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## JEE MAIN 2023
## JAN ATTEMPT
## PAPER-1 (B.Tech / B.E.)

# QUESTIONS & SOLUTIONS
### Reproduced from Memory Retention

SHIFT - 1

📅 31 JANUARY, 2023
🕐 9:00 AM to 12:00 Noon

Duration : 3 Hours                    Maximum Marks : 300

# SUBJECT - CHEMISTRY

# CHEMISTRY

**1.** In a nonpolar solvent arrangement of micelle can be shown by which of the following

(1)   (2)   (3)   (4) 
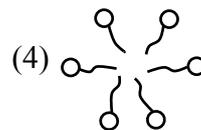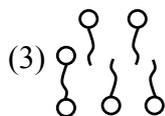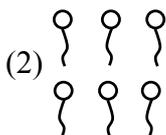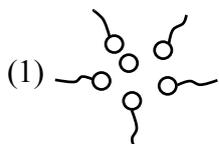
**Ans.** **(1)** **(Surface chemistry)**

**2.** Match the column

| | **Shapes** |
|---|---|
| (A) $NH_4^+$ | (P) Square planar |
| (B) $XeF_4$ | (Q) See-saw |
| (C) $SF_4$ | (R) Tetrahedral |
| (D) $BrCl_3$ | (S) T-shape |

**(Chemical Bonding)**

**Sol.**
$NH_4^+$ : Tetrahedral
$XeF_4$ : Square planar
$SF_4$ : See-saw
$BrCl_3$ : T-shape

**3.** $Cu^{2+} + KI \longrightarrow A \longrightarrow B + C$

B & C are:

**(d-Block Elements)**

**Sol.** $Cu^{2+} + KI \longrightarrow \underset{}{CuI_2}\downarrow \longrightarrow \underset{(B)}{Cu_2I_2} + \underset{(C)}{I_2}$
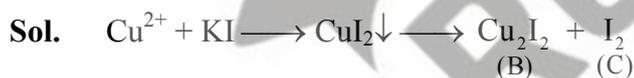
**4.** Which transition in hydrogen atom will have the same wavelength as $4 \rightarrow 2$ transition in $He^+$ ion spectrum?

**Ans.** $2 \rightarrow 1$ **(Atomic Structure)**

**Sol.** $\dfrac{Z_1}{Z_2} = \dfrac{n_1}{n_3} = \dfrac{n_2}{n_4}$

for $He^+$   $Z_1 = 2$   $n_1 = 2$   $n_2 = 4$

    H    $Z_2 = 1$   $n_3 = ?$   $n_4 = ?$

$\dfrac{2}{1} = \dfrac{2}{n_3} = \dfrac{4}{n_4}$

$\boxed{n_3 = 1}$   $\boxed{n_4 = 2}$

**5.** $Zn + HCl \longrightarrow ZnCl_2 + H_2$
   11.5g    excess

Find volume of $H_2$ at STP

$V_m$ at STP = 22.7L,

Atomic mass of Zn = 64.5

**Ans.** **4.047 L**            **(Mole Concept)**

**Sol.** $Zn + 2HCl \longrightarrow ZnCl_2 + H_2$

Mole of Zn = $\dfrac{11.5}{64.5}$

Mole of $H_2$ = $\dfrac{11.5}{64.5}$ mole

Volume of $H_2$ at STP = $\dfrac{11.5}{64.5} \times 22.7$

$\qquad\qquad = 4.047$ L

**6.** Oxidation state of phosphorus in Hypophosphoric acid is _____.

**Ans.** **+4**            **(Chemical Bonding)**

**Sol.** Hypophosphoric acid: $H_4P_2O_6$

O.S. of P $\Rightarrow$ +4

**7.** Which of the following is/are not a method of concentration of ore?
   (a) Hydraulic washing
   (b) Froth Floatation
   (c) Electrolysis
   (d) Leaching
   (e) Liquation

           **(Metallurgy)**

**Sol.** Except electrolysis and liquation all other are methods of concentration of ore.

**8.** Lead storage battery contains 38% $H_2SO_4$ by mass, then find the temperature at which liquid of battery will freeze? (i = 2.67, $K_f$ of water = 1.86 k-kg/mole).

**Ans.** **–31.05°C**        **(Solution & Colligative properties)**

**Sol.** $\Delta T_f = i \times K_f \times m$

$\qquad = 2.67 \times 1.86 \times \dfrac{38}{98} \times \dfrac{1000}{62}$

$\qquad = 31.05°C$

$\Delta T_f = (T_f)_{solvent} - (T_{f_1})_{solution}$

$31.05 = 0 - (T_{f_1})_{solution}$

$(T_{f_1})_{solution} = -31.05°C$

**9.** 0.6g **x** gas (MW = 20g) and 0.45g **y** gas (MW = 45g) are mix together in non-reacting mixture. If total pressure is 740 mm of Hg, then calculate partial pressure of **x** gas in mixture.

**Ans.** **555** **(Solution & Colligative properties)**

**Sol.** $n_x = \dfrac{0.6}{20} = 0.03$ mole

$n_y = \dfrac{0.45}{45} = 0.01$ mole

Total mole = 0.03 + 0.01 = 0.04 mole

$P_x = \dfrac{n_x}{n_{total}} \times 740$

$= \dfrac{0.03}{.04} \times 740$

$= \dfrac{3}{4} \times 740$

$= 555$

**10.** $V_2O_5$, $V_2O_3$, $V_2O_4$ basicity order :

**Ans.** $V_2O_5 < V_2O_4 < V_2O_3$ (basic strength) **(Chemical Bonding)**

**Sol.** $V_2O_5 > V_2O_4 > V_2O_3$

As oxidation number increasing acidic strength increases.

**11.** The electronic configuration of $Nd^{2+}$ is given as :

(1) $4f^2$ (2) $4f^3$ (3) $4f^4$ (4) $4f^5$

**Ans.** **(3)** **(d- & f-Block Elements)**

**Sol.** Neodynium for $Nd^{2+}$ (Z = 60) : $[Xe]4f^4$

as Nd : $[Xe]4f^4 6s^2$

**12.** 2.56 g of a non-electrolyte solute is dissolved in one litre of a solution, it has osmotic pressure equal to 4 bar at 300 K temperature. Then find the molar mass of the compound.

Given R = 0.083 bar, round off to the nearest integer.

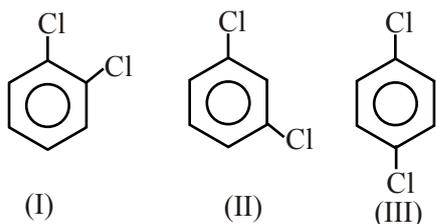**Ans.** **16 gm/mole** **(Solution & Colligative properties)**

**Sol.** $\pi = iCST$

$4 = 1 \times \dfrac{2.56}{M} \times 0.083 \times 300$

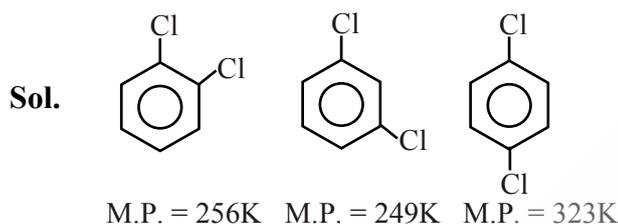$M = \dfrac{2.56 \times 0.083 \times 300}{4}$

$= 15.936 \approx 16$ gm/mole

**13.** Arrange the following isoelectronic species in order of their radius :

$K^+$, $Ca^{2+}$, $S^{2-}$, $Cl^-$

**(Periodic Table)**

**Sol.** $S^{2-}$ > $Cl^-$ > $K^+$ > $Ca^{2+}$

16 p   17 p   19 p   20 p

18 e⁻   18 e⁻   18 e⁻   18 e⁻

**14.** $SO_2(g) + \dfrac{1}{2} O_2(g) \rightleftharpoons SO_3(g)$, $T = 27°C$

If $K_C = 5 \times 10^{-12}$ and $K_P = x \times 10^{-12}$, then find out value of x.

$\left( R = \dfrac{1}{12} \text{ atm litre mole}^{-1}K^{-1} \right)$

**Ans.** **1**

**(Chemical Equilibrium)**

**Sol.** $\Delta n_g = 1 - (1 + 1/2) = -1/2$

$K_P = K_C (RT)^{\Delta n_g}$

$x \times 10^{-12} = 5 \times 10^{-12} \times \left( \dfrac{1}{12} \times 300 \right)^{-1/2} = 5 \times 10^{-12} \times \left( \dfrac{1}{5} \right)$

$x = 1$

**15.** Determine $\Delta H_r^o$ for $\dfrac{1}{2} Cl_2(g) \longrightarrow Cl^-(aq)$

Given  Bond enthalpy of Cl–Cl = 240 kJ/mole

Electron gain enthalpy of Cl(g) = –350 kJ/mole

Hydration enthalpy of $Cl^-(g)$ = –360 kJ/mole

**(Thermochemistry)**

**Sol.**

$$\begin{array}{ccc}
\dfrac{1}{2} Cl_2(g) & \longrightarrow & Cl^-(aq) \\
\Big\downarrow \dfrac{1}{2} \text{B.E.} & & \Big\uparrow \Delta H_{hyd.} \text{ of } Cl^-(g) \\
Cl(g) & \longrightarrow & Cl^-(g) \\
& \Delta H_{eg} \text{ of} & \\
& Cl(g) &
\end{array}$$

$\Delta H_r^o = \dfrac{1}{2} \times 240 + (-350) + (-360) = -590$ kJ/mole

**16.** A compound of $Co^{2+}$ on dissolution in water gives pink coloured octahedral compound (X), which on reaction with $Cl^-$ gives blue coloured compound (Y) of shape 'Z'. X, Y & Z are

**(Coordination Compounds)**

**Sol.** $[Co(H_2O)_6]^{2+} + Cl^- \longrightarrow CoCl_4^{2-}$

Pink                              Blue, $sp^3$ tetrahedral

**17.** The correct order of melting point of following compound is **[Haloalkanes & Haloarence]**



(I)  (II)  (III)

(1) I > II > III 　　　　　　　　　 (2) III > I > II

(3) III > II > I 　　　　　　　　　 (4) I > II > III

**Ans.** **(2)**

**Sol.**



M.P. = 256K　M.P. = 249K　M.P. = 323K

**18.** Choose correct option for following conversion **[Haloalkanes & Haloarence Part-2]**



(cis) → (trans)
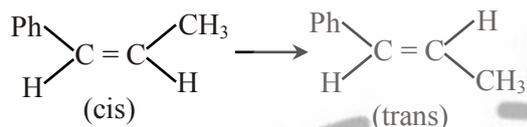
(1) $Br_2/CCl_4$, alc. KOH followed by $NaNH_2/\Delta$, $Na/NH_3(\ell)$

(2) $Br_2/CCl_4$, alc. KOH followed by $NaNH_2/\Delta$, $H_2/Pd-BaSO_4$

(3) $Br_2/CCl_4$, $Na/NH_3(\ell)$, $H_2/Pd-BaSO_4$

(4) $Br_2/CCl_4$, alc. KOH/$\Delta$, $H_2/Pd-BaSO_4$

**Ans.** **(1)**

**19.** Which artificial sugar have highest sweetness value in comparison to cane sugar ?
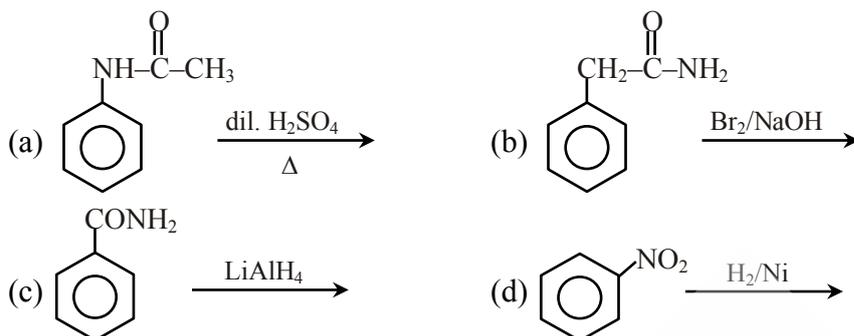
**[Chemistry in every day life]**

(1) Aspartame 　　(2) Saccharin 　　(3) Sucralose 　　(4) Alitame

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

**Sol.**

| Artificial sweetener | Sweetness value in comparison to cane sugar |
|---|---|
| Aspartame | 100 |
| Saccharin | 550 |
| Sucralose | 600 |
| Alitame | 2000 |

**20.** In how many of the following reactions aromatic amine is formed?

**[Aromatic compounds]**

(a) $\underset{\text{NH}-\overset{\displaystyle O}{\overset{\|}{C}}-CH_3}{\bigcirc}$ $\xrightarrow[\Delta]{\text{dil. H}_2\text{SO}_4}$

(b) $\underset{\text{CH}_2-\overset{\displaystyle O}{\overset{\|}{C}}-NH_2}{\bigcirc}$ $\xrightarrow{\text{Br}_2/\text{NaOH}}$

(c) $\underset{\text{CONH}_2}{\bigcirc}$ $\xrightarrow{\text{LiAlH}_4}$

(d) $\underset{\text{NO}_2}{\bigcirc}$ $\xrightarrow{\text{H}_2/\text{Ni}}$

**Ans.** **(2)**

**21.** Propanal + Methanal $\xrightarrow{\text{NaOH}}$ $\xrightarrow{\Delta}$ $\xrightarrow{\text{NaCN}}$ $\xrightarrow{\text{H}_3\text{O}^+}$ Final product
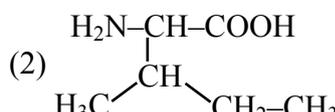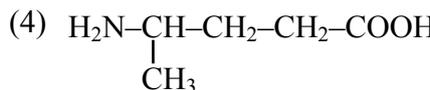
**[Aldehydes and ketones]**

(1) Final product is optically active.

(2) Final product is racemic mixture and releases gas with $NaHCO_3$.

(3) Final product is racemic mixture and gives ppt with Lucas reagent.

(4) Final product is achiral.

**Ans.** **(2)**

**Sol.**
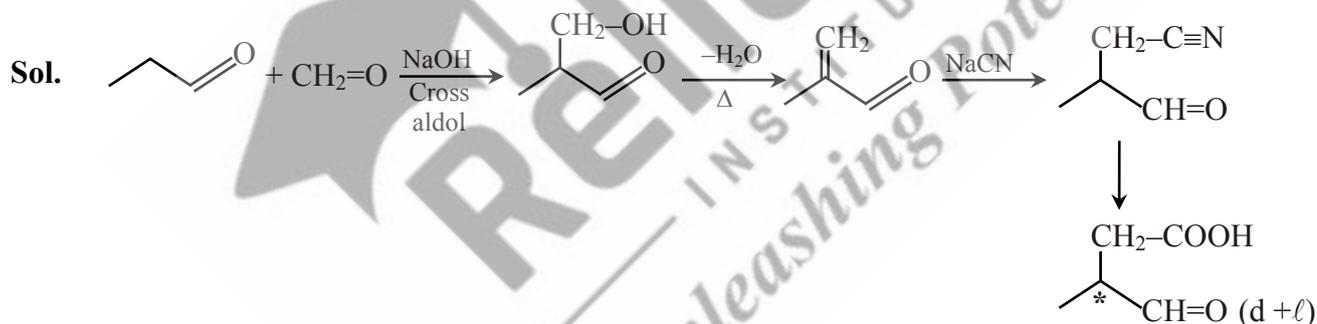


**22.** A protein with molecular mass 70000 u on hydrolysis gives amino acids. Which amino acid will be obtained from the followings ?

**[Biomolecules]**

(1) $H_2N-CH_2-CH_2-CH_2-CH_2-COOH$

(2) $\underset{\underset{H_3C}{}\overset{H_2N-CH-COOH}{\underset{CH}{|}}\overset{}{\diagdown}{CH_2-CH_3}}{}$

(3) $\underset{NH_2}{CH_3-CH-CH_2-COOH}$

(4) $\underset{CH_3}{H_2N-CH-CH_2-CH_2-COOH}$

**Ans.** **(2)**

**Sol.** Only one of the given amino acids is $\alpha$-amino acid.