### QUESTIONS

| S.NO | The molecular formula of a commercial resin used for exchanging ions in water softening is C8H7SO3Na (Mol. Wt. 206). What would be the maximum uptake of Ca2+ ions by the resin when expressed in mole per gram resin? (1) 1/103 (2) 1/206 (3) 2/309 (4) 1/412 | **ANSWER** | Ans.31 (4) 2 mol of water softener require one mole of Ca2+ , So Maximum uptake is 1/206×2 = 1/103 mol/gram |
| S.NO | Sodium metal crystallizes in a body centered cubic lattice with a unit cell edge of 4.29Å. The radius of sodium atom is approximately. (1) 1.86Å (2) 3.22Å (3) 5.72Å (4) 0.93Å | **ANSWER** | Ans.32 (1) For BCC unit cell \( r = \frac{4}{3}\sqrt[3]{a} \) so \( a = 4r/\sqrt[3]{3} \) \( a = 4 \times 0.93 / \sqrt[3]{3} \approx 1.85 \) approx. 1.86 Å |
| S.NO | Which of the following is the energy of a possible excited state of hydrogen? (1) +13.6 eV (2) +6.8 eV (3) +3.4 eV (4) +6.8 eV | **ANSWER** | Ans.33 (3) E\(n = 1\)= 13.6Z\(^2\)n\(^2\) eV n=2 (first excited state) so E\(n = 2\) = -13.68 * 1/4 = -3.4 ev |
| S.NO | The intermolecular interaction that is dependent on the inverse cube of distance between the molecules is (1) ion-ion interaction (2) ion-dipole interaction (3) London force (4) hydrogen bond | **ANSWER** | Ans.34 (2) Energy of ion- dipole interaction \( \propto \frac{1}{r^3} \), so force is \( \propto \frac{1}{r^3} \) |
| S.NO | The following reaction is performed at 298 K. \( 2\text{NO}(g) + \text{O}_2(g) \rightarrow 2\text{NO}_2(g) \) The standard free energy of formation of NO\(g\) (g) at 298 K? What is the standard free energy of formation of NO\(2\) (g) at 298 K? \( (K_p = 1.6 \times 10^{-3}) \) (1) \( R(T) \text{ln}(1.6 \times 10^{12}) \) (2) \( 86600 - R(T) \text{ln}(1.6 \times 10^{12}) \) (3) \( 86600 - \text{ln}(1.6 \times 10^{12}) \) R(T) (298) (4) \( 0.5 \left( \frac{86600 - R(T)}{R(298)} \right) \text{ln}(1.6 \times 10^{12}) \) | **ANSWER** | Ans.35 (4) \( \Delta G = -RT \text{ln} K_p \) -RT ln 1.6 * 10\(^{12}\) = 2 * \( \Delta G_{\text{NO}_2} \) - 2 \( \Delta G_{\text{NO}} \) \( \Delta G_{\text{NO}_2} = 0.5 \left( \frac{2 \times 86600 - R(298)}{R(298)} \right) \text{ln}(1.6 \times 10^{12}) \) |
| S.NO | The vapor pressure of acetone at 20°C is 185 torr. When 1.2 g of a non-volatile substance was dissolved in 100 g of acetone at 20°C, its vapor pressure was 183 torr. The molar mass \( (g \text{mol}^{-1}) \) (1) 32 (2) 64 (3) 128 (4) 488 | **ANSWER** | Ans.36 (2) \( \frac{p^s-p^a}{p^a} = X \) solute = \( \frac{n}{n_1+n_2} \) \[ \frac{185-183}{185} = \frac{1}{2/(1/2+1/2)} = \frac{1}{1/2+1/2} = \frac{1}{1/4} = 4 \] |
| S.NO | The standard Gibbs energy change at 300 K for the reaction \( 2\text{A} \rightarrow \text{B} + \text{C} \), \( \Delta G_0 = 2494.2 \text{ J} \) At a \( \frac{1}{2} \), \( [\text{B}] = 2 \) and \( [\text{C}] = \frac{1}{2} \) The reaction proceeds in the : \( [R] = 8.314 \text{ J/K/mol} \times 298 \text{ K} \) \( \text{e} = 2.718 \) (1) forward direction because \( Q > K \) (2) reverse direction because \( Q < K \) (3) forward direction because \( Q < K \) (4) reverse direction because \( Q > K \) | **ANSWER** | Ans.37 (2) \( \Delta G = -RT \text{ln} K_r \) \( \Delta G = -RT \text{ln} K_r \) \( K_r = e^{-\Delta G/RT} \) \( K_r = e^{-2494.2/298 \times 8.314} \times 300 \) So \( K_r = e^{-1} = 0.36 \) So, \( Q = [\text{B}][\text{C}]^2/[\text{A}]^2 = (1/2)(1/2)^2 = 4 \) As \( Q < K \) hence reaction will shift in reverse direction |
| S.NO | Two Faraday of electricity is passed through a solution of CuSO\(4\). The mass of copper deposited at the cathode is (at. mass of Cu = 63.5 amu) (1) 0 g (2) 63.5 g (3) 2 g (4) 127 g | **ANSWER** | Ans.38 (2) \( \text{Cu}^2+ + 2\text{e}^- \rightarrow \text{Cu} \) \( 2\text{Faraday of electricity will give 1 mole of Cu} \) |
| S.NO | Higher order (>3) reactions are rare due to : (1) low probability of simultaneous collision of all the reacting species (2) increase in entropy and activation energy as more molecules are involved (3) shifting of equilibrium towards reactants due to elastic collisions (4) loss of active species on collision | **ANSWER** | Ans.39 (1) Higher order (>3) reactions are less probable due to low probability of simultaneous collision of all the reacting species. |
| S.NO | 3 g of activated charcoal was added to 50 mL of acetic acid solution (0.06 N) in a flask. After an hour it was filtered and the strength of the filtrate was found to be 0.042 N. The amount of acetic acid adsorbed (per gram of charcoal) is : | **ANSWER** | Ans.40 (1) Amount of acetic acid adsorbed = \( \frac{(0.06 - 0.042) \times 50 \times 10^{-3} \times 60}{3} = 18 \times 10^{-1} = 18 \) mg. |
1. The iconic radii (in Å) of $N^-$, $O^-$ and $F$ respectively:
   - (1) 1.36, 1.40 and 1.71
   - (2) 1.36, 1.71 and 1.40
   - (3) 1.71, 1.40 and 1.36
   - (4) 1.71, 1.36 and 1.40
   **Ans.:** (1)

   Ionic Radii order: $N^-$ > $O^-$ > $F$ because in isoelectronic series size decreases as Z/e increases.

2. In the context of the Hall-Heroult process for the extraction of $A$, which of the following statements is false?
   - (1) CO and CO$_2$ are produced in this process
   - (2) $A_2O_3$ is mixed with CaF$_2$ which lowers the melting point of the mixture and brings Conductivity
   - (3) Al$^{3+}$ is reduced at cathode to form Al
   - (4) Na$_3$A F$_6$ serves as the electrolyte
   **Ans.:** (2)

   In the Hall-Heroult process, Al$_2$O$_3$ (molten) is electrolyte.

3. Which one of the following alkaline earth metal sulphates has its hydration enthalpy greater than its lattice enthalpy?
   - (1) CaSO$_4$
   - (2) BeSO$_4$
   - (3) BaSO$_4$
   - (4) SrSO$_4$
   **Ans.:** (2)

   BaSO$_4$ is least soluble and BeSO$_4$ is most soluble.

4. Which among the following is the most reactive?
   - (1) Cl$_2$
   - (2) Br$_2$
   - (3) I$_2$
   - (4) ICl
   **Ans.:** (4)

   Because interhalogen compounds are more reactive than halogens (except F$_2$).

5. Match the catalysts to the correct processes:
   - (A) TiCl$_3$
   - (B) PdCl$_2$
   - (C) CuCl$_2$
   - (D) $V_2O_5$
   - i) Wacker Process
   - ii) Ziegler-Natta polymerization
   - iii) Contact Process
   - iv) Deacon’s Process

   1(A) - ((i), (B) - (ii), (C) - (iv), (D) - (i))
   2(A) - (i), (B) - (ii), (C) - (iii), (D) - (iv))
   3(A) - (ii), (B) - (i), (C) - (iv), (D) - (i))
   4(A) - (iii), (B) - (i), (C) - (i), (D) - (iv))
   **Ans.:** (2)

   TiCl$_3$ = Ziegler - Natta polymerization
   PdCl$_2$ = Wacker process
   CuCl$_2$ = Deacon’s process
   $V_2O_5$ = Contact process

6. Which one has the highest boiling point?
   - (1) He
   - (2) Ne
   - (3) Kr
   - (4) Xe
   **Ans.:** (4)

   In periodic table as go down the group strength of vanderwal’s force of attraction increases so Xe has highest boiling point.

7. The number of geometric isomers that can exist for square planar
   $[Pt(Cl)(py)(NH_3)(NH_2OH)]^+$ is (py = pyridine):
   - (1) 2
   - (2) 3
   - (3) 4
   - (4) 6
   **Ans.:** (2)

   No. of Geometrical isomers of $[Pt(Cl) (Py) (NH_3) (NH_2OH)]^+$ = 3

8. The color of KMnO$_4$ is due to:
   - (1) M → L charge transfer transition
   - (2) d → d transition
   - (3) L → M charge transfer transition
   - (4) σ → σ$^*$ transition
   **Ans.:** (1)

   Charge transfer spectra M → L

9. **Assertion:** Nitrogen and Oxygen are the main components in the atmosphere but these do not react to form oxides of nitrogen.
   **Reason:** The reaction between nitrogen and oxygen requires high temperature.
   (1) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
   (2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
   (3) The assertion is incorrect, but the reason is correct
   **Ans.:** (1)

   Assertion and Reason are correct & the reason is the correct explanation for the assertion.

   $N_2 + O_2 \rightarrow 2NO$

   (occurs only during lightning)
### Question 50
In Carius method of estimation of halogens, 250 mg of an organic compound gave 141 mg of AgBr. The percentage of bromine in the compound is:

\[ \text{Percentage of bromine} = \frac{\text{Wt of AgBr}}{\text{Mol mass of AgBr}} \times \frac{\text{Mol mass of Br}}{\text{Wt of organic compound}} \times 100 \]

- (1) 24
- (2) 36
- (3) 48
- (4) 60

**Ans. 50** (1)

The percentage of bromine is 24%

\[ \frac{141}{188} \times \frac{80}{250} \times 100 = 24\% \]

### Question 51
Which of the following compounds will exhibit geometrical isomerism?

- 1) 1-Phenyl-2-butane
- 2) 3-Phenyl-1-butane
- 3) 2-Phenyl-2-butane
- 4) 1,1-Diphenyl-1-propane

**Ans. 51** (1)

Only 1-phenyl-2-butene can show geometrical isomerism.

### Question 52
Which compound would give 5-keto-2-methyl hexanal upon ozonolysis?

1. ![Image]
2. ![Image]
3. ![Image]
4. ![Image]

**Ans. 52** (2)

5-keto-2-methyl hexanal

### Question 53
The synthesis of alkyl fluorides is best accomplished by:

- (1) Free Radical fluorination
- (2) Sandmeyer’s reaction
- (3) Finkelstein reaction
- (4) Swarts reaction

**Ans. 53** (4)

Swarts reaction

\[ R - I + AgF \rightarrow R - F + AgI \] (Swarts Reaction)

### Question 54
In the following sequence of reactions:

\[ \text{To-} \xrightarrow{KIO_{3}} \xrightarrow{HCl} \xrightarrow{SOCl_{2}} \xrightarrow{H_{2}/Pd} \xrightarrow{C,} \]

the product C is

- (1) \( C_6H_5COOH \)
- (2) \( C_6H_5CH_3 \)
- (3) \( C_6H_5CH_2OH \)
- (4) \( C_6H_5CHO \)

**Ans. 54** (4)

The product C is \( CH_3C(OH) \).
55. Which polymer is used in the manufacture of paints and lacquers?
   (1) Bakelite  (2) Glyptal  (3) Polypropene  (4) Polyvinyl chloride
   Ans. (2) Glyptal used in the manufacture of paints and lacquers.

56. Which of the vitamins given below is water soluble?
   (1) Vitamin C  (2) Vitamin D  (3) Vitamin E  (4) Vitamin K
   Ans. (1) Vitamin ‘B’ and ‘C’ are water soluble.

57. Which of the following compounds is not an antacid?
   (1) Aluminium hydroxide  (2) Cimetidie  (3) Phenelzine  (4) Ranitide
   Ans. (3) Phenelzine is antidepressant drug.

58. Which of the following compounds is not colored yellow?
   (1) Zn₂[Fe(CN)₆]  (2) K₃[Co(NO₃)₆]  (3) (NH₄)₃[As₆O₁₉]₃  (4) BaCrO₄
   Ans. (1) Zn₂[Fe(CN)₆] is bluish white ppt.