PART : CHEMISTRY

1. 81 gm of Al when made to react with 128 gm of oxygen forms ....gm of Al_2O_3.

Ans. (153)

Sol. (L.R.)

$$4Al \ + \ 3O_2 \longrightarrow 2Al_2O_3$$
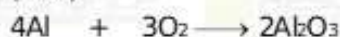
81 gm   128 gm

= 3 mole   = 8 mole

$\dfrac{3}{4} = 0.75$ $\dfrac{128}{16} = \dfrac{8}{3} = 2.667$

$4 \ Al \equiv 2$ mole Al_2O_3

$\therefore \ 3$ mol of $Al \equiv \dfrac{2}{4} \times 3$ mole of Al_2O_3

$= 1.5 \times (54 + 48) = 153$ gm

2. Minimum melting point among group-14 elements corresponds to atomic number :

    (1) 6   (2) 14   (3) 50   (4) 32

Ans. (3)

Sol. $_6C = 4373$ K ; $_{14}Si = 1693$ K ; $_{32}Ge = 1218$ K ; $_{50}Sn = 505$ K

3. What will be effect on pH of water when it is heated ?

    (1) Increase   (2) decrease

    (3) Remains same   (4) pH first increases then decreases

Ans. (2)

Sol. As $T \uparrow$, $Kw \uparrow$ $\therefore$ pH $\downarrow$

4. Match the following list-I with List-II :

List-I		List-II	
(a)	Bronze	(1)	$Cu + Zn$
(b)	Stainless Steel	(2)	$Cu + Sn$
(c)	UK silver coin	(3)	$Fe + Cr + Ni$
(d)	Brass	(4)	$Cu + Ni$

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

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

Ans. (1)

Sol. Bronze – $Cu + Sn$; Stainless steel – $Fe + Cr + Ni$

UK silver coin – $Cu + Ni$; Brass – $Cu + Zn$

5. **S-1 :** $\sqrt{v}$ vs Atomic number gives a straight line graph.

    S-2 : v vs Mass number gives a straight line graph.

    (1) **S-1** true ; **S-2** false   (2) **S-1** false ; **S-2** true

    (3) Both **S-1** & **S-2** are true   (4) Both **S-1** & **S-2** are false

Ans. (1)

Sol. $\sqrt{v}$ vs Atomic number gives a straight line graph.

(Moseley's law)

6. 0.01 mole of an organic compound containing 10% hydrogen on complete combustion produces 0.9 g H_2O. Molecular mass of organic compound is ....u.

Ans. **(100)**

Sol. Let organic compound be $C_xH_yO_z$

Applying POAC on H.

$$0.01 \times x = \left(\frac{0.9}{18}\right) \times 2 \qquad \therefore x = 10$$

$$\frac{10}{100} \times MM = 10 \qquad \therefore MM = 100 \text{ u}$$

7. Central atom has d^4 configuration in which complexes :

(i) $[NiF_6]^{2-}$ (ii) $[Fe(CN)_6]^{3-}$ (iii) $[Cr_2(CH_3COO)_4(H_2O)_2]$

(iv) $[Mn(CN)_6]^{3-}$ (v) $[FeO_4^{2-}]$

(1) (iii) & (iv)   (2) (i)   (3) (ii)   (4) (v)

Ans. **(1)**

Sol. $Ni^{4+} : d^6 \; ; Fe^{3+} : d^5 \; ; Cr^{2+} : d^4 \; ; Mn^{3+} : d^4 \; ; Fe^{6+} : d^2$

8. By using relation

$\Delta G = \Delta H - T\Delta S$

Which of the following is incorrect for spontaneous reaction at a given temperature

(1) $\Delta H > 0, \Delta S > 0$

(2) $\Delta H > 0, \Delta S < 0$

(3) $\Delta H < 0, \Delta S > 0$

(4) $\Delta H < 0, \Delta S < 0$

Ans. **(2)**

Sol. $\Delta H > 0 \; \& \; \Delta S < 0 \Rightarrow \Delta G > 0$ at all temperature.

9. Vapour pressure decreases by 10 mm of Hg when mole fraction of non volatile solute is 0.2. What is the mole fraction of non volatile solute if vapour pressure decreases by 20 mm of Hg ?
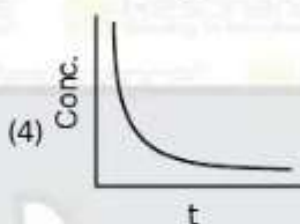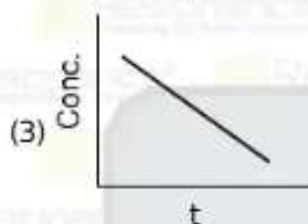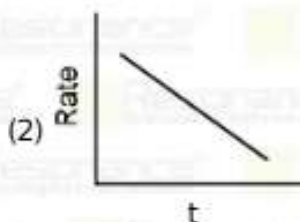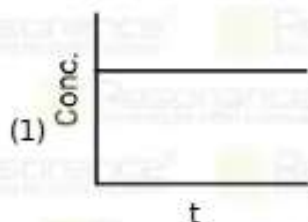
(1) 0.4   (2) 0.1   (3) 0.8   (4) 0.2

Ans. **(1)**

Sol. $\dfrac{P_0 - P_S}{P_0} = X_{solute}$

$\therefore \dfrac{(P_0 - P_S)}{(P_0 - P_S)_2} = \dfrac{X_{Solute \; 1}}{X_{solute \; 2}}$

$\therefore \dfrac{10}{20} = \dfrac{0.2}{X_{solute 2}}$

$\therefore X_{Solute 2} = 0.4$

10. Which one of the following plots represents zero order reaction ?

(1) Conc. vs t — horizontal line

(2) Rate vs t — straight line with negative slope

(3) Conc. vs t — straight line with negative slope

(4) Conc. vs t — decaying curve

Ans. **(3)**

Sol. For zero order :

Rate =constant (Straight line parallel to X-axis in rate vs t graph)

$C_t = C_0 - kt$ (........with −ve slope in conc. vs t graph)

11. $X_2Y_{(g)} \rightleftharpoons X_{2(g)} + \frac{1}{2} Y_{2(g)}$ The correct relationship between K_P, α and equilibrium pressure P is

(1) $K_P = \dfrac{\alpha^{1/2} P^{1/2}}{(2+\alpha)^{3/2}}$

(2) $K_P = \dfrac{\alpha^{1/2} P^{3/2}}{(2+\alpha)^{3/2}}$

(3) $K_P = \dfrac{\alpha^{3/2} P^{1/2}}{(2+\alpha)^{1/2}(1-\alpha)}$

(4) $K_P = \dfrac{\alpha^{1/2} P^{1/2}}{(2+\alpha)^{1/2}}$
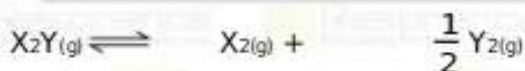
Ans. **(3)**

Sol.

$$X_2Y_{(g)} \rightleftharpoons X_{2(g)} + \frac{1}{2} Y_{2(g)}$$

	$X_2Y_{(g)}$	$X_{2(g)}$	$\frac{1}{2}Y_{2(g)}$
$t=0$	a	0	0
$t=t_{eq}$	$a-x$	x	x/2

For a mole, x moles are dissociated

For 1 mole, $\frac{x}{a}$ moles $=\alpha$ are dissociated

$x = a\alpha$

$$X_2Y_{(g)} \rightleftharpoons X_{2(g)} + \frac{1}{2} Y_{2(g)}$$

At $t=t_{eq}$	$a-a\alpha$	$a\alpha$	$\frac{a\alpha}{2}$

$$n_{total} = a + \frac{a\alpha}{2} = a\left(1+\frac{\alpha}{2}\right)$$

$$P_{A(g)} = \frac{a(1-\alpha)P}{a\left(1+\frac{\alpha}{2}\right)} = \frac{(1-\alpha)P}{1+\frac{\alpha}{2}} ;$$

$$P_{B(g)} = \frac{a\alpha \cdot P}{a\left(1+\frac{\alpha}{2}\right)} = \frac{\alpha P}{1+\frac{\alpha}{2}} \; ;$$

$$P_{C(g)} = \frac{(a\alpha/2)\cdot P}{a\left(1+\frac{\alpha}{2}\right)} = \frac{(\alpha/2)\cdot P}{1+\frac{\alpha}{2}}$$

$$K_P = \frac{P_B \cdot (P_C)^{1/2}}{P_A} = \frac{\left(\dfrac{\alpha}{1+\frac{\alpha}{2}}P\right)\left(\dfrac{\frac{\alpha}{2}P}{1+\frac{\alpha}{2}}\right)^{1/2}}{\dfrac{(1-\alpha)P}{\left(1+\frac{\alpha}{2}\right)}}$$

$$K_P = \frac{\alpha \cdot \alpha^{1/2}\cdot P^{1/2}}{(2+\alpha)^{1/2}(1-\alpha)} = \frac{\alpha^{3/2}\cdot P^{1/2}}{(2+\alpha)^{1/2}(1-\alpha)}$$

12. Statement I : For a particular shell, maximum number of orbital is n^2.

Statement II : For a given subshell, number of orientation lies from $-\ell$ to $+\ell$ including zero.

(1) S–I and S–II both are correct

(2) S–I and S–II both are incorrect

(3) S–I is correct and S–II is incorrect

(4) S–I is incorrect and S–II is correct

Ans. **(1)**

Sol. For a particular shell, maximum number of orbital is n^2.

For a given subshell, number of orientation lies from $-\ell$ to $+\ell$ including zero.

13. Calculate the following E° values of given half cell.

$$E^0_{Ag+Ag} = 0.8 \text{ V}$$

$$E^0_{Zn^{2+}/Zn} = -0.76 \text{ V}$$

$$E^0_{Cu^{2+}/Cu} = 0.34 \text{ V}$$

$$E^0_{Mg^{2+}/Mg} = -2.36 \text{ V}$$

Then which of the following will have the most negative value of ΔG°

(1) Zn/Zn²⁺ || Cu²⁺/Cu (2) Ag/Ag⁺ || Mg²⁺/Mg

(3) Zn/Zn²⁺ || Mg²⁺/Mg (4) Cu/Cu²⁺ || Ag⁺/Ag

Ans. **(1)**

Sol. $E^0_{Cell\,1} = 1.1$ V; $E^0_{Cell\,2} = -3.16$ V; $E^0_{Cell\,3} = -1.6$ V; $E^0_{Cell\,4} = 0.46$ V

Greater the +ve value of E^0_{Cell}, more negative will be ΔG°.

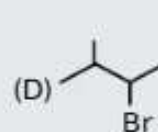**14.** α-Helix protein & β-pleated belong to which of the following structure of protein.
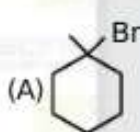
(1) Primary (2) Secondary (3) Tertiary (4) Quaternary

Ans. **(2)**

15.

$\xrightarrow[\text{(ii) H}^+/\text{H}_2\text{O}]{\substack{\text{(i) NaOH} \\ \text{High temp \& P.}}}$ (A) $\xrightarrow[\text{H}_2\text{SO}_4]{\text{K}_2\text{Cr}_2\text{O}_7}$ (B) Predict (A) & (B)?

(1)

(2)

(3)

(4)
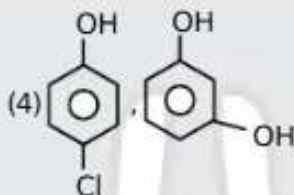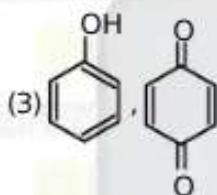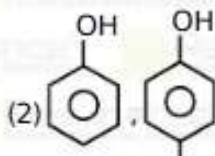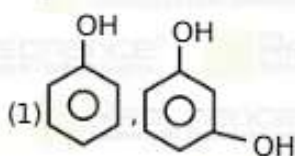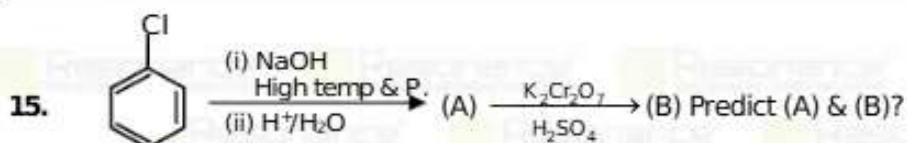
Ans. **(3)**

16. Rate of solvolysis of the following compounds is.

(A)   (B)   (C)   (D)
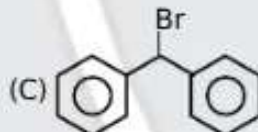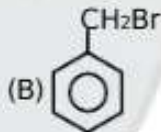
(1) A > C > D > B
(2) C > B > A > D
(3) C > A > D > B
(4) C > A > B > D

Ans. **(2)**

17. $R-CH=O \xrightarrow[\text{H}_2\text{O}]{K} R-CH \begin{smallmatrix} \text{OH} \\ \text{OH} \end{smallmatrix}$
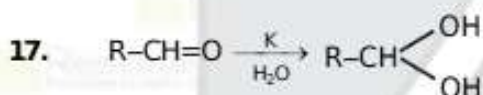
Statement-I : For HCHO relative rate is 2892 due to small size of 'H' atoms.

Statement-II : For CCl_3CHO relative rate is 2000 due to $-I$ effect of Cl.
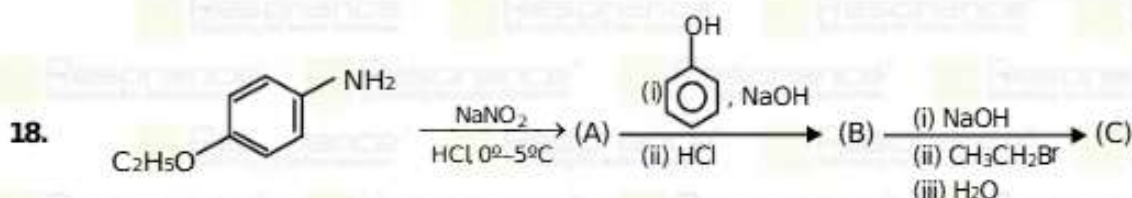
(1) Both Statement I and statement II are true
(2) Both statement I and statement II are false
(3) Statement I is true but statement II is false
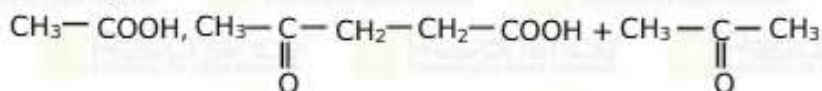(4) Statement I is false but statement II is true

Ans. **(1)**

18.

$\xrightarrow[\text{HCl } 0^\circ-5^\circ\text{C}]{\text{NaNO}_2}$ (A) $\xrightarrow[\text{(ii) HCl}]{\text{(i)} \text{ , NaOH}}$ (B) $\xrightarrow[\substack{\text{(ii) CH}_3\text{CH}_2\text{Br} \\ \text{(iii) H}_2\text{O}}]{\text{(i) NaOH}}$ (C)
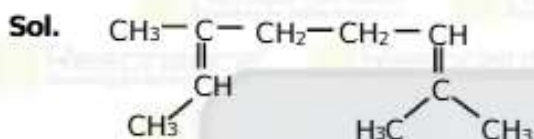
no. of sp^3 'C' atoms in (C) is.

Ans. **(4)**

19. An unknown compound 'X' that consumes two moles of H_2, X on oxidation with KM_nO_4 / $H^\oplus$ gives following products.

$$CH_3-COOH, \quad CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-CH_2-CH_2-COOH + CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-CH_3$$

Find no of σ bonds in compound 'X'

Ans. **(27)**

Sol.

$$CH_3-\overset{\overset{\displaystyle \|}{C}}{\underset{\underset{\displaystyle CH_3}{CH}}{}}-CH_2-CH_2-\overset{CH}{\underset{\overset{\displaystyle C}{H_3C\quad CH_3}}{}}$$
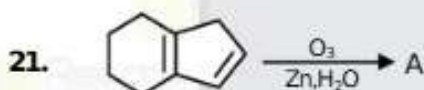
20. **Statement-1 :** Melting point of phenol & alcohols increases with increase in carbon atoms.
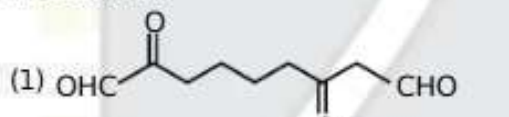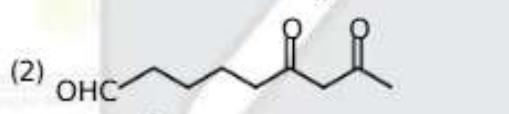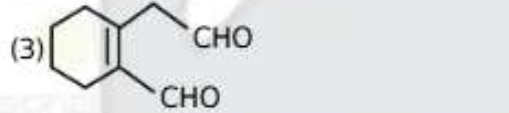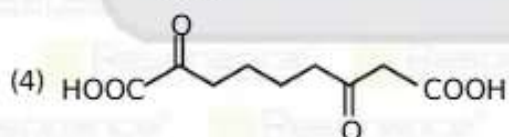
Statement-2 : Phenol and alcohols has higher melting point than ether and haloalkanes.

(1) Both Statement I and statement II are true

(2) Both statement I and statement II are false

(3) Statement I is true but statement II is false

(4) Statement I is false but statement II is true

Ans. **(1)**

21.

$$\xrightarrow[\text{Zn,H}_2\text{O}]{\text{O}_3} \text{A}$$

Product A is.

(1) $OHC-\overset{\overset{\displaystyle O}{\|}}{C}-CH_2-CH_2-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-CH_2-CHO$

(2) $OHC-\text{...}-\overset{\overset{\displaystyle O}{\|}}{C}-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-CH_3$

(3) cyclohexene with CHO, CHO substituents

(4) $HOOC-\overset{\overset{\displaystyle O}{\|}}{C}-CH_2-CH_2-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-CH_2-COOH$

Ans. **(1)**