molecules are present in 1 cc of N_2, gas at STP? **[BMP2]**

A: 2.65×10^{19} molecules

[22400cc of N_2 contains 6.023×10^{23} molecules

1cc of N_2 contains x molecules $\Rightarrow x = \frac{6.023 \times 10^{23} \times 1}{22400} = 2.65 \times 10^{19}$

HINTS FOR HARD MCQ & FIB

MULTIPLE CHOICE QUESTIONS [MCQ]

1. **(2)**
2. **(4)**
3. **(3)**
4. **(2)** $\text{Avg.atomic mass} = \frac{(54\times5)+(56\times90)+(57\times5)}{100} = 55.95$
5. **(2)** Density of the gas at STP is d = 1.25 g/L; Molar volume at S.T.P is V= 22.4
   Molar mass $= d \times V = 1.25 \times 22.4 = 28$ g/mol
6. **(3)** No.of atoms = No.of moles $\times N_A \times$ atomicity; Atomicity of Diatomic molecule is 2 .

$$\text{No.of moles } n = \frac{\text{No.of atoms}}{N_A \times \text{Atomicity}} = \frac{2.4\times10^{22}}{6.022\times10^{23}\times2} = \frac{2.4\times10^{22}}{12.044\times10^{23}} = 0.02 \text{ mol}$$

$$\text{Molar mass} = \frac{W}{n} = \frac{1.32}{0.02} = 66u$$

7. **(3)** Weight of .0.5 moles of X_2Y_3 is 38 g.
   Weight of 0.1 moles of X_2Y is 4.4g.

$$n_{mole} = \frac{\text{Given mass}}{\text{Molar mass}} \Rightarrow \text{Molar mass} = \frac{\text{Given mass}}{n_{mole}}$$

$\therefore$ Molar mass of $X_2Y_3 = \frac{38}{0.5} = 76 g/mol$; Molar mass of $X_2Y = \frac{4.4}{0.1} = 44 g/mol$

$2M_X + 3M_Y = 76$ .....(1)

$2M_X + M_Y = 44$ .....(2)

(1)–(2) $\Rightarrow 2M_Y = 32 \Rightarrow M_Y = 16$

Now $2M_X + 3(16) = 76 \Rightarrow 2M_X = 76 - 48 = 28 \Rightarrow M_X = 14$

8. **(3)** 1)**448 L of O_2 at STP**:No.of moles $n = \frac{\text{Volume at STP}}{22.4} = \frac{448}{22.4} = 20$ moles

2) **440 L of CO_2:** No.of moles $n = \frac{\text{actual volume}}{\text{molar volume}} = \frac{440}{22.4} = 19.6$ moles

3)**22.4 L of water:**No.of moles $n = \frac{22.4}{22.4} = 1$ mole

4) **2.24 L of H_2:** No.of moles $n = \frac{2.24}{22.4} = 0.1$ mole

$\therefore$ **448 L of O_2 with 20 moles** contains more no.of molecules [☛ Given textual answer is a mistake]

9. **(3)** All are of equal weights (1g). Element with lowest atomic mass contains more no.of atoms. Among the given options Li has least atomic mass and hence it has largest no.of atoms.

10. **(3)** Empirical formula mass of CH_2 = 12 + 2 = 14; given mass of 1 mole of CH_2 = 42 g

$n = \frac{42}{14} = 3$ $\therefore$ Molecular formula = $(CH_2) \times 3 \Rightarrow C_3H_6$

11. **(4)** Mass of pure limestone $= 10g \times \frac{90}{100} = 9g$; GMW of $CaCO_3$= 100 g

No.of moles of $CaCO_3 = \frac{9g}{100g} = 0.09\,moles$

$$\underset{1mole}{CaCO_3} \longrightarrow \underset{1mole}{CaO} + \underset{1mole}{CO_2}$$

1 mole of CO_2 occupies 22.4 L

0.09 moles of CO_2 occupies x L

$x = \frac{22.4 \times 0.09}{1} = 2.016\,L$

12. **(1)** No.of moles of NaCl is 1; Given weight of H_2O = 1000 g; GMW of H_2O = 18 g

No.of moles of $H_2O = \frac{1000}{18} = 55.56$ moles

Total moles = 1 + 55.56 = 56.56 moles

$\therefore$ Mole fraction of $NaCl = \frac{n_{NaCl}}{n_{NaCl} + n_{H_2O}} = \frac{1}{1+55.56} = \frac{1}{56.56} = 0.0177$

13. **(2)** $Molality = \frac{W_{solute} \times 1000}{GMW_{solute} \times W_{solvent}} = \frac{3.42 \times 1000}{342 \times 250} = \frac{4}{100} = 0.04$ mol/Kg

14. **(1)** $Molarity = \frac{n_{moles}}{V_{solution(L)}}$ [☛ Given textual answer is a mistake]

n = M × V= 0.2 × 1 = 0.2

15. **(3)**

FILL IN THE BLANKS [FIB]

1. $\mathbf{1.66 \times 10^{-24}\,g}$

2. $\mathbf{6.022 \times 10^{23}}$

3. GMW of Sulphur is 32 g $\Rightarrow$ 32 g of Sulphur contains $1N_A$ of atoms.

   $\therefore$ Number of atoms in 64 g of Sulphur = $2N_A = 2(6.022 \times 10^{23}) = 1.024 \times 10^{24}$

4. **22.4 Litres**.

5. $Molarity\,M = \frac{W}{GMW}\frac{1}{V(L)} = \frac{20}{342} \times \frac{1}{2} = 0.0292\,M$

2. STRUCTURE OF ATOM

1 OMQ + 2 VSAQ + 1SAQ + LAQ [1 M + 2M + 2M + 4M + 8M = 17 M]

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. Which of the following statements are correct about cathode rays? [3]

I. They move from cathode to anode. II. These are visible rays.

III.Television picture tubes are cathode ray tubes.

IV.In the absence of electrical or magnetic field, these rays travel in straight lines.

Choose the most appropriate answer from the options given below

1) I, II and III 2) II, III and IV **3) I, III and IV** 4) I, II, III and IV

2. Increasing order for the values of e/m for electron (e), proton (p), neutron (n) and α-particles is [BMP1] [2]

1) e < p < n < α **2) n < α < p < e** 3) n < p < e < α 4) n < p < α < e

3. Rutherford's experiment on the scattering of α-particles showed for the first time that the atom has [3]

1) Electrons 2) Protons **3) Nucleus** 4) Neutrons

4. Thomson's model of the atom is also called [4]

1) Plum pudding model 2) Raisin pudding model

3) Watermelon model **4) All of the above**

5. In photoelectric effect at which frequency electron will be ejected with certain kinetic energy (ν_0 = threshold frequency) [4]

1) $\nu - \nu_0$ 2) $\nu_0 > \nu$ 3) $\nu_0 \geq \nu$ **4) $\nu > \nu_0$**

6. A 600 Watt mercury lamp emits monochromatic radiation of wavelength 331.3 nm. How many photons are emitted from the lamp per second? ($h = 6.626 \times 10^{-34}$ Js, Velocity of light: 3×10^8 m/s) [3]

1) 1×10^{19} 2) 1×10^{20} **3) 1×10^{21}** 4) 1×10^{23}

7. Which of the following electronic transitions in the hydrogen atom will require highest energy? [2]

1) n = 4 to n = 5 **2) n = 1 to n = 2** 3) n = 3 to n = 5 4) n = 2 to n = 3

8. The ratio of radii of second orbit of hydrogen atom to 4th orbit of He^+ ion is [3]

1) 1 : 4 2) 2 : 1 **3) 1 : 2** 4) 3 : 2

9. The energies of an electron in first orbit of He^+ and 3rd orbit of Li^{2+} in J are respectively [1]

1) -8.72×10^{-18}, -2.18×10^{-18} J 2) -8.72×10^{-18}, -1.96×10^{-17} J

3) -1.96×10^{-17}, -2.18×10^{-18} J 4) -8.72×10^{-17}, -1.96×10^{-17} J

10. The value of Rydberg constant is [3]

1) 109777cm^{-1} 2) 109977 cm^{-1} **3) 109677cm^{-1}** 4) 109277cm^{-1}

11. The velocity of a particle A is 0.1 m/s and that of particle B is 0.05 m/s. If the mass of the particle B is 5 times that of particle A. Then the ratio of de-Broglie wavelengths associated with the particles A and B is [4]

1) 2 : 5 2) 3 : 4 3) 6 : 4 **4) 5 : 2**

12. The number of radial nodes and angular nodes of a 4f orbital are respectively [1]

1) 0, 3 2) 1, 2 3) 2, 1 4) 2, 0

13. Maximum number of electrons possible with spin quantum number +1/2 with principal quantum number n = 4 is [1]

1) 16 2) 9 3) 4 4) 25

14. The wavelength of second line in the Lyman series of hydrogen atomic spectrum is (Rydberg constant = Rcm^{-1}) [2]

1) $\frac{8R}{9}$ **2) $\frac{9}{8R}$** 3) $\frac{4}{3R}$ 4) $\frac{3R}{4}$

15. What is the correct orbital designation of an electron with the quantum numbers n = 4 , l=3, m = – 2, s = +1/2 ? [2]

1) 3s **2) 4f** 3) 5p 4) 4d

II. FILL IN THE BLANKS(FIB)

1. Splitting of spectral lines in magnetic field is called **Zeeman effect** .
2. Splitting of spectral lines in electric field is called **Stark effect**. **[MAR-26]**
3. The preference of three unpaired electrons in the nitrogen atom can explained by **Hund's Rule**.
4. The electronic configuration of copper is **$[Ar]4s^1 3d^{10}$** .
5. The electronic configuration of chromium is **$[Ar]4s^1 3d^5$** .
6. In potassium atom, the differentiating electrons enters into 4s orbital instead of 3d orbital. This is according to **Aufbau principle**.

III. ONE WORD ANSWER Q'S

1. Define isotopes.

A: **Isotopes** are atoms of the same element with **same atomic number** but **different atomic mass number**. **Ex :** $^{12}_{6}C$, $^{13}_{6}C$, $^{14}_{6}C$

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2. Write the difference between orbit and orbital?

A: **Orbit** is a well defined circular path of a revolving electron around the nucleus.
Orbital is the 3-d space around the nucleus where the probability of finding an electron is maximum.

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3. How many nodal planes are present in d orbitals? **[BMP2]**

A: Number of nodal planes present in d orbitals **2.**

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4. How many 'p' electrons are present in Sulphur atom?

A: Number of 'p' electrons in sulphur = 6+4 = **10.**
Electronic configuration of S(16) is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$

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5. What are degenerate orbitals?

A: Degenerate orbitals are atomic orbitals with in the same sub-shells and the same energy.
Ex: p_x, p_y, p_z are degenerate orbitals of 2p.

HINTS FOR HARD MCQ & FIB

MULTIPLE CHOICE QUESTIONS [MCQ]

1. **(3)**

2. **(2)** $\frac{e}{m}$ of electron $=\frac{1}{\left(\frac{1}{1837}\right)}=1837$; $\frac{e}{m}$ of proton $=\frac{1}{1}=1$;

$\frac{e}{m}$ of neutron $=\frac{0}{1}=0$; $\frac{e}{m}$ of $\alpha-$particle $=\frac{2}{4}=0.5$ $\quad\therefore n<\alpha<p<e$

3. **(3)**

4. **(4)**

5. **(4)**

6. **(3)** 600W = 600 J/s$\Rightarrow$Energy emitted per second = 600 J

Given $\lambda=313.3\text{nm}=313.3\times10^{-9}\text{m}$; Also h= 6.626×10^{-34}Js, c= $3\times10^{8}\text{ms}^{-1}$

Energy of one photon $E=\frac{hc}{\lambda}=\frac{6.626\times10^{-34}\text{Js}(3\times10^{8}\text{ms}^{-1})}{313.3\times10^{-9}\text{m}}=6.394\times10^{-19}$

Photons emitted per second $=\frac{600\text{J}}{6.3\times10^{-19}}=1\times10^{21}$

7. **(2)** Among the given n=1 to n=2 has lower quantum numbers hence higher is its energy. (or)

$$\Delta E=-13.6\left[\frac{1}{n_1^2}-\frac{1}{n_2^2}\right]=-13.6\left[\frac{n_2^2-n_1^2}{n_1^2n_2^2}\right]$$

Hence, if the value in the denominator $n_1^2n_2^2$ is low, the fractional value is high.

8. **(3)** $r_n=0.529\times\frac{n^2}{Z}$; $r_H=0.529\times\frac{2^2}{1}$; $r_{H_e^+}=0.529\times\frac{4^2}{2}$; $\frac{r_H}{r_{H_e^+}}=\frac{0.529\times4}{0.529\times8}=\frac{1}{2}=1:2$

9. **(1)** $E_n=-2.18\times10^{-18}\left(\frac{Z^2}{n^2}\right)\text{J/atom}$

$E_{He^+}=-2.18\times10^{-18}\left(\frac{2^2}{1^2}\right)=-8.72\times10^{-18}\text{J}$; $E_{Li^{+2}}=-2.18\times10^{-18}\left(\frac{3^2}{3^2}\right)=-2.18\times10^{-18}\text{J}$

11. **(4)** $\lambda_A=\frac{h}{m_Av_A}$; $\lambda_B=\frac{h}{m_Bv_B}\Rightarrow\frac{\lambda_A}{\lambda_B}=\frac{h(m_Bv_B)}{h(m_Av_A)}=\frac{m_Bv_B}{m_Av_A}=\frac{5m_A\times0.05}{m_A\times0.1}=\frac{0.25}{0.1}=2.5=\frac{5}{2}$

12. **(1)** No.of Radial nodes = n – l – 1 [for 4f, n = 4 & l = 3]

No.of Radial nodes in 4f = 4 – 3 – 1 = 0; Angular nodes in 4f = l = 3

13. **(1)** $n^2=4^2=16$

14. **(2)** Form second line in Lyman series, n_1=1, n_2=3

$$\bar{v}=\frac{1}{\lambda}=R\left[\frac{1}{1^2}-\frac{1}{3^2}\right]=R\left[1-\frac{1}{9}\right]=\frac{8R}{9}\Rightarrow\lambda=\frac{9}{8R}$$

15. **(2)** n = 4, l =3, m = –2, s = +1/2; n = 4, l =3 is for f $\therefore$ 4f

3. Classification of Elements & Periodicity in Properties

1 OMQ + 1 VSAQ + 1 SAQ + 1 LAQ [1 M + 2M + 4M+ 8M = 15 M]

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. Which of the following oxide, when dissolved in water form an acidic solution? [BMP1]

1) Na_2O 2) CO 3) Al_2O_3 **4) Cl_2O_7** [4]

2. The maximum covalency of Be in $[BeF_4]^-$ and Al in $[AlF_6]^{3-}$ are respectively?

1) 4, 6 2) 4, 4 3) 6, 4 4) 6, 6 [1]

3. The increasing order of ionization enthalpy of second period elements is [3]

1) Li < B < Be < C < NO < F < Ne 2) Li < Be < B < C < N < O < F < Ne

3) Li < B < Be < C < O < N < F < Ne 4) Li < Be < B < C < O < N < F < Ne

4. The difference in electronegativities of elements give information regarding [2]

1) bond length **2) nature of bond**

3) volume of anion 4) volume of cation

5. The atomic radius of fluorine is 64 pm. What is the ionic radius of fluoride ion?

1) 64 pm **2) 136 pm** 3) 32 pm 4) 60 pm [2]

6. The atomic number of the element unnilennium is [4]

1) 102 2) 108 3) 119 **4) 109**

7. Which one of the following sets of ions represents a collection of iso electronic species? [4]

1) L i^+ , Na^+, Mg^2 + C a^{2+} 2) Ba^{2+}, Sr^{2+}, K^+, Ca^{2+}

3) N^{3-}, O^{2-}, F^-, S^{2-} **4) K^+, Cl^-, Ca^{2+}, Sc^{3+}**

8. Three elements X, Y and Z are in the third period of the periodic table. The oxides of X, Y and Z respectively are basic, amphoteric and acidic. The correct order of the atomic numbers of X, Y and Z is [3]

1) X < Z < Y 2) Z < Y < X **3) X < Y < Z** 4) Y < X < Z

9. In which of the following, elements are arranged in the decreasing order of their metallic nature? [1]

1) Na > Mg > Be > Si > P 2) P > Si > Be > Mg > Na

3) Si > P > Be > Na > Mg 4) Be > Na > Mg > Si > P

10. What is the atomic number of the element present in the 4th period and 17th group of the periodic table? [2]

1) 29 **2) 35** 3) 37 4) 30

11. If the formula of oxide of Eka-aluminium is E_2O_3 its chloride can be [2]

1) $AlCl_3$ **2) $GaCl_3$** 3) $GeCl_2$ 4) Ga_2Cl_3

12. To which group an element with atomic number 84 belongs to [3]

1) Group-12 2) Group-17 **3) Group-16** 4) Group-11

13. As we move from left to right across a period, the non-metallic character and as we go down the group metallic character [4]

1) Increases, Decreases 2) Decreases, Increases

3) Decreases, Increases **4) Increases, Increases**

14. The IUPAC official name of unnilquadium [4]

1) Seaborgium 2) Lawrencium 3) Dubnium **4) Rutherfordium**

II. FILL IN THE BLANKS(FIB)

1. Among the alkali metals, the metal with the highest ionization enthalpy is **Lithium** .
2. The examples of neutral oxides are **CO, NO, N_2O** .
3. Beryllium more closely resembles with **Aluminium**.
4. The element with highest electronegativity on Pauling scale is **Fluorine.**
5. In an atom the decrease in the attractions between nucleus and outer most electrons by the core electrons is called **Shielding effect or Screening effect**.

III. ONE WORD ANSWER Q'S

1. State Mendeleev's periodic law.

A: Mendeleev's periodic law: The physical and chemical properties of elements are **periodic functions** of their **atomic weights.**

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2. State Moseley's modern periodic law.

A: Modern periodic law: The physical and chemical properties of elements are the **periodic functions** of their **'atomic numbers'.**

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3. What are the elements having highest electronegativity and electron gain enthalpy?

A: **F** has highest **electronegativity** and **C*l*** has highest **electron gain enthalpy**.

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4. What is diagonal relationship? **[MAR-26]**

A: Diagonal relationship: The elements of 2nd period have certain similarities with the elements situated diagonally in the third period .

II period : Li Be B C

III period: Na Mg A*l* Si

Ex: (Li→ Mg); (Be→A*l*); (B→ Si)

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5. What is an amphoteric oxide ?

A: The oxide having both **basic** and **acidic nature** is called **amphoteric oxide.**

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6. What is iso-electronic series?

A: A group of atoms or ions having the **same number of electrons** is called **isoelectronic series**.

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7. What are transuranic elements?

A: Elements placed after uranium are called Transuranic elements.
They are artificially created elements with an atomic number greater than 92.
They cannot be found in nature and are produced through nuclear reaction.

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8. What is the starting element of fifth period ?

A: Starting element of fifth period is **Rubidium (Rb)**

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9. What are the units of electron gain enthalpy?

A: Units of electron gain enthalpy is **KJ/mole**

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10. For which group, valency and group number has no relation. **[BMP2]**

A: In Group 18 or Zero group , valency and group number has no relation.

4. CHEMICAL BONDING AND MOLECULAR STRUCTURE

1 OMQ + 2 VSAQ + 2 SAQ [1 M + 2M + 2M+ 4M + 4M = 13 M]

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. The octet rule is valid for which of the following molecules? [4]

1) SF_6 2) $PC1_5$ 3) $BeCl_2$ **4) NH_3**

2. The valency shell of calcium contains [1]

1) 2 electrons 2) 4 electrons 3) 6 electrons 4) 8 electrons

3. Which of the following compound has an electrovalent bond? [2]

1) CH_4 **2) $MgCl_2$** 3) $SiCl_4$ 4) BI_3

4. Which of the following is ionic ? **[MAR-26]** [1]

1) KI 2) CH_4 3) Diamond 4) H_2

5. The low solubility of $BaSO_4$ in water can be attributed to [1]

1) high lattice energy 2)dissociation energy

3) low lattice energy 4) ionic bond

6. The number of bond pairs and number of lone pair of electrons actually present in O_2 as per Valence Bond theory are [2]

1) 2, 2 **2) 2, 4** 3) 2, 1 4) 2, 3

7. A covalent bond is formed [2]

1) by the transfer of electrons **2) by sharing of electrons**

3) by donating electrons 4) all of these

8. The shape of molecule of the type AX_5 (where the central atom has no lone pairs) as per VSEPR theory is [4]

1) octahedral 2) square pyramidal 3) tetrahedral **4)trigonal bipyramid**

9. Water shows abnormal properties due to [3]

1) intra molecular hydrogen bonding 2) covalent bonds

3) inter molecular hydrogen bonding 4) polarity

10. A central atom in a molecule has two lone pairs of electrons and forms three single bonds. The shape of the molecule is [3]

1) Trigonal pyramidal 2) Planar triangular **3) T-shaped** 4) See-saw

11. What is the shape of AB_4 E type of molecule like SF_4 ? [4]

1) Distorted tetrahedron 2)A folded square 3) See-saw **4) All**

12. Which of the following molecules has a triple bond? [3]

1) CH_4 2) C_2H_4 **3) C_2H_2** 4) CO_2

13. If the bond enthalpy of O_2, N_2 and H_2 are 498 kJ/mol, 946 kJ/mol and 435.8 kJ/mol respectively. Choose the correct order of decreasing bond strength [2]

1) $H_2 > N_2 > O_2$ **2) $N_2 > O_2 > H_2$** 3) $H_2 > O_2 > N_2$ 4) $N_2 > H_2 > O_2$

14. Which of the following has zero dipole moment? [4]

1) HF 2) H_2O 3) NH_3 **4) BF_3**

15. Which of the following is correct? [4]

1) PCl_5 has 3 equatorial and 2 axial bonds 2) In PCl_5 bond angles are 120° and 90°

3) Axial bonds are longer but weaker than equatorial bonds, which makes PCl_5 molecule more reactive.

4) All the above

II. FILL IN THE BLANKS(FIB)

1. A chemical bond in which the electron cloud is unevenly shared is known as **Polar Covalent** bond.
2. Hybridisation produces a set of **Hybrid** orbitals.
3. Bond order in N_2 molecule is **3**. **[BMP2]**
4. The shape of ammonia molecule is **Trigonal Pyramidal** .
5. The total number of sigma and pi bonds in C_2H_4, molecule is **5 Sigma and 1 Pi bond**.

III. ONE WORD ANSWER Q'S

1. What is the carbon oxygen bond length in CO_2 molecule?

A: 116 pm or 1.163 Å

---

2. How many electrons are shared during the formation of a double bond?

A: **4** electrons are shared during the formation of a double bond.

---

3. Define formal charge.

A: Formal charge is a hypothetical charge assigned to an atom in a molecule assuming that all electrons in a bond are shared equally, regardless of electronegativity.
It helps predict the most likely structure of a molecule when multiple structures are possible.

---

4. What is the shape of NH_4^+ ion? **[BMP1]**

A: Shape of NH_4^+ ion is **Tetrahedral.**

---

5. What is the bond angle in SO_2 molecule?

A: Bond angle in SO_2 molecule is 119.5° .

5. THERMODYNAMICS

1 OMQ + 1 VSAQ + 2 SAQ [1 M + 2M + 4M + 4M = 11 M]

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. According to the third law of thermodynamics which one of the following quantities for a perfectly crystalline solid is zero at absolute zero (–273.15°C)? [2]

1) Gibbs energy **2) Entropy** 3) Enthalpy 4) internal energy

2. The heat of combustion of carbon is-393.5 kJ/mol. The enthalpy change in the formation of 35.2g of CO_2 from carbon and oxygen gas is [1]

1) –315 kJ 2) + 315 kJ 3) –630 kJ 4) –3.15 kJ

3. For the reaction, $N_2 + 3H_2 \rightleftharpoons 2NH_3, \Delta H = ?$ [2]

1) $\Delta U + 2RT$ **2) $\Delta U - 2RT$** 3) $\Delta H = RT$ 4) $\Delta U - RT$

4. Which amongst the following options is the correct relation between change in enthalpy and change in internal energy? [1]

1) $\Delta H = \Delta U + \Delta n_g RT$ 2) $\Delta H - \Delta U = -\Delta nRT$

3) $\Delta H + \Delta U = \Delta nR$ 4) $\Delta H = \Delta U - \Delta n_g RT$

5. A thermodynamic state function is a quantity [2]

1) used to determine heat changes **2) whose value is independent of path**

3) used to determine pressure-volume work 4) whose value depends on temperature only

6. For the process to occur under adiabatic conditions, the correct condition is: [3]

1) $\Delta T = 0$ 2) $\Delta p = 0$ **3) q = 0** 4) $w = 0$

7. The enthalpies of all elements in their standard states are: [2]

1) Unity **2) Zero** 3) <0 4) Different for every element

8. The enthalpy of combustion of methane, graphite and dihydrogen at 298 K are -890.3 kJ/mol, –393.5 kJ mol^{-1} and –285.8 kJ mol^{-1} respectively. Enthalpy of formation of CH_4 (g) will be [1]

1) –74.8kJmol^{-1} 2) 52.27kJmol^{-1} 3) +74.8kJmol^{-1} 4) –52.26 kJmol^{-1}

9. A reaction, A + B → C + D + q, is found to have a positive entropy change. The reaction will be [4]

1) possible at high temperature 2) possible only at low temperature

3) not possible at any temperature **4) possible at any temperature**

10. Which of the following are not state functions? [2]

1) work and entropy **2) heat and work**

3) entropy and internal energy 4) heat and entropy

11. The Gibbs energy change (ΔG) at constant temperature is equal to [4]

1) ΔH – TS 2) ΔH + TS 3) ΔH + TΔS **4) ΔH – TΔS**

12. For the reaction, $2Cl(g) \rightarrow Cl_2(g)$ the correct option is [3]

1) $\Delta_r H > 0$ and $\Delta_r S < 0$ 2) $\Delta_r H < 0$ and $\Delta_r S > 0$

3) $\Delta_r H < 0$ and $\Delta_r S < 0$ 4) $\Delta_r H > 0$ and $\Delta_r S > 0$

13. Which of the following is not an extensive property? [3]

1) Mass 2) Volume **3) Temperature** 4) Enthalpy

14. The correct thermodynamic conditions for the spontaneous reaction at all temperatures is [2]

1) $\Delta_r H > 0$ and $\Delta_r S < 0$ **2) $\Delta_r H < 0$ and $\Delta_r S > 0$**

3) $\Delta_r H < 0$ and $\Delta_r S < 0$ 4) $\Delta_r H > 0$ and $\Delta_r S > 0$

15. If a process is carried out at constant volume ($\Delta V = 0$), the correct expression is [2]

1) $\Delta U = q - P_{ex}\Delta V$ **2) $\Delta U = q$** 3) $_{ex}\Delta U = q + P_{ex}\Delta V$ 4) $\Delta U = w$

II. FILL IN THE BLANKS(FIB)

1. $q = w = -P_{ext}(v_f - v_i)$ is for irreversible **Isothermal** change.
2. $q = -w = nRT \ln (v_f / v_i)$ is for isothermal **Reversible** change.
3. For an isolated system, $\Delta U = 0$ the value of ΔS will be **$\geq$ 0(zero)**. **[MAR-26]**
4. In **Isolated** system there is no exchange of matter and energy between the system and surroundings. **[BMP2]**
5. For chemical reactions, **bomb calorimeter** is used to measure the value of heat change at constant volume.

III. ONE WORD ANSWER Q'S

1. Work is done by the system and 'q' amount of heat is supplied to the system. What type of system would it be? **[BMP1]**

A: Closed system

---

2. The system loses 'q' amount of heat though no work is done on the system. What type of wall does the system have?

A: Thermally conducting wall

---

3. What is the work done in the free expansion of an ideal gas in reversible and irreversible processes?

A: No work done

---

4. In isothermal reversible change of an ideal gas, what is the value of q?

A: $q = 2.303nRT \log\left(\frac{V_f}{V_i}\right)$

---

5. For an adiabatic change in an ideal gas what is the relationship between its ΔU and W(adiabatic)?

A: $\Delta U = W$

HINTS FOR HARD MCQ & FIB

MULTIPLE CHOICE QUESTIONS [MCQ]

1. **(2)**

2. **(1)** $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$

1 mole of CO_2 = 44g releases –393.5 KJ/mol heat

35.2g releases x ? $x = \frac{-393.5 \times 35.2}{44} = -315$ KJ

3. **(2)** $N_2 + 3H_2 \rightleftharpoons 2NH_3 \Rightarrow \Delta n_g = [2-(1+3)] = = -2$; $\Delta H = \Delta U + \Delta n_g RT = \Delta U - 2RT$

4. **(1)** 5.**(2)** 6.**(3)** 7.**(2)**

8. **(1)** (i) Combustion of methane: $CH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O(l)$; $\Delta H = -890.3$ KJ / mol

(ii)Combustion of graphite: $C_{(S)} + O_{2(g)} \longrightarrow CO_{2(g)}$; $\Delta H = -393.5$ KJ / mol

(iii)Combustion of dihydrogen: $H_{2(S)} + \frac{1}{2}O_{2(g)} \longrightarrow H_2O_{(l)}$; $\Delta H = -285.8$ KJ / mol

Formation of methane : $C_{(S)} + 2H_{2(g)} \longrightarrow CH_{4(g)}$; $\Delta H = ?$

Reverse the combustion equation of methane & multiply the combustion of dihydrogen by 2

ΔH formation of CH_4 = +890.3 – 393.5 + (2x – 285.8) $\Rightarrow$ 890.3 – 393.5 – 571.6 = – 74.8 KJ

9. **(4)** 10.**(2)** 11. **(4)** $\Delta G = \Delta H - T\Delta S$ 12.**(3)** 13. **(3)**

14.**(2)** For a spontaneous reaction, ΔG must be –ve

$\therefore \Delta H < 0$ and $\Delta S > 0$ $[\because \Delta G = \Delta H - T\Delta S]$

15.**(2)** From 1st law of thermodynamics, $\Delta U = q + W$....(1); given that $\Delta V = 0$

Now $W = -p\,\Delta V = -p(0) = 0$ $\therefore$ From (1), $\Delta U = q + 0 = q$ $\Delta U = q$

6.EQUILIBRIUM

1 OMQ + 1 VSAQ + 2 SAQ [1 M + 2M + 4M + 4M = 11 M]

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. The pH of a solution of hydrochloric acid is 4. The molarity of the solution is: [3]

1) 4.0 M 2) 0.4 M **3) 0.0001 M** 4) 0.04 M

2. The strong conjugate base in the following is [4]

1) NO_3^- 2) Cl^- 3) SO_3^{2-} **4) CH_3COO^-**

3. When NH_4Cl is added to NH_4OH solution the dissociation of ammonium hydroxide is reduced. It is due to: [1]

1) common ion effect 2) hydrolysis

3) oxidation 4) reduction

4. The following reaction is at equilibrium $Fe^{3+}_{(aq)} + SCN^-_{(aq)} \rightleftharpoons [Fe(SCN)]^{2+}_{(aq)}$ [3]

In the above reaction, colour intensity of red colour can be increased by

1) addition of oxalic acid which reacts with Fe^{3+} ions

2) addition of Hg^{2+} ions which reacts with SCN ions

3) addition of KSCN 4) red colour intensity cannot be changed

5. K_{sp} of a sparingly soluble salt AB_2 is 4×10^{-12}. The solubility of the salt is [4]

1) 2×10^{-6} M 2) 4×10^{-6} M 3) 1×10^{-12} M **4) 1×10^{-4} M**

6. An aqueous solution of ammonia consists of [4]

1) H^+ only 2) OH^- only 3) NH_4^+ only **4) NH_4^+ and OH^-**

7. The pH of a 0.05 M of H_2SO_4 solution is [2]

1) 0.05 **2) 1** 3) –1 4) 1.3010

8. If the molar Solubility of Zirconium phosphate $Zr_3(PO_4)_4$ is 'S'. Solubility product Ksp of Zirconium phosphate is [2]

1) $6912\ (S)^5$ **2) $6912\ (S)^7$** 3) $108\ (S)^7$ 4) $27\ (S)^5$

9. For a reversible reaction, if the concentration of reactants is increased, the equilibrium constant of the reaction [2]

1) Increases **2) Remains constant**

3) Decreases 4) Depends on amount of reactant

10. The pK_a of acetic acid and pK_b, of ammonium hydroxide are 4.76 and 4.75 respectively. The pH of ammonium acetate solution is [2]

1) 6.098 **2) 7.005** 3) 8 4) 5.0

11. Which among the following salt solutions is basic in nature? [4]

1) Ammonium chloride 2)Ammonium sulphate

3) Ammonium nitrate **4) Sodium acetate**

12. Observe the following equilibrium at T (Kelvin) [4]

$H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$ **Which one of the following does not disturb the above equilibrium at constant volume?**

1) Addition of $H_{2\,(g)}$ 2) Removal of HI_g 3) Addition of $I_{2(g)}$ **4) Addition of $He_{(g)}$**

13. Solution of 0.1 N NH_4OH and 0.1 N NH_4Cl has pH 9.25. [2]

Find out pK_b of NH_4OH.

1) 9.25 **2) 4.75** 3) 3.75 4) 8.25

14. For the following process the expression for the K_c [2]

$Ni_{(s)} + 4CO_{(g)} \rightleftharpoons Ni(CO)_{4(g)}$

1) $K_c = \frac{[Ni(CO)_4]^2}{[Ni][CO]^4}$ **2)** $\mathbf{K_c = \frac{[Ni(CO)_4]}{[CO]^4}}$ 3) $K_c = \frac{[Ni][CO]^4}{[CO]^4}$ 4) $K_c = \frac{[CO]^4}{[Ni(CO)_4]^2}$

15. K_1 and K_2 are equilibrium constants for reactions (i) & (ii). [4]

Then the relation between K_1 and K_2 **(i)** $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$ **(ii)** $HI_{(g)} \rightleftharpoons \frac{1}{2}H_{2(g)} + \frac{1}{2}I_{2(g)}$

1) $K_1 = K_2^{\,2}$ 2) $K_1 = \frac{1}{K_2}$ 3) $K_1 = K_2^0$ **4)** $\mathbf{K_1 = \frac{1}{K_2^2}}$

II. FILL IN THE BLANKS(FIB)

1. Acidity of BF_3, can be explained on the basis of **Lewis** theory of acids and bases.
2. The nature of aqueous solution of ammonium chloride (NH_4Cl) is **Acidic**. **[BMP2]**
3. K_p for the following equation: $\mathbf{Kp = P_{CO_2}}$.

   $CaCO_{3(g)} \rightleftharpoons CaO_{(s)} + CO_{2(g)}$
4. The molarity of pure water is **55.5M**.
5. If K_c is in the range of $\mathbf{10^{-3}}$ **to** $\mathbf{10^3}$ appreciable concentrations of both reactants and products are present.

III. ONE WORD ANSWER Q'S

1. What is a Bronsted base? **[AP 16]**

A: A **proton acceptor** is called a **Bronsted base**.

Ex: H_2O, NH_3

---

2. What is Lewis acid? **[AP 15,16,23]**

A: An **electron pair acceptor** is called a **Lewis acid.**

Ex: BF_3, H^+

---

3. What is the value of K_w at 25°C? **[MAR-26][BMP1]**

A: At 25°C, Ionic product of water $K_w = = 1.008 \times 10^{-14}$ mol^2/L^2.

---

4. What is a conjugate acid-base pair? **[AP 16]**

A: It is acid-base pair which differ only by proton.

---

5. Write the relation between Gibbs energy and equilibrium constant.

A: $\Delta G^0 = -RT\ln K_c$ (or) $\Delta G^0 = -2.303\ RT\log K_c$

HINTS FOR HARD MCQ & FIB

MULTIPLE CHOICE QUESTIONS [MCQ]

1. **(3)** pH of HCl = 4; $pH = -\log[H^+] \Rightarrow \log[H^+] = -pH \Rightarrow [H^+] = 10^{-pH}$

$\therefore [H^+] = 10^{-4} = 0.0001$ M $\quad [\because \log_b a = n \Rightarrow a = b^n]$

2. **(4)** A weak acid has a strong conjugate base. 3.**(1)** 4.**(3)**

5. **(4)** $K_{SP} = 4 \times 10^{-12}$ .For AB_2 type salt, $K_{SP} = 4S^3$

$$\Rightarrow S^3 = \frac{K_{SP}}{4} \Rightarrow S = \sqrt[3]{\frac{K_{SP}}{4}} = \sqrt[3]{\frac{4\times10^{-12}}{4}} = \sqrt[3]{10^{-12}} = 10^{-4}\,M$$ 6.**(4)**

7.**(2)** Given concentration of H_2SO_4 is 0.05M

$[H^+]$ = Conc × Basicity= $0.05 \times 2 = 5 \times 10^{-2} \times 2 = 10^{-1} \Rightarrow$pH = 1

8. **(2)** $Zr_3(PO_4)_4 \rightleftharpoons \underset{[3S]^3}{3Zr^{+4}} + \underset{[4S]^4}{4PO_4^{-3}}$ $K_{SP} = [3S]^3\,[4S]^4 = 27S^3 \times 256\,S^4 = 6912\,S^7$

9. **(2)** 10. **(2)** $pH = 7 + \frac{1}{2}(pK_a - pK_b) = 7 + \frac{1}{2}(4.76 - 4.75) = 7 + \frac{1}{2}(0.01) = 7.005$

11. **(4)** 12.**(4)**

13.**(2)** $pOH = pK_b + \log\frac{[salt]}{[base]}$ .....(1) Given pH = 9.25

pH + pOH = 14$\Rightarrow$pOH = 14 – 9.25= 4.75

From (1), $4.75 = pK_b + \log\frac{0.1}{0.1} = pK_b + \log 1 = pK_b + 0 = pK_b$ $\quad[\because \log 1 = 0]$ $\therefore pK_b = 4.75$

14.**(2)** $Ni_{(s)}$ is in solid form, we should take it as unity (1). $\therefore K_C = \frac{[Ni(CO)_4]}{[CO]^4}$

15.**(4)** i) $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI(g)$ ii) $HI_{(g)} \rightleftharpoons \frac{1}{2}H_2(g) + \frac{1}{2}I_{1(g)}$

$K_1 = \frac{[HI]^2}{[H_2][I_2]}$; $K_2 = \frac{[H_2]^{1/2}[I_2]^{1/2}}{[HI]}$ $\quad\therefore K_1 = \frac{1}{K_2^2}$

FILL IN THE BLANKS [FIB]

4. For pure water at 25°C molarity $= \frac{1000}{18} = 55.5M$

7. REDOX REACTIONS

1 OMQ + 1 VSAQ + 1 SAQ [1 M + 2M + 4M = 7 M]

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. The oxidation number of an element in a compound is evaluated on the basis of certain rules. Which of the following rule is incorrect? [1]

1) Oxidation number of hydrogen is always +1

2) The algebraic sum of all the oxidation numbers of all elements is equal to charge present on a compound

3) An element in the free or uncombined state, it's oxidation number is zero

4) In all its compounds, the oxidation number of fluorine is –1

2. When hydrogen sulphide gas is passed through a solution of Cu^{+2} ions solution, then [1] **[BMP2]**

1) Black cupric sulphide is formed 2) White cupric sulphide is formed

3) Red cupric sulphide is formed 4) No reaction

3. The Oxidation number of oxygen in O_2F_2 and OF_2 are respectively [3]

1) +2 and +1 2) +1 and +1 **3) +1 and +2** 4) +2 and +2

4. Which of the molecules can undergo disproportionation in the alkaline medium [4]

1) S_8 2) P_4 3) Cl_2 **4) All of these**

5. The oxidation number of Sulphur in $Na_2S_4O_6$ is [1] **[MAR-26]**

1) 2.5 2) 1.5 3) 2 4) 3

6. $PbO_2 + 4HCl \rightarrow PbCl_2 + Cl_2 + 2H_2O$. In this reaction PbO_2 act as an [3]

1) Reducing agent 2) Both Reducing agent and Oxidising agent

3) Oxidising agent 4) Bleaching agent

7. Oxidation state of middle carbon in C_3O_2 is [4]

1) +2 2) +3 3) –2 **4) 0**

8. $xMnO_4^- + Br^- + H_2O \rightarrow xMnO_2 + BrO_3^- + 2OH^-$. The value of x is [2]

1) 1 **2) 2** 3) 3 4) 4

9. When a strip of metallic zinc is placed in aqueous solution of copper sulphate, the blue colour of the solution disappears due to the formation of [2]

1) Cu^{2+} **2) Zn^{2+}** 3) ZnS 4) CuS

10. In which of the compounds, does manganese exhibits highest oxidation number? [2]

1) MnO_2 **2) $KMnO_4$** 3) K_2MnO_4 4) $MnSO_4$

11. What is the change in oxidation number of Carbon in the following reaction? [2]

$CH_{4(g)} + 4Cl_{2(g)} \rightarrow CCl_{4(l)} + 4HCl_{(g)}$

1) 0 to +4 **2) –4 to + 4** 3) 0 to –4 4) +4 to –4

12. Which of the following is the correct order for reducing activity? [4]

1) Zn < Cu > Ag 2) Zn > Cu < Ag

3) Zn < Cu < Ag **4) Zn > Cu > Ag**

13. The indicator to be used to detect end point in titration of $FeSO_4$ solution with $KMnO_4$ solution in the presence of acid is [2]

1) Phenolphthalein **2) $KMnO_4$ itself acts as self indicator**

3) starch solution 4) methyl orange

14. The salt which is commonly used in salt bridge is [4]

1) Barium sulphate 2) Aluminium chloride

3) Silver chloride **4) Potassium chloride**

15. Which of the following have no reaction with hydrochloric acid? [3]

1) Mg, Au 2) Ca, Ag **3) Ag, Au** 4) Mg, Ca

II. FILL IN THE BLANKS(FIB)

1. Oxidation Number of sulphur in S_8 molecule is **Zero**.
2. The element that can not undergo disproportionation is **Fluorine**.
3. In any compounds oxidation states of IA & IIA group elements are **+1** and **+2** respectively.
4. Reductant is the element which can reduce the other substances and itself undergoes **Oxidation**. **[BMP1]**
5. Oxidation state of oxygen in peroxides and super oxides are **–1** and **–½** respectively.

HINTS FOR HARD MCQ & FIB

MULTIPLE CHOICE QUESTIONS [MCQ]

1. **(1)**

2. **(1)**

3. **(3)** Oxidation state of O is +ve with F

F always shows –1 oxidation state.

$\therefore$ Oxidation state of O in O_2F_2 is +1 and OF_2 is +2 .

4. **(4)** In disproportionation, element should be in intermediate oxidation state

$\overset{\circ}{S_8}$, $\overset{\circ}{P_4}$, $\overset{\circ}{Cl_2}$

(1) P shows –3 to +5

(2) S shows –2 to +6

(3) C*l* shows –1 to +7

5. **(1)** $Na_2S_4O_6$

$$Na-O-\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}-\overset{O}{S}-\overset{O}{S}-\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}-O-Na \Rightarrow \frac{5+0+0+5}{4}=\frac{10}{4}=2.5$$

6. **(3)**

7. **(4)** $O=\overset{+2}{C}=\overset{0}{C}=\overset{+2}{C}=O$. For middle carbon, oxidation state = zero

8. **(2)**

Diff is 6 units

$$\underset{+7}{Mn}O_4^- + \underset{-1}{Br^-} + H_2O \longrightarrow \underset{+4}{Mn}O_2 + \underset{+5}{Br}O_3^- + 2OH^-$$

[Diff is 3 units] x 2

change in oxidation state $7 \rightarrow 4$: 3 units

change in oxidation state $-1 \rightarrow +5 \Rightarrow$ 6 units

9. **(2)**

10. **(2)**

11. **(2)**

12. **(4)**

13. **(2)**

14. **(4)**

15. **(3)**

8. ORGANIC CHEMISTRY

1 OMQ + 2 VSAQ + 1 SAQ [1 M + 2M + 2M + 4M = 9 M]

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. Alicyclic compounds are [2]

1) Aromatic compounds **2) Aliphatic cyclic compounds**
3) Heterocyclic compounds 4) Alkanes

2. What is the formula of Anisole? [1]

1) $C_6H_5OCH_3$ 2) $C_6H_3NH_2$ 3) $C_6H_5COCH_3$ 4) C_6H_5OH

3. Which of the following is an example for heterocyclic aromatic compound? [3]

1) Aniline 2) Benzene **3) Furan** 4) Naphthalene

4. In which of the following functional groups are arranged as per the priority order of the functional groups? [4]

1) $-COOH > -CHO > -CN > -\overset{|}{C}=O$ 2) $-COOH > -CHO > -\overset{|}{C}=0 > -CN$

3) $C = O > -CN > -COOH - CHO$ **4) $-COOH > -CN > -CHO > C = O$**

5. The IUPAC name of neopentane is [BMP2] [4]

1) 2-methylpropane 2) 2, 2-dimethylbutane 3) 2-methylbutane **4)2, 2-dimethylpropane**

6. Hybridisation of Carbon in $\overset{+}{C}H_3$ is [2]

1) sp^3 **2) sp^2** 3) sp 4) sp^3d

7. Which of the following involves the displacement effect of sigma bonded electrons?

1) Mesomeric effect **2) Inductive effect** [2]
3) Resonance 4) Electromeric effect

8. Kjeldahl method is not applicable to compounds containing nitrogen in [4]

1) Nitro group 2) Azo group 3) Nitrogen present in the ring **4) All**

9. Crude oil in petroleum industry is separated by [2]

1) Distillation **2) Fractional distillation** 3) Crystallisation 4) Solvent extraction

10. Chloroform and aniline are easily separated by the technique [1]

1) Distillation 2) Fractional Distillation 3)Sublimation 4) Chromatography

II. FILL IN THE BLANKS(FIB)

1. Ethyl alcohol and methyl alcohol can be separated by **Fractional distillation**.

[MAR-26][BMP1]

2. Steam distillation is applied to separate substances which are **Steam volatile**.
3. Nitrogen, sulphur and halogens present in an organic compound are detected by **Lassaigne's test**.
4. Methoxy propane and Ethoxy ethane are examples of **Metamers** .
5. Propanone and propanal are **Functional group isomerism** isomers.

III. ONE WORD ANSWER Q'S

1. Define catenation.

A: **Catenation** is the property of self-linkage among the atoms of the same element to form long chains and rings.

---

2. What is the hybridisation of carbon in Ethane? **[BMP2]**

A: Hybridisation of carbon in Ethane is **sp^3.**

3. What is the hybridization of carbon in CH_3F? **[BMP1]**

A: Hybridization of carbon in CH_3F is **sp^3**.

---

4. Define functional group.

A: **Functional group** is 'group of atoms', which are responsible for the **characteristic** properties of an organic compound.

---

5. What is homologous series?

A: Homologous series is a series of compounds in which two successive compounds are differ by a $-CH_2-$ group and having similar chemical properties. **Ex:** Alkanes, Alkenes, Alkynes.

---

6. How many chain isomers are possible for alkane having molecular formula C_5H_{12}?

A: 3 isomers. [n-pentane, isopentane and neopentane]

---

7. What is an electrophile?

A: The electron deficient species which can accept electrons is called electrophile.

Ex: BF_3

8. What is an electromeric effect? **[BMP2]**

A: **Eelectromeric effect** is defined as the complete transfer of a shared pair of π electrons to one of the atoms joined by a multiple bonds on the demand of an attacking reagent.

---

9. What is differential extraction?

A: **Differential extraction** is a powerful separation technique. It is used to isolate specific compounds from a mixture. It is used in forensic DNA analysis, and in labs to test DNA samples. It separates an organic compound from an aqueous solution by shaking it with an organic solvent.

10. What is distillation? **[BMP1]**

A: Distillation is a separation process which is used to separate volatile liquids from non volatile impurities and the liquids having enough difference in their boiling points. (>40ºC)

Liquids having different boiling points vapourises at different temperatures.

These vapours are cooled and the liquids formed are collected separately.

Ex : $CHCl_3$(chloroform) and $C_6H_5NH_2$ (aniline) are easily separated by distillation

---

11. What is retardation factor?

A: The relative adsorption of a component of the mixture is expressed in terms of its Retardation Factor (R_f) value. $R_f = \frac{\text{Distance moved by the substance from base line(X)}}{\text{Distance moved by the solvent from base line(Y)}}$

---

12. Write the principle involved in paper chromatography.

A: The principle behind paper chromatography is differential movement of substances through a stationary phase (paper containing water) and a mobile phase (solvent).

---

13. Give two examples for alicyclic compounds.

A: Cyclopropane, Cyclohexane, Cyclobutane.

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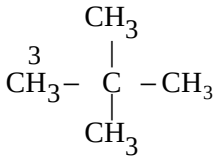
14. Give examples for benzenoid aromatic compounds.

A: Benzene , Phenol , Aniline , Naphthalene.

HINTS FOR HARD MCQ & FIB

MULTIPLE CHOICE QUESTIONS

5.**(4)** Neopentane structure



2, 2 – Dimethyl propane

9. HYDRO CARBONS

1 OMQ + 2 VSAQ + 1SAQ + 1LAQ [1 M + 2M + 2M + 4M + 8M = 17 M]

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. Alkyl halides on reaction with sodium in the presence of dry ether give alkanes. This reaction is named as [1]

1) Wurtz reaction 2) Kolbe's reaction 3) Decarboxylation 4)Dehydrohalogenation

2. Complete combustion of methane gives [1]

1) $CO_2 + H_2O$ 2) $CO_2 + H_2$ 3) $COCl_2$ 4) $CO+CO_2+H_2O$

3. How many conformations are possible for ethane? [3]

1) 2 2) 3 **3) infinite** 4) 5

4. By which reaction Ethene is obtained from Ethyne [3]

1) Oxidation 2) Polymerisation **3) Hydrogenation** 4) Dehydrogenation

5. When one mole of an alkene produces one mole of methanal and one mole of ethanal on ozonolysis followed by hydrolysis. The alkene is [2]

1) Ethylene **2) Propene** 3) 2-butene 4) 2,3-dimethyl.2-butene

6. The reaction of HBr with $CH_3CH=CH_2$ at 400°C yields [2]

1) $CH_2Br-CH=CH_2$ **2) $CH_3-CHBr-CH_3$**

3) $CH_3- -CH_2-CH_2Br$ 4)$CH_2Br-CH_2- -CH_2Br$

7. When acetylene is passed through dil. H_2SO_4 in presence of $HgSO_4$ the compound formed is [2] **[BMP2]**

1) Ethanol **2) Ethanal** 3) Ethanoic acid 4) Propanone

8. Acetylenic hydrogens are acidic because [1]

1) sigma electron density of C–H bond in acetylene is nearer to carbon which has 50% s-character

2) Acetylene has only one hydrogen on each carbon.

3) Acetylene contains least number of hydrogens among the possible hydrocarbons having two carbons.

4) Acetylene belongs to the class of alkynes with molecular formula C_nH_{2n-2}

9. Aromatic compounds burn with sooty flame, because [3]

1) They have a ring structure of carbon atoms 2)They have a relatively high percentage of hydrogen

3) They have a relatively high percentage of carbon

4) They resist reaction with oxygen of air

II. FILL IN THE BLANKS(FIB)

1. Decreasing order of Acidic behaviour of Ethane, Ethene and Ethyne is **Ethyne > Ethene > Ethane**.
2. Carbon-carbon single bond length in ethane is **1.54Å** carbon-carbon double bond length in ethane is **1.34Å**.
3. When Benzene treated with 1-chloropropane in presence of anhydrous $AlCl_3$ **Isopropyl benzene** is formed.
4. The possible Isomers for C_4H_{10} are **2 chain isomers** . **[BMP1]**
5. Calcium carbide on hydrolysis gives **Acetylene**.

III. ONE WORD ANSWER Q'S

1. How do you prepare ethyl bromide from ethylene? **[AP 24]**

A: Ethyl bromide is prepared by the addition of HBr to Ethylene.

$CH_2=CH_2+HBr \rightarrow CH_3-CH_2Br$

Ethylene Ethylbromide

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2. What is decarboxylation?

A: **Decarboxylation** is the removal of a carboxyl group(–COOH).

Ex: Preparation of Ethane by heating **sodium propionate** undergoes decarboxylation.

$$C_2H_5COONa + NaOH \xrightarrow[\Delta]{CaO} C_2H_6 + Na_2CO_3$$

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3. What is halogenation? **[AP 18]**

A: Halogenation is the addition of a halogen (Cl_2 ,Br_2 ,I_2) to a molecule like alkane, Alkene, Alkyne, Benzene.

Ex: Benzene reacts with chlorine, and undergoes halogenation to form Chloro Benzene.

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4. What is meant by aromatization or reforming?

A: **Aromatization** is a chemical reaction in which a **non-aromatic compound** is converted into an **aromatic compound** through the loss of hydrogen or other leaving group.

Ex: $3HC \equiv CH \xrightarrow[873K]{\text{Red hot iron tube}} C_6H_6$

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5. What is meant by isomerisation?

A: Conversion of one Isomer into another isomer in presence of $AlCl_3$ + Conc.HCl is called Isomerisation .

Ex: $H_3C-CH_2-CH_3 \xrightarrow[200°C-35\,Atm]{AlCl_3+Conc.HCl} H_3C-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$

n-butane iso-butane

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6. What is pyrolysis or cracking?

A: **Pyrolysis** is **decomposition** of higher alkanes on heating at high temperature into lower alkanes, alkenes.

Ex: Dodecane a constituent of kerosene oil on heating to 973K in the presence of platinum, palldium gives a mixture of heptane and pentene.

7. What is Lindlar's catalyst? **[MAR-26]**

A: Partially deactivated Palladised charcoal (**Pd/C**) is called Lindlar's catalyst.

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8. What is ozonolysis?

A: **Ozonolysis** is a chemical reaction where ozone (O_3) is used to cleave unsaturated bonds in alkenes and alkynes.

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9. What is polymerisation?

A: **Polymerisation** is a chemical reaction in which small molecules (monomers) combine to form a large molecule (polymer)

Ex: $\text{Ethene} \xrightarrow[\text{catalyst}]{\text{High temp. \& pressure}} \text{Polythene}$

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10. What is linear polymerisation?

A: **Linear Polymerisation** is a type of polymerisation that results in the formation of **long, continuous chains of monomer** units. **Ex:** Polythene

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11. What is cyclic polymerisation?

A: **Cylcic Polymerisation** is a type of polymerisation that results in the formation of **ring-like cyclic structures**.

Ex : $3C_2H_2 \xrightarrow[600^oC]{\text{Red hot Cu}} C_6H_6$ (Benzene)

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12. What are arenes ?

A: Arenes are **Aromatic hydrocarbons.** [aroma means pleasant odour]
Most of such compound contains benzene ring.

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13. Give any two examples for o- and p- directing groups.

A: $-NH_2$ (Amine), $-OCH_3$(methoxy)

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14. What is meant by carcinogenicity?

A: Carcinogenicity is cancer producing property (by causing damage DNA- Human body)
Ex: Benzene and polynuclear compounds

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15. Give any two examples for m- directing groups.

A: $\underset{\text{Aldehyde}}{-CHO}$, $\underset{\text{Carboxylic Acid}}{-COOH}$

HINTS FOR HARD MCQ & FIB

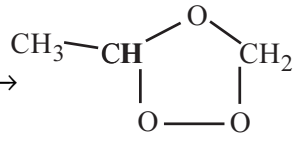
MULTIIPLE CHOICE QUESTIONS

1.**(1)**

2.**(1)** $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

3.**(3)**

4.**(3)**

5.**(2)** $CH_3 - CH = CH_2 + O_3 \longrightarrow$  $\xrightarrow{Zn/H_2O} CH_3.CHO$ (Ethanal) + HCHO (Methanal)

Propene

6.**(2)** $CH_3 - CH = CH_2 \xrightarrow[400^0C]{\overset{\delta+}{H}\overset{\delta-}{Br}} CH_3 - \underset{\underset{Br}{|}}{CH} - CH_3$ (Markovnikov's rule)

7.**(2)**

8.**(1)**

9.**(3)**