CHEMISTRY

1. Which of the following compounds is formed by ammonolysis of ethyl chloride and reacts with tosyl-chloride but remains insoluble in KOH?

   (1) Ph–NH–PH  (2) Et–NH₂  (3) Ph–NH–Pr  (4) Et–NH–Pr

**Ans.** (4)

**Sol.** Sulphonamides of secondary amine will be insoluble in KOH.

2. Statement-I: Orthonitrophenol has intra molecular H-bonding
   Statement-II: Orthonitrophenol has high melting point due to H-bonding.

   (1) Statement I is true, Statement II is false
   (2) Statement I is false, Statement II is true
   (3) Statement I, II both are true
   (4) Statement I, II both are false

**Ans.** (1)

3. Give the major product (P) of the following reaction

   \[ \text{CH}_3-\text{CH} = \text{CH} - \text{Br} \xrightarrow{(i) \text{NaNH}_2/\Delta} \xrightarrow{(ii) \text{Red hot Fe tube}} (P) \]

   (1) \[ \text{CH}_3\text{-} \text{CH} = \text{CH} - \text{Br} \]
   (2) \[ \text{CH}_3\text{-} \text{CH} = \text{CH} - \text{Br} \]
   (3) \[ \text{CH}_3\text{-} \text{CH} = \text{CH} - \text{Br} \]
   (4) \[ \text{CH}_3\text{-} \text{CH} = \text{CH} - \text{Br} \]

**Ans.** (2)

4. Which metal is used in the coagulation of blood?

   (1) Vitamin K  (2) Vitamin C  (3) Vitamin A  (4) Vitamin E

**Ans.** (1)

**Sol.** Vitamin K is used by the body to help blood clot. Warfarin (Coumadin) is used to show blood clotting. By helping the blood clot, vitamin K might decrease the effectiveness of warfarin.
5. What is the major product of the following reaction

\[
\text{CN} \quad \text{CH}_2-\text{CH}_3 \quad \xrightarrow{\text{Br}_2/\text{hv}} \quad \text{CN} \quad \text{CHBrCH}_3
\]

(1) \quad (2) \quad (3) \quad (4)

Ans. (2)

Sol.

It is free-radical substitution reaction of alkanes, so bromination takes place at benzylic carbon.

6. What is the structure of neoprene?

(1) \quad (2)

(3) \quad (4)

Ans. (3)

Sol.

2-chloro-1,3 butadiene or chloroprene

\[\text{Cl} \quad \text{nCH}_2\text{C}={\text{CH}}_2 \xrightarrow{\text{Ziegler-Natta \ Catalyst}} \text{Cl} \quad \text{nCH}_2\text{C}={\text{CH}}_2\text{CH}_2\text{H} \] (Trans polymer or Trans polychloroprene or Neoprene)
7. What will be major product [A] and [B] in the given sequence of reactions?

\[
\begin{align*}
\text{(1)} & \quad \text{OH} & \quad \text{CHO} & \quad \text{OH} & \quad \text{Br} \\
\text{(2)} & \quad \text{OH} & \quad \text{CHO} & \quad \text{OH} & \quad \text{Br} \\
\text{(3)} & \quad \text{OH} & \quad \text{CHO} & \quad \text{OH} & \quad \text{Br} \\
\text{(4)} & \quad \text{OH} & \quad \text{CHO} & \quad \text{OH} & \quad \text{Br}
\end{align*}
\]

Ans. (2)

Sol.

It is Reimer–Tiemann reaction.

It is monobromination of phenol.

8. \( \text{C}_4\text{H}_8\text{Cl}_2 \rightarrow \text{C}_4\text{H}_8\text{O} \)

B forms oxime with \( \text{NH}_2\text{OH} \) but does not give Tollen's test.

Compound (A) and (B) are respectively:

(1) 2,2–Dichlorobutane & 2-Butanone
(2) 2,2–Dichlorobutane & 2-Butanal
(3) 1,1–Dichlorobutane & 2-Butanal
(4) 1,2–Dichlorobutane & 2-Butanone

Ans. (1)

Sol.

2-Butanone forms oxime with \( \text{NH}_2\text{OH} \) but does not give Tollen's test.

9. **Statement – I**: Chloroform and aniline is separated by simple distillation.

**Statement – II**: When we separate water and aniline by steam distillation aniline boils below its boiling point.

(1) Statement I is true ,Statement II is false
(2) Statement I is false ,Statement II is true
(3) Statement I , II both are true
(4) Statement I , II both are false

Ans. (3)
10. Which statement is false?
   (1) Kjeldal method is used for estimation of nitrogen.
   (2) Carius tube is used for estimation of sulphur
   (3) Carius tube is used for estimation of Nitrogen
   (4) Phosphoric acid is precipitated by adding magnesia mixture on yields Mg$_2$P$_2$O$_7$

   Ans. (3)

11. A compound on reaction with hot dilute H$_2$SO$_4$ liberates a gas ‘X’ which when brought in contact with $K_2Cr_2O_7$ paper dipped in dil. H$_2$SO$_4$ gives a green compound ‘Y’.

   ‘X’ and ‘Y’ respectively are
   (1) SO$_3$, Cr$_2$(SO$_4$)$_3$
   (2) SO$_2$, Cr$_2$O$_3$
   (3) SO$_2$, Cr$_2$O$_3$
   (4) SO$_2$, Cr$_2$(SO$_4$)$_3$

   Ans. (4)

Sol. Compound + H$_2$SO$_4$ → SO$_2$(g) → $k_2Cr_2O_7$ → Cr$_2$(SO$_4$)$_3$

   (sulphite)       Hot dil.

12. Which of the following combination is correct?

   Ore      Elements
   (A) Kernite       (P) Zn
   (B) Calamine       (Q) F
   (C) Cassiterite    (R) B
   (D) Cryolite       (S) Sn

   (2) A – R, B–Q, C–P, D–S
   (3) A –P, B–R, C–S, D–Q

   Ans. (1)

13. A compound which is used in lead storage battery, having amphoteric nature & is a strong oxidising agent is?

   (1) PbO$_2$
   (2) Pb$_3$O$_4$
   (3) PbSO$_4$
   (4) PbO

   Ans. (1)

14. Which does not form MO$_2$?

   (1) Nd
   (2) Yb
   (3) Dy
   (4) Pr

   Ans. (2)

Sol. Yb shows +2 & +3 only
15. Match the following electronic configuration with ΔH_r values:
   (i) 1s^2 2s^2
   (p) 801
   (ii) 1s^2 2s^2 2p^1
   (p) 899
   (iii) 1s^2 2s^2 2p^3
   (r) 1300
   (iv) 1s^2 2s^2 2p^4
   (s) 1400
   (1) (i) – q; (ii) – p; (iii) – s; (iv) – r
   (2) (i) – q; (ii) – s; (iii) – p; (iv) – r
   (3) (i) – s; (ii) – q; (iii) – p; (iv) – r
   (4) (i) – s; (ii) – p; (iii) – q; (iv) – r
   Ans. (1)
   Sol. Order : B < Be < O < N

16. Select the correct statement
   (a) Heavy water is used to determine reaction mechanism
   (b) Viscosity of heavy water is less than that of water
   (c) D_2O can be prepared by exhaustive electrolysis of H_2O
   (d) Boiling point of heavy water is more than that of normal water
   (1) a, d
   (2) a, b, d
   (3) a, c
   (4) a, b, c
   Ans. (1)
   Sol. Since extent of intermolecular forces are more in D_2O as compared to H_2O, therefore D_2O has more viscosity as well as Boiling point as compared to H_2O.

17. Statement-I : Dipole-dipole interaction is the only non-covalent interaction force responsible for H-Bonding
    Statement-II : F is the most EN element & HF forms symmetrical H-bond
    (1) Statement I is true ,Statement II is true and Statement II is correct explanation of Statement I
    (2) Statement I is false ,Statement II is true
    (3) Statement I , II both are true
    (4) Statement I , II both are false
    Ans. (2)

18. For which of the following orbital, number of angular node and radial node are each 2.
    (1) 5d
    (2) 4f
    (3) 3p
    (4) 2s
    Ans. (1)
    Sol.

<table>
<thead>
<tr>
<th>Orbital</th>
<th>Angular Node</th>
<th>Radial Node</th>
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<tr>
<td>5d</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4f</td>
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<td>0</td>
</tr>
<tr>
<td>3p</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2s</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
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19. \( \text{O}_3 \) is troposphere

(1) Form photochemical smog  
(2) Protect us from UV light

(3)  
(4)

Ans. (1)

20. When dichromate reacts with base. What is the oxidation number of Cr in the product?

Ans. 6

Sol. \( \text{Cr}_2\text{O}_7^{2-} + 2\text{OH}^- \rightarrow 2\text{CrO}_4^{2-} + \text{H}_2\text{O} \)

\( \text{CrO}_4^{2-} \)

\[ x + (-2 \times 4) = -2 \]

\[ x = 6 \]

21. 3.12g of \( \text{O}_2 \) is adsorbed in 1.2g Pt. Determine volume of \( \text{O}_2 \) (in L) adsorbed per gm of Pt at 1atm and 300 K

\[ R = 0.082 \text{ atm-L/Mol-K} \]

Ans. (2)

Sol. Moles of \( \text{O}_2 = \frac{3.12}{32} = 0.0975 \)

Volume of \( \text{O}_2 = \frac{nRT}{P} = \frac{0.0975 \times 0.082 \times 300}{1} = 2.3985 \text{ litres} = 2.4 \text{ litres} \)

Volume of \( \text{O}_2 \) adsorbed per gm of Pt = \( \frac{2.4}{1.2} = 2 \)

22. \( \text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O} \)

Determine the amount of current in faraday for conversion of 5 moles of \( \text{MnO}_4^- \) to \( \text{Mn}^{2+} \).

(Given \( E_{\text{MnO}_4^-/\text{Mn}^{2+}} = 1.51 \text{ V} \) )

Ans. 25

Sol. \( \text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O} \)

1 mole of \( \text{MnO}_4^- \) require 5 Faraday charge

5 moles of \( \text{MnO}_4^- \) will require 25 Faraday
23. No. of Bridging CO ligands in Mn₂(CO)₁₀ is
Ans. Zero

Sol. 
\[ \text{[Mn}_{(CO)}_{n}] \]

24. \( \Delta H = -20 \text{ kJ/mole} \) \( E_a \) for forward = 30 kJ/mole
Determine \( E_a \) for backward = ?
Ans. 50 kJ/mole

Sol. \( \Delta H = E_a, f - E_{a,b} \)
\[-20 = 30 -E_{a,b} \]
\( E_{a,b} = 50 \text{ kJ/mole} \)

25. For a reaction \( \Delta H = 80 \text{ kJ} \) \( \Delta S = 2T \text{ J/mole-k} \)
Calculate the minimum temperature at which the reaction will be spontaneous.
Ans. 200 K

Sol. For spontaneous reaction \( \Delta G < 0 \)
\( \Delta H - T\Delta S < 0 \)
\( 80,000 - (T)(2T) < 0 \)
\( 2T^2 > 80,000 \)
\( T > 40,000 \)
\( T > 200 \text{ K} \)
\[ \therefore \text{Ans.} 200 \text{ K} \]

26. For a gas \( P(V_m - b) = RT \)
If \( \left( \frac{dz}{dp} \right)_T = \frac{xb}{RT} \) find \( x \)
Ans. 1

Sol. \( P(V - b) = RT \)
\( PV - Pb = RT \)
\( \frac{PV}{RT} - \frac{Pb}{RT} = 1 \)
\( z = 1 + \frac{Pb}{RT} \)
\( \frac{dz}{dp} = 0 + \frac{b}{RT} \)
\( = \frac{b}{RT} \cdot \frac{x}{RT} \)
\( x = 1 \)
27. \[ \text{AB}_2(g) \rightleftharpoons A(g) + 2B(g) \]

Starting with 1 mole of AB₂ in 25L container, pressure at equilibrium is found to be 1.9 atm at 300K. If \( K_P \) is \( x \times 10^{-1} \), determine \( x \).

**Ans. 7**

**Sol.**  
\[ \text{AB}_2(g) \rightleftharpoons A(g) + 2B(g) \]

\[
P_i = \frac{1 \times 1 \times 300}{12} \times \frac{25}{2x} = 1
\]

\[
1 + 2x = 1.9
\]

\[
2x = 0.9
\]

\[
x = 0.45
\]

\[
K_P = \frac{9 \times 9 \times 9 \times 20}{20 \times 100 \times 11} = 0.6627 = 6.627 \times 10^{-1}
\]