# CUET (UG) Exam Paper 2023
## National Testing Agency
### Held on 26th May 2023
# CHEMISTRY
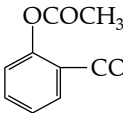## Solved

### (*This includes Questions pertaining to Domain Specific Subject only*)

Max. Marks: 200                                                    Time allowed: 45 Minutes

1. The compound (OCOCH₃ / COOH) is used as:

    (1) Antiseptic          (2) Antibiotic
    (3) Analgesic          (4) Pesticide

**Ans. Option (3) is correct**

> *Explanation:* The given compound is "Aspirin (Salicylic acid), which is used for the treatment of fever and mild pain.

2. A small amount of $CaF_2$ is added in electrolytic reduction of $Al_2O_3$ dissolved in fused cryolite
    (A) To decrease the rate of oxidation of carbon at anode
    (B) To act as catalyst
    (C) To make fused mixture conducting
    (D) To lower the fusion temperature of melting.
    **Choose the correct answer from the options given below:**
    (1) (A), (B), (D) only          (2) (B), (C) only
    (3) (A), (B) only          (4) (C), (D) only

**Ans. Option (4) is correct**

> *Explanation:* A small amount of $CaF_2$ is added in electrolytic reduction of $Al_2O_3$ dissolved in fused cryolite because it enhance the electrical conductivity of fused mixture of $Al_2O_3$ and it lowers the fusion temperature of melting.

3. Match List -I with List - II.

| List -1 Complex | List - II hybridisation |
|---|---|
| (A) $[CoF_6]^{3-}$ | (I) $sp^3$ |
| (B) $[Co(NH_3)6]^{3+}$ | (II) $dsp^2$ |
| (C) $[NiCl_4]^{2-}$ | (III) $d^2sp^3$ |
| (D) $[Ni(CN)_4]^{2-}$ | (IV) $sp^3d^2$ |

**Choose the correct answer from the options given below**
(1) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
(2) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)
(3) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)
(4) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)

**Ans. Option (4) is correct**

> *Explanation:* Hybridisation is a concept of intermixing of two atomic orbitals which give rise to a new atomic orbital and define the geometry of the complex compounds.

4. Match List -I with List - II.

| List -I | List - II |
|---|---|
| (A) Chloroxylenol + terpineol | (I) Tranquillizer |
| (B) Penicillin | (II) Analgesic |
| (C) Iproniazid | (III) Antiseptic |
| (D) Aspirin | (IV) Antibiotic |

**Choose the correct answer from die options given below**
(1) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)
(2) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)
(3) (A)-(II), (B)-(IV), (C)-(III), (D)-(I)
(4) (A)-(l), (B)-(III), (C)-(II), (D)-(IV)

**Ans. Option (2) is correct**

> *Explanation:* Mixture of Chloroxylenol and terpineol is called Dettol which is used as an antiseptic. Penicillin act as antibiotic which kill/inhibit the growth of microorganism. Iproniazid act as Tranquillizer which was initially used for treatment of Tuberculosis and later on, used as antidepressant. Aspirin used for relieving mild pain and fever.

5. Zone refining is mainly used for:
    (1) Ni          (2) Ga
    (3) Zr          (4) Ta

**Ans. Option (2) is correct**

*Explanation:* Zone refining method is used for purification of metals like Ga, Si and Ge, which acts as semiconductors.

**6.** An aqueous solution of 2% non-volatile solute exerts a pressure of 1.004 bar at the normal boiling point of the solvent. What is the molecular mass of the solute?

(1) 41.35 g/mol  (2) 10 g/mol
(3) 23.4 g/mol  (4) 20.8 g/mol

**Ans: Option (1) is correct**

*Explanation:* Mass of Solute ($w_2$) = 2g
Mass of solution = 100g
Mass of solvent = 100-2
= 98g
vapour pressure of pure water = 1 atm. or 1.013 bar
According to Raoult's Law-

$$\frac{P^\circ - P}{P^\circ} = X_2 = \frac{W_2 \times M_1}{M_2 \times W_1}$$

$$\frac{1.013 - 1.004}{1.013} = \frac{2 \times 18}{M_2 \times 98}$$

$$M_2 = 41.35 \, g/mol$$

**7.** Solution of $KMnO_4$ is reduced to various products $\textcircled{P}$, $\textcircled{Q}$, $\textcircled{R}$ depending upon the pH of the solution. At pH <7 it is reduced to colourless substance $\textcircled{P}$. At pH = 7 it forms a brown precipitate $\textcircled{Q}$ At pH >7 it forms a green coloured solution $\textcircled{R}$.

$\textcircled{P}$, $\textcircled{Q}$, $\textcircled{R}$, will be:

| | $\textcircled{P}$ | $\textcircled{Q}$ | $\textcircled{R}$ |
|---|---|---|---|
| (1) | $Mn^{2+}$ | $MnO_2$ | $MnO_4^{2-}$ |
| (2) | $MnO_2$ | $MnO_4^{2-}$ | $Mn^{2+}$ |
| (3) | $MnO_4^{2-}$ | $Mn^{2+}$ | $MnO_2$ |
| (4) | $Mn^{2+}$ | $Mn^{4+}$ | $MnO_2$ |

**Ans. Option (1) is correct**

*Explanation:* At pH <7 it reduced to colourless substance which is $Mn^{2+}$. At pH=7, it form a brown color precipitate of $MnO_2$. At pH>7, it forms a green coloured compound name as $MnO_4^{2-}$.
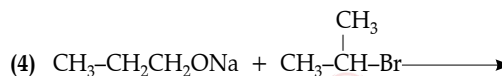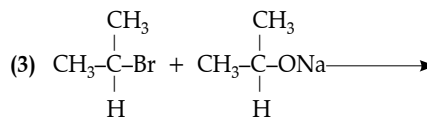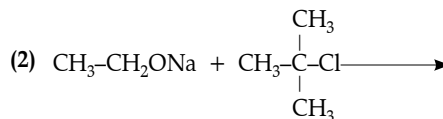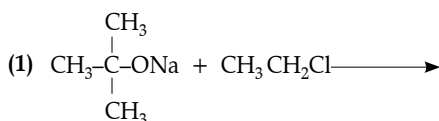
**8.** Molecules are the constituent particles of molecular solids. Identify the molecular solid amongst the following;

(1) $SO_2$  (2) C
(3) Fe  (4) NaCl

**Ans. Option (1) is correct**

*Explanation:* Molecular solids are the solids in which smaller number of atoms strongly bonded together i.e., $CO_2$, $SO_2$, $H_2O$, Naphthalene, gasoline etc.

**9.** Which of the following reaction will give t-Butyl ethyl ether by Williamson synthesis?

(1) $CH_3-\overset{\underset{\displaystyle |}{CH_3}}{\underset{\underset{\displaystyle CH_3}{|}}{C}}-ONa + CH_3CH_2Cl \longrightarrow$

(2) $CH_3-CH_2ONa + CH_3-\overset{\underset{\displaystyle |}{CH_3}}{\underset{\underset{\displaystyle CH_3}{|}}{C}}-Cl \longrightarrow$

(3) $CH_3-\overset{\underset{\displaystyle |}{CH_3}}{\underset{\underset{\displaystyle H}{|}}{C}}-Br + CH_3-\overset{\underset{\displaystyle |}{CH_3}}{\underset{\underset{\displaystyle H}{|}}{C}}-ONa \longrightarrow$

(4) $CH_3-CH_2CH_2ONa + CH_3-\overset{\underset{\displaystyle |}{CH_3}}{CH}-Br \longrightarrow$
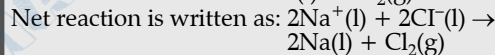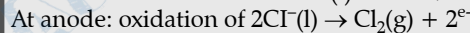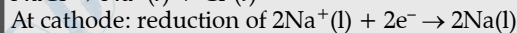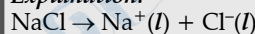
**Ans. Option (1) is correct**

*Explanation:* Williamson synthesis involve the reaction of alkoxide with alkyl halide to form ether. Here, the correct pair of reactant used for the preparation of t-butyl ethyl ether are sodium t-butoxide and ethyl chloride.

**10.** Electrolysis of molten NaCl gives:

(1) $H_2$ at cathode, $Cl_2$ at anode and NaOH solution
(2) Na at cathode, $Cl_2$ at anode and NaOH solution
(3) $H_2$ at anode, $Cl_2$ at cathode
(4) Na at cathode and $Cl_2$ at anode

**Ans. Option (4) is correct**

*Explanation:*
$NaCl \rightarrow Na^+(l) + Cl^-(l)$
At cathode: reduction of $2Na^+(l) + 2e^- \rightarrow 2Na(l)$
At anode: oxidation of $2Cl^-(l) \rightarrow Cl_2(g) + 2e^-$
Net reaction is written as: $2Na^+(l) + 2Cl^-(l) \rightarrow 2Na(l) + Cl_2(g)$

**11.** Which two transition metal ions has same 3d electronic configuration?

(A) $Mn^{3+}$  (B) $Fe^{2+}$
(C) $Mn^{2+}$  (D) $Fe^{3+}$
(E) $Cr^{3+}$

**Choose the correct answer from the options given below:**

(1) (A) and (B) only  (2) (B) and (C) only
(3) (C) and (D) only  (4) (D) and (E) only

**Ans. Option (3) is correct**

*Explanation:* **(A)** The electronic configuration for a $Mn^{3+}$ ion is [Ar] $3d^4$.
**(B)** The electronic configuration for a $Fe^{2+}$ ion is [Ar] $3d^6$.
**(C)** The electronic configuration for a $Mn^{2+}$ ion is [Ar] $3d^5$.
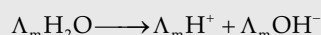**(D)** The electronic configuration for a $Fe^{3+}$ ion is [Ar] $3d^5$.
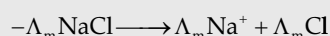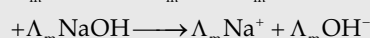**(E)** The electronic configuration for a $Cr^{3+}$ ion is [Ar] $3d^5 4s^1$

**12.** Limiting molar conductivity of $H_2O$ is equal to:

(1) $\Lambda^\circ_m$ NaCl + $\Lambda^\circ_m$ HCl – $\Lambda^\circ_m$ NaOH
(2) $\Lambda^\circ m$ HC1 + $\Lambda^\circ_m$ NaOH – $\Lambda^\circ_m$ NaCl
(3) $\Lambda^\circ_m$ HCl + $\Lambda^\circ_m$ $NH_4OH$ – $\Lambda^\circ m$ NaCl
(4) $\Lambda^\circ_m$ NaCl + $\Lambda^\circ_m$ HCl – $\Lambda^\circ_m$ $NH_4OH$

**Ans. Option (2) is correct**

*Explanation:*
$$\Lambda_m HCl \longrightarrow \Lambda_m H^+ + \Lambda_m Cl^-$$
$$+\Lambda_m NaOH \longrightarrow \Lambda_m Na^+ + \Lambda_m OH^-$$
$$-\Lambda_m NaCl \longrightarrow \Lambda_m Na^+ + \Lambda_m Cl$$
$$\Lambda_m H_2O \longrightarrow \Lambda_m H^+ + \Lambda_m OH^-$$
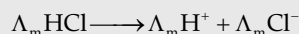
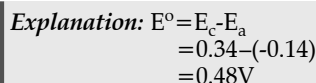**13.** A cell is prepared by dipping a Cu rod in 1 M $CuSO_4$ solution and Sn rod in 1 M $SnCl_2$ solution. The standard electrode potential of Cu is +0.34 V and Sn is -0.14 V. Emf of cell will be:

**(1)** 0.48 V **(2)** 0.20 V
**(3)** 0.34 V **(4)** 0.14 V

**Ans. Option (1) is correct**

> *Explanation:* $E^o = E_c - E_a$
> $= 0.34 - (-0.14)$
> $= 0.48 V$

**14.** On passing ammonia gas through a solution of copper sulphate, a deep blue solution is obtained. The deep blue colour of the solution is due to the formation of:

**(1)** $[Cu(NH_3)_2]^{2+}$ **(2)** $[Cu(NH_3)_4]^{2+}$
**(3)** $[Cu(NH_3)_6]^{+}$ **(4)** $[Cu(NH_3)_6]^{2+}$

**Ans. Option (2) is correct**

> *Explanation:* Deep blue colour developed by addition of excess of ammonia gas in copper Sulphate solution and the formed complex is $[Cu(NH_3)_4]^{2+}$.

**15.** The correct increasing basicity in aqueous medium for (I) $NH_3$ (II) $CH_3CH_2CH_2$ (III) $(CH_3CH_2)_2NH$ (IV) $(CH_3CH_2)_3N$ is:

**(A)** (II) < (I) < (IV) < (III) **(B)** (II) < (I) < (III) < (IV)
**(C)** (I) < (II) < (IV) < (III) **(D)** (I) > (II) > (IV) > (III)

**Choose the correct answer from the options given below:**

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

**Ans. Option (3) is correct**

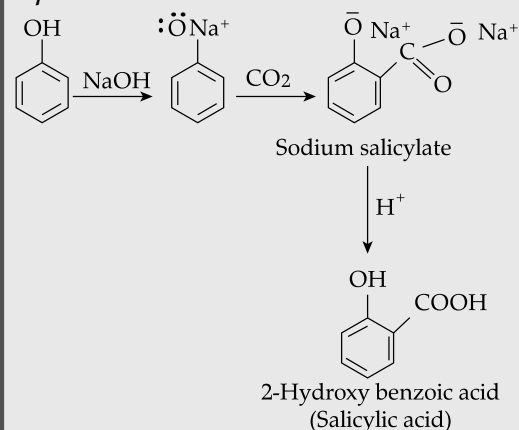> *Explanation:* The basicity of amine and alkyl amine depends upon the +I effect and Steric effect.

**16.**
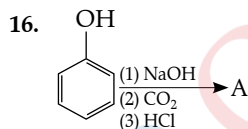


Product 'A' is:

**(1)** Salicylaldehyde **(2)** Benzoic acid
**(3)** p-Chloro benzoic acid **(4)** Salicylic acid

**Ans. Option (4) is correct**

> *Explanation:*
>
> 
>
> 2-Hydroxy benzoic acid
> (Salicylic acid)

**17.** Match List-I with List-II.

| List – I | | List – II | |
|---|---|---|---|
| (A) | $[Ni(CN)_4]^{2-}$ | **(I)** | EDTA |
| (B) | bidentate | **(II)** | paramagnetic |
| (C) | chelate ligand | **(III)** | diamagnetic |
| (D) | $[NiCl_4]^{2-}$ | **(IV)** | oxalate |

**Choose the correct answer from the options given below**

**(1)** (A)-(III), (B)-(IV), (C)-(I), (D)-(II)
**(2)** (A)-(II), (B)-(IV), (C)-(I), (D)-(III)
**(3)** (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
**(4)** (A)-(II), (B)-(I), (C)-(IV), (D)-(III)

**Ans. Option (1) is correct**

> *Explanation:*
> (A) In $[Ni(CN)_4]^{2-}$, $CN^-$ is a strong field ligand which allows the pairing of the electrons and diamagnetic in nature.
> (B) Oxalate is an example of bidentate ligand.
> (C) EDTA is a chelating agent.
> (D) In $[Ni(Cl)_4]^{2-}$, $Cl^-$ is a weak field ligand which do not allow the pairing of the electrons in an orbital. Hence, it is paramagnetic in nature.

**18.** Identify the biodegradable polymer in the following:

**(1)** Nylon -6, 6 **(2)** PVC
**(3)** Polythene **(4)** PHBV

**Ans. Option (4) is correct**

> *Explanation:* PHBV is poly -3-hydroxy butyrate Co-3-hydroxy valerate. It is biodegradable, non-toxic and bio-compatible plastic polymer.

**19.** Which of the following statements are correct about alkyl halides:

**(A)** Alkylhalides are polar so they are soluble in water
**(B)** RX on reaction with alc.KOH give alkenes
**(C)** RX on reaction with $AgNO_2$ give RONO
**(D)** $S_N1$ proceeds with inversion in configuration
**(E)** R—X have higher boiling point than parent alkanes

**Choose the correct answer from the options given below:**

**(1)** (B), (E) only **(2)** (A), (C) only
**(3)** (D), (E) only **(4)** (B), (C) only

**Ans. Option (1) is correct**

> *Explanation:* Their boiling point is higher than the parent alkanes because of high molecular weight of halogens, high intermolecular forces of attractions and polarizability of the halogens.
>
> 
>
> (X = Cl, Br, I)
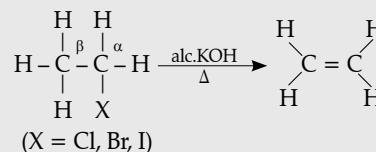
**20.** When 1.5g of a non-volatile solute is dissolved in 30g of a solvent, the boiling point of the solvent is raised by 2 K. Calculate the molar mass of the solute, given that $K_b$ for the solvent is 1.85 K kg $mol^{-1}$.

**(1)** 46.25 g $mol^{-1}$ **(2)** 103 g $mol^{-1}$
**(3)** 94 g $mol^{-1}$ **(4)** 23 g $mol^{-1}$

**Ans. Option (1) is correct**

*Explanation:*

$$M_B = \frac{K_b \times W_B \times 1000}{\Delta T_b \times W_A}$$

$$= \frac{1.85 \times 1.5 \times 1000}{2 \times 30}$$

$$= 46.25 \text{ g mol}^{-1}$$

**21.** Which of the following statements are true?
   **(A)** Noble gases have low M.P. or B.P. due to weak dispersion forces.
   **(B)** All noble gases have completely filled $ns^2np^6$ electronic configuration.
   **(C)** $XeF_2$ and $XeF_6$ are colourless crystalline solid.
   **(D)** $XeO_3$ has pyramidal geometry.
   **Choose the correct answer from the options given below:**
   **(1)** (A), (C) only
   **(2)** (B), (C), (D) only
   **(3)** (A), (B), (C), (D) only
   **(4)** (A), (C), (D) only

**Ans. Option (4) is correct**

*Explanation:* All noble gases have low melting and boiling point due to weak dispersion forces of attraction. $XeF_2$ and $XeF_4$ are colourless crystalline solids. $XeO_3$ has pyramidal symmetry.
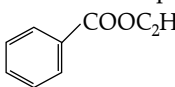


$XeO_3$ = Pyramidal Symmetry     $XeF_2$     $XeF_6$
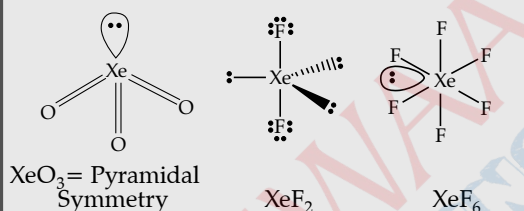
**22.** The entities which do not dissociate into simple ions are:
   **(A)** $[Fe(CN)_6]^{4-}$       **(B)** $KCl \cdot MgCl_2 \cdot 6H_2O$
   **(C)** $K_4[Fe(CN)_6]$       **(D)** $KAl(SO_4)_2 \cdot 12H_2O$
   **(E)** $FeSO_4 \cdot (NH_4)2SO_4 \cdot 6H_2O$
   **Choose the correct answer from the options given below:**
   **(1)** (A) and (C) only       **(2)** (B) and (D) only
   **(3)** (D) and (E) only       **(4)** (A) and (B) only
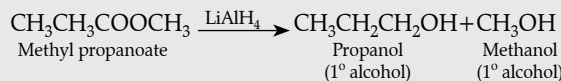
**Ans. Option (1) is correct**

*Explanation:* Both are the complex coordination compounds and remains unchanged. They do not have water of crystallization in their structures.

**23.** Ethanol cannot be prepared from:

**(1)**  (phenyl $COOC_2H_5$)

**(2)** $CH_3CH_2CH_2COOC_2H_5$

**(3)** $C_2H_5COOCH_3$

**(4)** $CH_3COOC_2H_5$

**Ans. Option (3) is correct**

*Explanation:* Methyl propanoate on reduction gives Propanol and Methanol.

$$CH_3CH_2COOCH_3 \xrightarrow{LiAlH_4} CH_3CH_2CH_2OH + CH_3OH$$

Methyl propanoate    Propanol (1° alcohol)    Methanol (1° alcohol)

**24.** Arrange the following in the increasing order of their van't Hoff factors
   **(A)** Very dilute $MgCl_2$ solution
   **(B)** Very dilute $AlCl_3$ solution
   **(C)** Very dilute NaCl solution
   **(D)** Very dilute $Al_2O_3$ solution
   **(E)** Very dilute urea solution
   **Choose the correct answer from the options given below:**
   **(1)** (E) < (C) < (A) < (B) < (D)
   **(2)** (E) < (C) < (A) < (D) < (B)
   **(3)** (E) < (C) < (B) < (A) < (D)
   **(4)** (E) < (B) < (A) < (D) < (C)

**Ans. Option (1) is correct**

*Explanation:* Urea, $i=1$
$NaCl \longrightarrow Na^+ + Cl^-$, $i=2$
$MgCl_2 \longrightarrow Mg^{2+} + 2Cl^-$, $i=3$
$AlCl_3 \longrightarrow Al^{3+} + 3Cl^-$, $i=4$
$Al_2O_3 \longrightarrow 2Al^{3+} + 3O^-$, $i=5$

**25.** Match List - I with List - II.

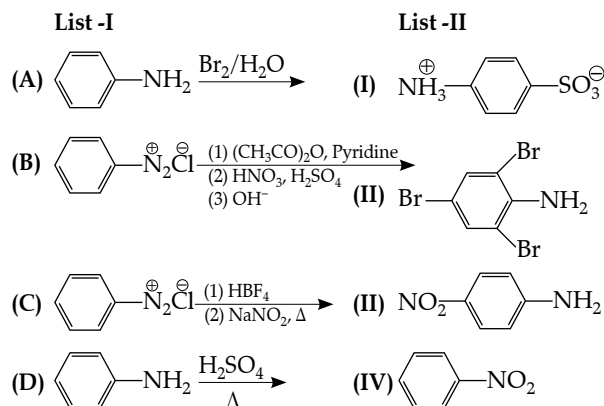| List - I | List - II |
|---|---|
| (A) Denaturation | (I) Sequence of amino acids in a protein |
| (B) Primary structure of protein | (II) α-Helix and β-pleated sheets |
| (C) Quaternary structure of protein | (III) 2° and 3° structures gets destroyed |
| (D) Secondary structure of protein | (IV) The spatial arrangement of subunits (containing 2 or more polypeptide chain) with respect to each other. |

**Choose the correct answer from the options given below:**
   **(1)** (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
   **(2)** (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
   **(3)** (A)-(III), (B)-(II), (C)-(IV), (D)-(I)
   **(4)** (A)-(I), (B)-(IV), (C)-(II), (D)-(III)

**Ans. Option (2) is correct**

*Explanation:* Denaturation is a process in which proteins denature at high temperature, loose its identity and remains in primary structure Primary structure is a sequence of amino acid. Secondary structure consist of α-helix and β-pleated sheets. Quaternary struture is the spatial arrangement of sub-units with respect to each other (consist of two or more polypeptide chain).

26. Match List -1 with List - II.

   **List -I**                                          **List -II**

   (A) ⬡—$NH_2$ $\xrightarrow{Br_2/H_2O}$     (I) $\overset{\oplus}{N}H_3$—⬡—$SO_3^{\ominus}$

   (B) ⬡—$\overset{\oplus}{N_2}\overset{\ominus}{Cl}$ $\xrightarrow[(3)\ OH^-]{\underset{(2)\ HNO_3,\ H_2SO_4}{(1)\ (CH_3CO)_2O,\ Pyridine}}$    (II) Br—⬡—$NH_2$ with Br groups

   (C) ⬡—$\overset{\oplus}{N_2}\overset{\ominus}{Cl}$ $\xrightarrow[(2)\ NaNO_2,\ \Delta]{(1)\ HBF_4}$    (II) $NO_2$—⬡—$NH_2$

   (D) ⬡—$NH_2$ $\xrightarrow[\Delta]{H_2SO_4}$    (IV) ⬡—$NO_2$

   **Choose the correct answer from the options given below:**
   (1) (A)-(II), (B)-(IV), (C)-(III), (D)-(I)
   (2) (A)-(III), (B)-(II), (Q-(IV), (D)-(I)
   (3) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)
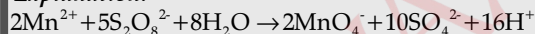   (4) (A), (I), (B)-(II), (C)-(III), (D)-(IV)

**Ans. Option (3) is correct**

27. Manganese ions on reaction with peroxydisulphate ions form:
   (1) $MnO_4^{2-}$              (2) $MnO_2$
   (3) $Mn_2O_7$               (4) $MnO_4^-$

**Ans. Option (4) is correct**

> *Explanation:*
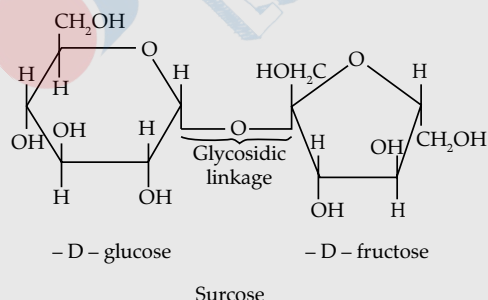> $2Mn^{2+}+5S_2O_8^{2-}+8H_2O \rightarrow 2MnO_4^-+10SO_4^{2-}+16H^+$

28. Glylosidic linkage is formed by:
   (1) Elimination of water molecule
   (2) Addition of water molecule
   (3) Elimination of ammonia molecule
   (4) Addition of ammonia molecule

**Ans. Option (1) is correct**

> *Explanation:* Glycosidic linkage formed by two monosaccharide units connected by a oxygen atom with the loss of one water molecule.
>
> 
>
> Surcose

29. $t_{99\%}$ with respect to $t_{90\%}$ for a first order reaction is
   (1) four times of $t_{50\%}$
   (2) one and half time
   (3) It is same
   (4) Double

**Ans. Option (4) is correct**

> *Explanation:*
> for $t_{90\%}$, at $= \dfrac{10a_o}{100} = \dfrac{a_o}{10}$
>
> $$t_{90\%} = \frac{1}{K} \ell n \frac{a_o}{a_o/100} = \frac{\ell n10}{K} \quad (1)$$
>
> For $t_{99\%}$ , $a_t = \dfrac{1}{100}a_o$
>
> $$t_{99\%} = \frac{1}{K} \ell n \frac{a_o}{a_o/100}$$
>
> $$= \frac{2\ell n10}{K} \quad (2)$$
>
> From equation (1) and (2)
>
> $t_{99\%} = 2 \times t_{90\%}$
>
> x=2

30. Match List -1 with List - II.

| List -I | | List - II | |
|---------|--|-----------|--|
| (A) | Molarity | (I) | Number of moles of solute/kilogram of solvent |
| (B) | Molality | (II) | Osmotic pressure |
| (C) | Coiligative property | (III) | Number of moles of solute/litre of solution |
| (D) | Non-ideal solution | (IV) | Deviation from Raoult's Law |

   **Choose the correct answer from the options given below:**
   (1) (A)-(III), (BHD, (C)'(IV), (D)-(II)
   (2) (A)-(III), (B)-(I), (C)-(II), (D)-(IV)
   (3) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)
   (4) (A)-(I), (B)-(III), (C)-(IV), (D)-(II)

**Ans. Option (2) is correct**

> *Explanation:* Molarity is number of moles of solute dissolve per litre of solution. Molality is number of moles of solutes dissolve per kilogram of solvent. Osmosis is one of the colligative property. Non-ideal solutions do not follows Raoult's Law.

31. The decomposition of ammonia on platinum surface is a zero order reaction. How much time it will take for $1 \times 10^{-4}$ mol $L^{-1}$ of ammonia to reduce into half of its concentration?
   (K=$0.5 \times 10^{-4}$ mol $L^{-1}$ $s^{-1}$)
   (1) 1 s                (2) 10 s
   (3) 100 s              (4) 5 s

**Ans. Option (1) is correct**

> *Explanation:*
> $$(A_0) = 1 \times 10^{-4}$$
>
> $$(A) = \frac{1 \times 10^{-4}}{2} = 0.5 \times 10^{-4}$$
>
> $$t = \frac{A_0 - A}{K}$$
>
> $$t = \frac{1 \times 10^{-4} - 0.5 \times 10^{-4}}{0.5 \times 10^{-4}}$$
>
> t=1s

**32.** Identify the correct statement:
  (1) $CrO$ is acidic, $Cr_2C_3$ is basic, $CrO_3$ is amphoteric.
  (2) $CrO$ is basic, $Cr_2C_3$ is acidic, $CrO_3$ is amphoteric.
  (3) $CrO$ is basic, $Cr_2C_3$ is amphoteric, $CrO_3$ is acidic.
  (4) $CrO$ is amphoteric, $Cr_2C_3$ is basic, $CrO_3$ is acidic.
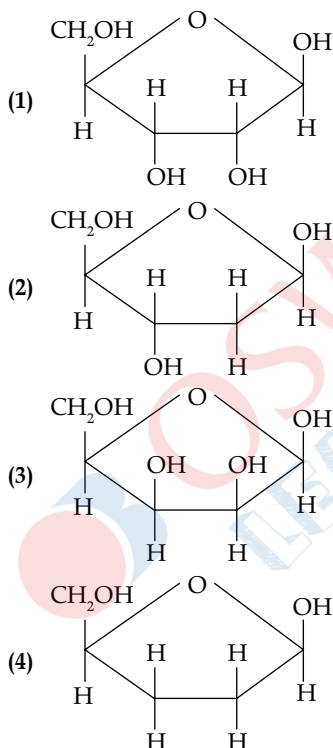
**Ans. Option (3) is correct**

> *Explanation:* Oxidation state of $CrO$ is +2, Oxidation state of $Cr_2O_3$ is +3 and oxidation state of $CrO_3$ is +6. Lower oxidation states forms basic oxide, higher oxidation state forms amphoteric and acidic oxides.

**33.** Which of the following is not a property of $\alpha$-sulphur?
  (1) It is readily soluble in $CS_2$
  (2) It has monoclinic structure.
  (3) This allotrope is yellow in colour.
  (4) It's melting point is 385.8 K.

**Ans. Option (2) is correct**

> *Explanation:* $\alpha$-sulphur is known as rhombic sulphur while $\beta$-sulphur is known as monoclinic sulphur.

**34.** The following pentose sugar is obtained by complete hydrolysis of DNA, along with phosphoric acid and nitrogenous base:



**Ans. Option (2) is correct**

> *Explanation:* Complete hydrolysis of DNA give inorganic phosphate, 2-deoxyribose and one of four different heterocyclic bases.

**35.** Lustre, electrical and thermal conductivity of metals can be explained by the theory of:
  (1) dipole-dipole interactions
  (2) Coulombic (electrostatic) forces
  (3) Sea of free electrons
  (4) London forces

**Ans. Option (3) is correct**

> *Explanation:* Many properties of metal like lustre, electrical and thermal conductivity depends upon free electrons.
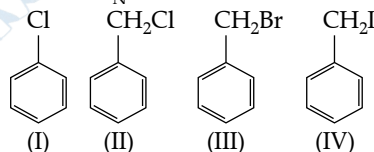
**36.** The integrated rate equation for a first order reaction $\dfrac{kt}{2.303}$ is $\log R_o - \log R_t$. The straight line graph is obtained by plotting:
  (1) time vs $R_t$
  (2) time vs $\log R_t$
  (3) time vs $\dfrac{1}{R_t}$
  (4) time vs $R_o$

**Ans. Option (2) is correct**
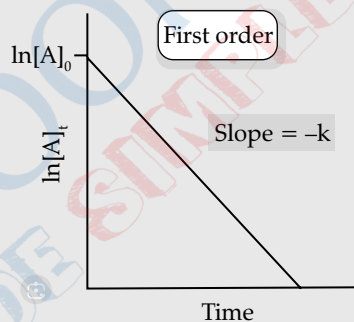
> *Explanation:*
> 

**37.** The correct order of reactivity of following halides towards $S_N1$ reaction is:



  (1) (IV) > (III) > (II) > (I)
  (2) (I) > (II) > (III) > (IV)
  (3) (IV) > (II) > (III) > (I)
  (4) (I) > (III) > (II) > (IV)
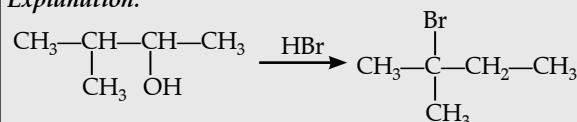
**Ans. Option (1) is correct**

> *Explanation:* In $S_N1$ mechanism, reactivity decreases by intermediate benzyl carbocation formed in the slowest steps which is stabilized by resonance.

**38.** The reaction of 3-methylbutan-2-ol with HBr, will give:
  (1) 2-Bromo-2-methylbutane
  (2) 3-Bromo-2-methylbutane
  (3) 3-Bromo-3-methylbutane
  (4) 2-Bromo-3-methylbutane

**Ans. Option (1) is correct**
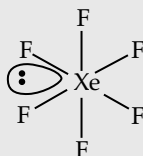
> *Explanation:*
> 

**39.** The shape of $XeF_6$ is:
  (1) Regular octahedral  (2) Square planar
  (3) Distorted octahedral  (4) Square pyramidal

**Ans.** Option (3) is correct

*Explanation:*



40. The relative order of reactivity of 1°, 2°, 3° alcohol towards dehydration is:
    (1) 1° > 2° > 3°
    (2) 2° > 1° > 3°
    (3) 2° > 3° > 1°
    (4) 3° > 2° > 1°

**Ans.** Option (4) is correct

*Explanation:* Reactivity is 3°> 2° >1°, because tertiary carbocation is more stable than 2° and 2° is more stable than 1° due to inductive effect of alkyl group.

**Read the passage below and answer the question:**
Aldehydes and Ketones, having atleast one methyl group linked to the carbonyl carbon atom (methyl Ketones), are oxidised by sodium hypohalite to sodium salts of corresponding carboxylic acids having one carbon atom less them that of carbonyl compound is converted to haloform. This oxidation does not affect carbon – carbon double bond, if present in a molecule.
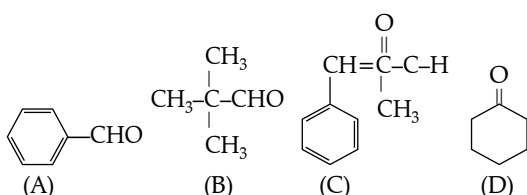
41.

| List - I | List - II |
|---|---|
| (A) $CH_3$ C=O+$H_2$NOH H | (I) Hydrazones |
| (B) $CH_3$ C=O+$H_2$NNH₂ H | (II) oximes |
| (C) $CH_3$ C=O+$H_2$NNHC₆H₅ H | (III) Ethane |
| (D) $CH_3$ C=O+Zn – Hg/HCl H | (IV) phenyl hy-drazones |

Choose the correct answer from the options given belowr:
(1) (A)-(II), (B)-(IV), (C)-(III), (D)-(I)
(2) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
(3) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)
(4) (A)-(III), (B)-(I), (C)-(II), (D)-(IV)

**Ans.** Option (2) is correct

42. Which of the following aldehyde will give Aldol condensation:



(A)   (B)   (C)   (D)

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

**Ans.** Option (4) is correct

*Explanation:* cyclic hexanone undergo aldol condensation.

43. Arrange in decreasing order of nuelophilic addition:
    (A) $CH_3CHO$
    (B) $C_2H_5COCH_3$
    (C) $CH_3COCH_3$
    (D) HCHO
    **Choose the correct answer**
    (1) (D) > (A) > (C) > (B)
    (2) (D) > (A) > (B) > (C)
    (3) (C) > (B) > (A) > (D)
    (4) (B) > (C) > (A) > (D)

**Ans.** Option (1) is correct

*Explanation:* The reactivity of nucleophilic addidtion in carbonyl compound decreases with increse in electron density on carbonyl carbon. The inductive effect increase the electron density on carbonyl carbon atoms. Hence, +I effect is HCHO<$CH_3$CHO< $CH_3COCH_3$<$C_2H_5COCH_3$

44. Which of the following statements are true?
    (A) $CH_3CHO$, and $CH_3CH_2CHO$ can be distinguished by Tollen's test.
    (B) $CH_3CH_2CHO$ and $CH_3COCH_3$ can be distinguished by Fehling's test.
    (C) $CH_3CHO$, ⬡—CHO can be distinguished by Fehling's test.
    (D) HCHO, $CH_3CHO$ can be distinguished by $NaHCO_3$ test.
    (E) HCOOH, $CH_3COOH$ can be distinguished by $NaHCO_3$ test.
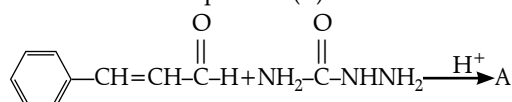    **Choose the correct answer from the options given below:**
    (1) (A), (B) only
    (2) (B), (C) only
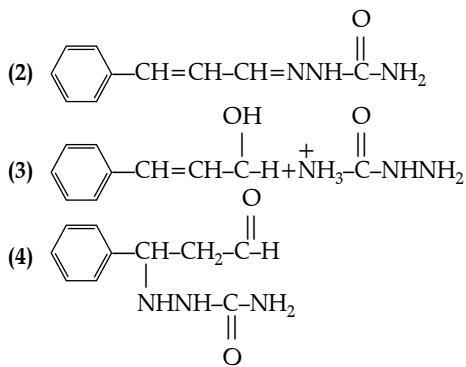    (3) (C), (D) only
    (4) (E), (A) only

**Ans.** Option (2) is correct

*Explanation:* Benzaldehyde and Ketones do not give Fehling's test. Ethanal and propanal both give silver mirror test and red precipitate with Fehling's solution.
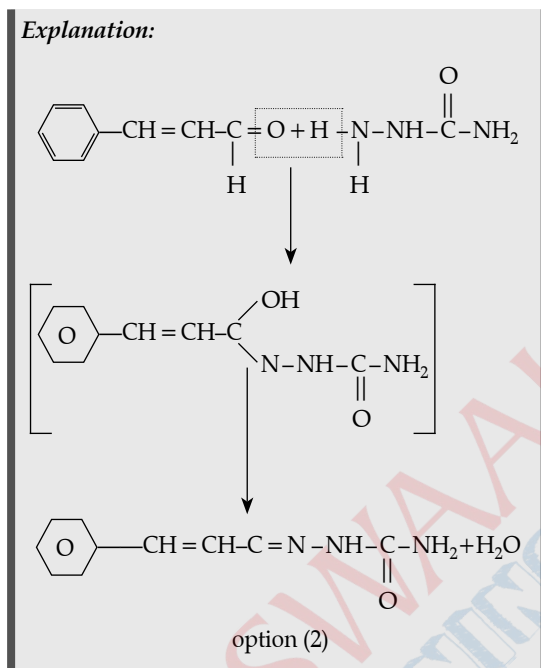
45. Predict the correct product (A):



(1) ⬡—CH=CH–CH=N–C–NHNH₂ (with O double bond on C)

**(2)**

$$\bigcirc\!\!-\!CH=CH-CH=NNH-\overset{\overset{\displaystyle O}{\|}}{C}-NH_2$$

**(3)**

$$\bigcirc\!\!-\!CH=CH-\overset{\overset{\displaystyle OH}{|}}{C}-H+\overset{+}{N}H_3-\overset{\overset{\displaystyle O}{\|}}{C}-NHNH_2$$

**(4)**

$$\bigcirc\!\!-\!CH-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-H$$
$$|$$
$$NHNH-\overset{}{C}-NH_2$$
$$\overset{\overset{\displaystyle \|}{}}{O}$$

**Ans. Option (2) is correct**

*Explanation:*

$$\bigcirc\!\!-\!CH=CH-C=O+H-N-NH-\overset{\overset{\displaystyle O}{\|}}{C}-NH_2$$
$$\qquad\qquad|\qquad\qquad|$$
$$\qquad\qquad H\qquad\qquad H$$

$$\Big[\bigcirc\!\!-\!CH=CH-\overset{\overset{\displaystyle OH}{|}}{\underset{\underset{\displaystyle N-NH-\overset{\overset{\displaystyle O}{\|}}{C}-NH_2}{|}}{C}}\Big]$$

$$\bigcirc\!\!-\!CH=CH-C=N-NH-\overset{\overset{\displaystyle O}{\|}}{C}-NH_2+H_2O$$

option (2)

**Read the passage below and answer the question (Q. No. 46 to 50):**

The accumulation of molecular species at the surface rather than in the bulk of a solid or liquid is termed as adsorption. There are two types of adsorption. In physiorsorption, attractive forces are mainly Van der Waals while in chemical adsorption adsorbate is held with chemical bonds adsorbent. Adsorption increases with increase in pressure and decreases as temperature is increased.

**46.** Adsorption is spontaneous because:
**(1)** $\Delta S$ is – ve and is more than $\Delta H$
**(2)** $\Delta S$ is + ve and is more than $\Delta H$
**(3)** $\Delta H$ is – ve and is more than $T\Delta S$
**(4)** $\Delta H - \Delta S$

**Ans. Option (3) is correct**

*Explanation:* For a spontaneous reaction $\Delta H$ is always -ve and it is more than $T\Delta S$.

**47.** Which of the following is not characteristic of chemical adsorption?

**(1)** It is irreversible
**(2)** It is highly specific
**(3)** High temperature is favourable
**(4)** It results into multi molecular layers

**Ans. Option (4) is correct**

*Explanation:* Chemical adsorption do not results into multi molecular layers which is not a characteristics of chemical adsorption while all others are characteristics of chemical adsorption.

**48.** Which of the following is **not** an application of adsorption?
**(1)** Control of humidity using silica gel
**(2)** Separation of noble gases using charcoal
**(3)** Removal of colouring matter from solutions
**(4)** Inversion of cane sugar using mineral acids as catalysts

**Ans. Option (4) is correct**

*Explanation:* Adsorption is not applicable in inversion of cane sugar using mineral acids as catalyst while all others are application of adsorption.

**49.** For Freundlich isotherm, graph of $\log(x/m)$ is plotted against $\log Y$. The slope of line and its Y axis intercepts respectively are:

**(1)** $\dfrac{1}{n}, K$      **(2)** $\dfrac{1}{n}, \log K$

**(3)** $n, 1/K$      **(4)** $n, \dfrac{1}{\log K}$

**Ans. Option (2) is correct**
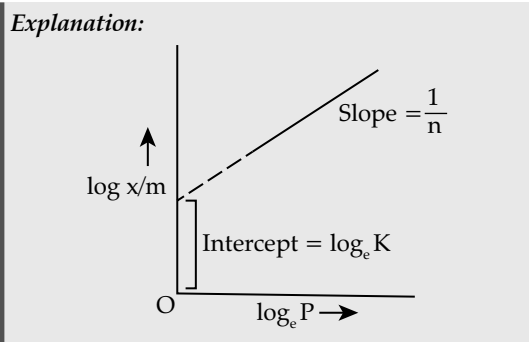
*Explanation:*



**50.** Critical temperature of few gases are given $SO_2$ (630K), $CH_4$, (190K), $H_2$ (33K). What is the correct order of case of physisorption of these gases?

**(1)** $CH_4 > H_2 > SO_2$    **(2)** $SO_2 > CH_4 > H_2$
**(3)** $H_2 > CH_4 > SO_2$    **(4)** $H_2 > SO_2 > CH_4$

**Ans. Option (2) is correct**

*Explanation:* physisorption of gases depends upon the nature of gas and its liquification at critical temperature. Lower the value of critical temperature, lesser will be adsorption. $H_2$ has low value 33K, $CH_4$ has 190K and $SO_2$ has 630K.

# CUET Question Paper 2022
## NATIONAL TESTING AGENCY
### 10th August 2022—Slot-1
# Chemistry

**[*This includes Questions pertaining to Domain Specific Subject Only*]**

SOLVED

**1.** Among the following statements, choose the correct statements.

(A) In ionic solid, ions are the constituent particles.

(B) Ionic solids are soft.

(C) Ionic solids are electrical insulators in the solid state.

(D) Ionic solids conduct electricity in molten state.

(E) Ionic solids have low melting and boiling points.

Choose the correct answer from the options given below :

**(A)** A, C & D only　　　　**(B)** A, D & E only

**(C)** A, B & C only　　　　**(D)** A, C & E only

**Ans. Option (A) is correct**

> *Explanation:* Ionic compound forms by the transfer of electrons from one atom to another, which create ions (cation and anion) and they become the main constituents of an ionic compound. These ions are strongly packed together in a three-dimensional arrangement by a strong electrostatic force of attraction which makes ionic crystals hard and brittle in nature. These compounds have high melting points and boiling points because of the large amounts of energy is needed to break many strong bonds. The ionic solids are insulators in the solid state because the ions are entrapped in fixed places within the crystal lattice and cannot move on applying an electric field. However, in a molten state, the well-ordered arrangement of ions is destroyed and the ions are in a position to move about in the liquid medium when an electric field is applied. So, ionic solids conduct electricity in the molten state.

**2.** Atoms of element B form *hcp* lattice and those of element A occupy $2/3^{rd}$ of tetrahedral voids. What is the formula of the compound formed by the elements A and B?

**(A)** $A_3B_4$　　　　　　　**(B)** $A_4B_3$

**(C)** $A_2B_3$　　　　　　　**(D)** $A_3B_2$

**Ans. Option (B) is correct**

> *Explanation:*
> In *hcp* lattice, if atoms of element B = $n$
> Number of tetrahedral voids = $2n$
> Then, atoms of element A occupy two third of the tetrahedral voids
> $$= \frac{2}{3} \times 2n = \frac{4n}{3}$$
> Atomic ratio = $\dfrac{\frac{4n}{3}}{n} = \dfrac{4}{3}$
> Thus, the formula of the lattice is $A_4B_3$.

**3.** Consider the 1 M aqueous solution of the following compounds and arrange them in the increasing order of elevation in the boiling points.

(A) $C_6H_{12}O_6$　　　　　　(B) NaCl

(C) $MgCl_2$　　　　　　　　(D) $AlCl_3$

(E) $Al_2(SO_4)_3$

Choose the correct answer from the options given below:

**(A)** B < C < D < E < A

**(B)** A < E < D < C < B

**(C)** A < B < C < D < E

**(D)** E < D < C < B < A

**Ans. Option (C) is correct**

*Explanation:* Elevation in boiling point depends upon van't Hoff factor and molarity at a specific temperature,

$$\Delta T_b = iK_b m$$

For the same molarity 1M aqueous solution, the extent to which a substance associates or dissociates in a solution is described by the Van't Hoff factor.

$$\Delta T_b \, \alpha \, i$$

|   |   |   |
|---|---|---|
| A. | $C_6H_{12}O_6$ | nonelectrolyte |
| B. | NaCl | i = 2 |
| C. | $MgCl_2$ | i = 3 |
| D. | $AlCl_3$ | i = 4 |
| E. | $Al_2(SO_4)_3$ | i = 5 |

Thus, increasing order of elevation in boiling point: A < B < C < D < E

**4.** Calculate the molarity of a solution containing 5 g of NaOH in 450 mL solution.

**(A)** $0.278 \times 10^{-3}$ M     **(B)** 0.278 M

**(C)** $2.78 \times 10^{-3}$ M     **(D)** 2.78 M

**Ans. Option (B) is correct**

*Explanation:* For molarity of a solution, volume (L) = 450/1000 = 0.450

Molecular mass of NaOH = 40 g

$$\text{Molarity}, M = \frac{W}{M \times V_l}$$

$$= \frac{5}{40 \times 0.450}$$

$$= \frac{5}{18}$$

$$= 0.278 M$$

**5.** Among the following statements related to ionic conductance, choose the correct statements.

(A) Ionic conductance depends on the nature of the electrolyte.

(B) Ionic conductance is due to the movements of electrons.

(C) Ionic conductance is also called electronic conductance.

(D) Ionic conductance depends on temperature.

(E) Ionic conductance also depends on the nature of the solvent.

Choose the correct answer from the options given below:

**(A)** A, B and C only     **(B)** B, C and D only

**(C)** B, C and E only     **(D)** A, D and E only

**Ans. Option (D) is correct**

*Explanation:* Ionic conductance is electrical conductance due to the motion of ionic charge. Elementary science introduces this phenomenon as a property of liquid electrolyte solutions.
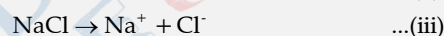
The conductance of a solution depends on

- the nature of the electrolyte added,
- size of the ions produced
- their solvation
- the nature of the solvent
- its viscosity
- concentration of the electrolyte
- temperature.

For example, with increases in dilution, the number of ions present in the solution increases and the conductance of the solution increases.
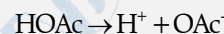
**6.** $\Lambda^{\circ}_m$ for NaCl, HCl and NaOAc are 126.4, 425.9 and 91.0 S cm$^2$mol$^{-1}$ respectively. Calculate $\Lambda^{\circ}$ for HOAc.

**(A)** 390.5 S cm$^2$ mol$^{-1}$     **(B)** 643.3 S cm$^2$ mol$^{-1}$

**(C)** 461.3 S cm$^2$ mol$^{-1}$     **(D)** 208.5 S cm$^2$ mol$^{-1}$

**Ans. Option (A) is correct**

*Explanation:*

$$HCl \rightarrow H^+ + Cl^- \qquad \qquad ...(i)$$

$$NaOAc \rightarrow Na^+ + OAc^- \qquad ...(ii)$$

$$NaCl \rightarrow Na^+ + Cl^- \qquad \qquad ...(iii)$$

From equations, (i)+(ii)-(iii)

$$HOAc \rightarrow H^+ + OAc^-$$

$$\Lambda^{\circ}_{m(HOAc)} = \Lambda^{\circ}_H + \Lambda^{\circ}_{Ac-}$$

$$= \Lambda^{\circ}_{m(HCl)} + \Lambda^{\circ}_{m(NaOAc)} - \Lambda^{\circ}_{m(NaCl)}$$

$$= (425.9 + 91.0 - 126.4) S cm^2 mol^-$$

$$= 390.5 S cm^2 mol^-$$

**7.** How much charge is required for the reduction of 1 mole of $MnO^-$ to $Mn^{2+}$ ?

**(A)** 1 F     **(B)** 5 F

**(C)** 3 F     **(D)** 6 F

**Ans. Option (B) is correct**

*Explanation:* In an acidic medium, Mn (+7) is getting reduced to Mn(+2).

$$Mn^{+7}O_4^- + 5e^- \rightarrow Mn^{2+}$$
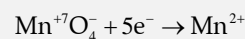
Thus, n factor = 5

$$n_{eq} = n_{mol} \times n \text{ - factor}$$
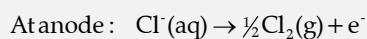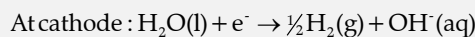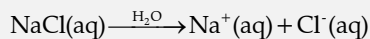
$$= 1 \times 5$$

$$= 5$$

Thus, charge in Faraday = 5F

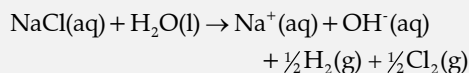**8.** The products formed at the cathode and anode by electrolysis of aqueous NaCl solution respectively are :

**(A)** Na, $Cl_2$     **(B)** Na, $O_2$

**(C)** $H_2$, $Cl_2$     **(D)** $H_2$, $O_2$

**Ans. Option (C) is correct**

*Explanation:* When an electric current is passed through a concentrated sodium chloride solution, hydrogen gas forms at the negative electrode, chlorine gas forms at the positive electrode, and a solution of sodium hydroxide is also formed.

$$NaCl(aq) \xrightarrow{H_2O} Na^+(aq) + Cl^-(aq)$$

$$At \, cathode: H_2O(l) + e^- \rightarrow \frac{1}{2}H_2(g) + OH^-(aq)$$

$$At \, anode: \quad Cl^-(aq) \rightarrow \frac{1}{2}Cl_2(g) + e^-$$

Net reaction:

$$NaCl(aq) + H_2O(l) \rightarrow Na^+(aq) + OH^-(aq)$$
$$+ \frac{1}{2}H_2(g) + \frac{1}{2}Cl_2(g)$$

**9.** The artificial sweetener used only for cold food is:

**(A)** Alitame      **(B)** Sucralose

**(C)** Aspartame      **(D)** Saccharin

**Ans. Option (C) is correct**

*Explanation:* Aspartame is the most successful and widely used artificial sweetener. It is the methyl ester of dipeptide formed from aspartic acid and phenylalanine. Use of aspartame is limited to cold foods and soft drinks because it is unstable at cooking temperature.

**10.** Rate constant 'k' for a certain reaction is k = 2.3 × $10^{-5}$ L $mol^{-1}$ $s^{-1}$. Order of the reaction is:

**(A)** 0      **(B)** 1

**(C)** 2      **(D)** 3

**Ans. Option (C) is correct**

*Explanation:* Given, rate constant $k$ = 2.3 x $10^{-5}$ L $mol^{-1}$ $s^{-1}$

The order of a reaction can be find out by unit of rate constant, i.e., $[k]$= $L^{(n-1)}$ $mol^{(1-n)}s^{-1}$

Comparing units at n=2, we get L $mol^{-1}$ $s^{-1}$.
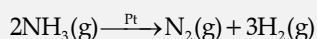
Hence, it is a second-order reaction.

**11.** The decomposition of $NH_3$ on the platinum surface is zero order reaction. If $k = 2.5 \times 10^{-4}$ mol $L^{-1}$ $s^{-1}$ the rate of production of $H_2$ is:

**(A)** $2.5 \times 10^{-4}$ mol $L^{-1}$ $s^{-1}$

**(B)** $7.5 \times 10^{-4}$ mol $L^{-1}$ $s^{-1}$

(3   $5.0 \times 10^{-4}$ mol $L^{-1}$ $s^{-1}$

**(D)** $10.0 \times 10^{-4}$ mol $L^{-1}$ $s^{-1}$

**Ans. Option (B) is correct**

*Explanation:*

For chemical reaction,

$$2NH_3(g) \xrightarrow{Pt} N_2(g) + 3H_2(g)$$

As it is a zero-order reaction, the rate is independent of the rate of change in the reactant's concentration.
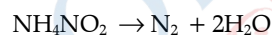
$$Rate = k[NH_3]^0$$

$$Rate = k$$

$$Also, Rate = \frac{-1}{2}\frac{\Delta[NH_3]}{\Delta t} = \frac{1}{3}\frac{\Delta[H_2]}{\Delta t}$$

$$\therefore \frac{\Delta[H_2]}{\Delta t} = 3k$$

$$= 3 \times 2.5 \times 10^{-4}$$

$$= 7.5 \times 10^{-4} \, mol \, L^{-1}s^{-1}$$

**12.** The molecularity of the following elementary reaction is:

$$NH_4NO_2 \rightarrow N_2 + 2H_2O$$

**(A)** Zero      **(B)** One

**(C)** Two      **(D)** Three

**Ans. Option (B) is correct**

*Explanation:* Molecularity is the number of molecules that participates in an elementary (single-step) reaction. Molecularity is equal to the sum of stoichiometric coefficients of reactants in the elementary reaction with effective collision (sufficient energy) and correct orientation.

$$NH_4NO_2 \rightarrow N_2 + 2H_2O$$
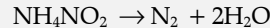
Here, only one reactant is involved in the reaction, therefore, it is a unimolecular reaction. Hence, its molecularity is 1.

**13.** Which of the following is not the characteristic of physisorption?

**(A)** It arises because of van Der Waals forces.

**(B)** It is not specific in nature.

**(C)** Enthalpy of adsorption is high.

**(D)** It results into multimolecular layers on the adsorbent surface under high pressure.

**Ans. Option (C) is correct**

*Explanation:* **Specificity:** The force of van Der Waals is global. As a result, an adsorbent's surface does not display any preference for a particular gas. Hence, specificity is lacking.

**Reversible nature:** The physisorption of a gas by a material is usually reversible. As an outcome, it can be denoted as:

Solid + Gas ↔ Gas/Solid + Heat

**Surface Area:** As the surface area of the adsorbent grows, the fraction of physisorption increases. As a result, finely split metals and porous materials with large surface areas are good adsorbents.

**Enthalpy:** The process of physical adsorption is already exothermic. However, its enthalpy of adsorption is low, ranging between 20 and 40 kJ $mol^{-1}$.