Guru Aanklan

Grand Test	HSC Examination Chemistry Code - Set - A	SOLUTIONS

SECTION - A

1. (a) zero [1 M]
2. (d) 2.6Å [1 M]
3. (c) +3 [1 M]
4. (b) $C_6H_5CH_2CH_2–NH_2$ [1 M]
5. $\Delta S = \Delta_{fus} + \Delta_{vap}$

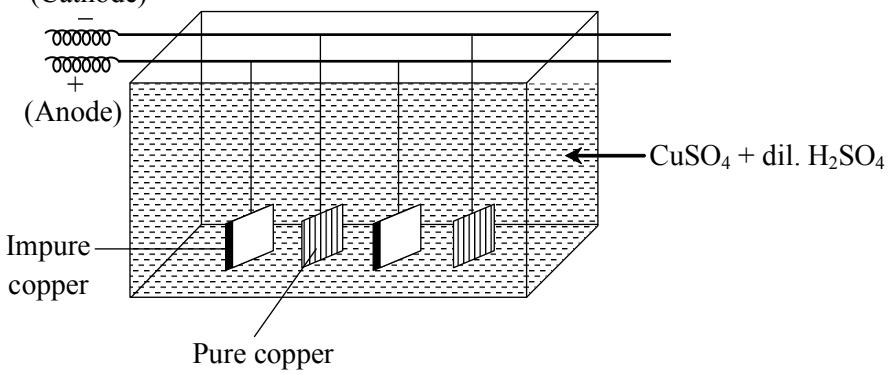
   $51.08 = x + 45.07 \quad \therefore \quad x = 6.01 \text{ kJ mol}^{-1}$ [1 M]
6. **Density goes on increasing as** van der waals forces increases, agglomeration increases. [1 M]
7. $CH_3OH + CH_2N_2 \xrightarrow[\Delta]{HBF_4} CH_3 - O - CH_3 + N_2$ [1 M]
8. $nCH_2=CH–Cl$ vinyl chloride [1 M]

SECTION - B

9. (i) As dilution of an electrolytic solution increases or concentration decreases, the dissociation of an electrolyte increases. [1 M]

   (ii) At infinite dilution, the dissociation of an electrolyte is complete (100% dissociation). Hence all the ions from one mole of an electrolyte are available to carry electricity. It is always constant for a given electrolyte at constant temperature. [1 M]

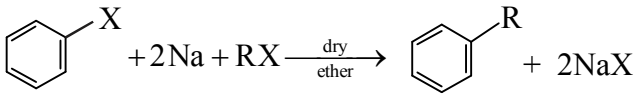
10. [1 M diag. + 1 M Labeling]



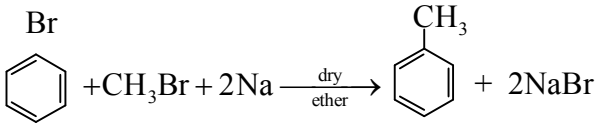
11. (a) **Osmosis :** It is a spontaneous unidirectional flow of the solvent molecules from a pure solvent or a dilute solution to the more concentrated solution through a semipermeable membrane. [1 M]

    (b) **Isotonic solutions :** The solutions having the same osmotic pressure at a given temperature are called isotonic solutions. [1 M]

12. **Wurtz-fitting reaction :** When an alkyl halide and an aryl halide is treated with sodium metal in dry ether, The corresponding alkylarene (alkyl benzene) is formed. [1 M]



(alkylbenzene)

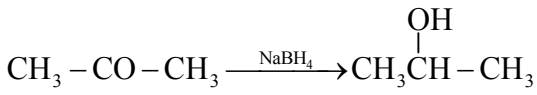
eg.  [1 M]

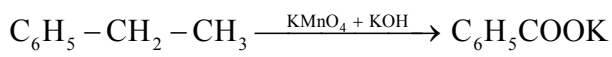
(Toluene)

(Methylbenzene)

13. Interstitial compounds are those which are formed when small atoms like C, H or N are trapped inside the interstitial space in the crystal lattice of metals. [1 M]

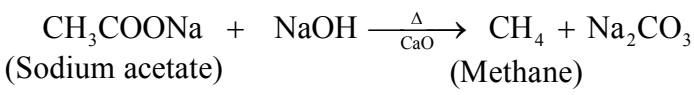
They have higher melting points than pure metals as the metal-non metal bonds are stronger than metal-metal bonds in pure metals. [1 M]

14. (i)  [1 M]

(ii)  [1 M]

OR

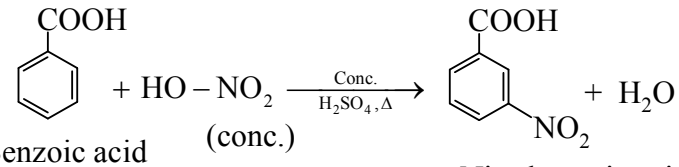
14. (a) Removal of CO_2 from carboxylic acids (removal of CO_2 metallic carbonates) is known as decarboxylation

e.g.  [1 M]

(Sodium acetate) (Methane)

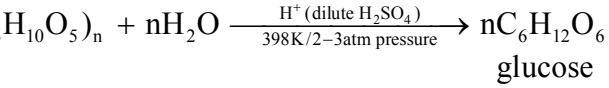
(b) Aromatic carboxylic acids undergo electrophilic substitution reactions in which the carboxyl group acts as a deactivating and meta-directing group.

e.g. reaction of benzoic acid with conc. HNO_3



Benzoic acid (conc.) m-Nitrobenzoic acid [1 M]

15. Commercially, glucose is prepared by hydrolysis of starch with dilute sulphuric acid. Starchy material is mixed with water and dilute sulphuric acid and heated at 393 K under pressure.



glucose [1 M]

On completion of hydrolysis calcium carbonate (chalk powder) is added. It neutralizes excess of acid.

 [1 M]

Activated charcoal is added which removes coloured impurities by adsorption. Filtered to remove insoluble impurities. Recrystallized to obtain pure glucose.

SECTION - C

16. **Given :**

Solution : Mass of 1 atom of Ag $= \frac{108}{6.022 \times 10^{23}} = 17.93 \times 10^{-23}$ g [½ M]

Fcc unit cell contains 4 Ag atoms [½ M]

$\therefore$ Mass of a unit cell $= 4 \times 17.93 \times 10^{-23}$

$= 71.72 \times 10^{-23}$ g [½ M]

Volume of unit cell $= \frac{\text{Mass of unit cell}}{\text{Density}}$ [½ M]

$= \frac{71.72 \times 10^{23}}{10.51A} = 6.824 \times 10^{-23}\,cm^3$ [1 M]

17. When tetraalkyl ammonium halide is heated with moist silver hydroxide; it gives quaternary ammonium hydroxide. This on strong heating undergo β-elimination to give alkenes. The major product is least substituted alkene. [1 M]

e.g. $C_2H_5 - \overset{+}{N}(CH_3)_3\,\bar{I} + AgOH \xrightarrow[\Delta]{Ag_2O/H_2O} C_2H_5 - \overset{+}{N}(CH_3)_3OH^- + AgI$ [1 M]

Ethyltrimethyl ammonium iodide

$C_2H_5 - \overset{+}{N}(CH_3)_3OH^- \xrightarrow{\Delta} CH_2 = CH_2 + (CH_3)_3N + H_2O$ [1 M]

Ethylene

18. **Given :**

Solution : $\Delta T_{b(ob)} = 373.0527 - 373 = 0.0527$ K [½ M]

$\Delta T_{b(th)} = K_b \times m = 0.52 \times 0.1 = 0.052$ K [½ M]

$i = \frac{\Delta T_{b(ob)}}{\Delta T_{b(th)}} = \frac{0.0527}{0.052} = 1.0135$ [½ M]

$\underset{1-\alpha}{NH_4OH} \rightleftharpoons \underset{\alpha}{NH_4^+} + \underset{\alpha}{OH^-}$ [½ M]

$i = 1 - \alpha + \alpha + \alpha = 1 + \alpha$

$\therefore$ $\alpha = i - 1 = 1.0135 - 1 = 0.0135$

$K_b = \frac{C\alpha^2}{1-\alpha}$ $\because$ α is very small, $1 - \alpha \approx 1$ [½ M]

$\therefore$ $K_b = C\alpha^2 = 0.1 \times (0.0135)^2$ [½ M]

$= 1.82 \times 10^{-5}$

19. (a) $CH_3-\overset{O}{\overset{\|}{C}}-OH + NH_3 \rightleftharpoons CH_3 - \overset{O}{\overset{\|}{C}} - \bar{O}NH_4^+ \xrightarrow{\Delta} CH_3 - \overset{O}{\overset{\|}{C}} - NH_2 + H_2O$ [1 M]

Ammonium acetate Acetamide

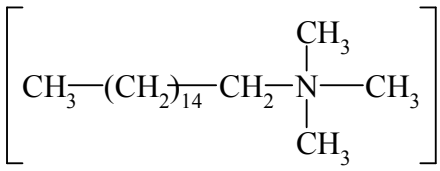
(b) $CH_3-\overset{O}{\overset{\|}{C}}-OH + PCl_5 \xrightarrow{\Delta} CH_3 - \overset{O}{\overset{\|}{C}} - Cl + POCl_3 + HCl\uparrow$ [1 M]

Acetylchloride

(c) $CH_3-\overset{O}{\overset{\|}{C}}-OH + SOCl_2 \xrightarrow{\Delta} CH_3 - \overset{O}{\overset{\|}{C}} - Cl + SO_2\uparrow + HCl\uparrow$ [1 M]

Acetylchloride

20. (a) Cationic detergents are quarternary ammonium salts of amines with chlorides, acetates or bromides. They have cations at the soluble end of the chain. [1 M]



(cetyltrimethyl ammonium chloride)

(b) Sodium salts of sulphonated long chains of hydrocarbons or alcohols. They have anions at the soluble ends of the chain.

$CH_3\text{—}(CH_2)_{10}CH_2OSO_3^-Na^+$ (sodium lauryl sulphate) [1 M]

(c) Monoesters of polyhydric alcohols are polyethers derived from ethylene oxide.
e.g. pentaerythrityl stearate. [1 M]

21. **Standard electrode potential :** It is defined as the difference of electrical potential between metal electrode and the solution around it at equilibrium when all the substances involved in the electrode reaction are in their standard states of unit activity or concentration at constant temperature. [1 M]

Advantages of SHE

(i) Potential of SHE is arbitrarily assumed to be 0.0 volt [½ M]

(ii) It can be used to determine potentials of other reference electrodes. [½ M]

Disadvantages : (Any two)

(i) Difficult to handle and construct [½ M]

(ii) Pure and dry H_2 gas cannot be obtained. [½ M]

(iii) Pressure of atmosphere / or active mass of H^+ difficult to be maintained at exactly unity.

OR

21. At infinite dilution, each ion migrates independently of its co-ion and makes its own contribution to the total molar conductivity of an electrolyte irrespective of the nature of other ion with which it is associated. [1 M]

Advantages of fuel cell :

(i) Cell reactions do not cause any pollution. [½ M]

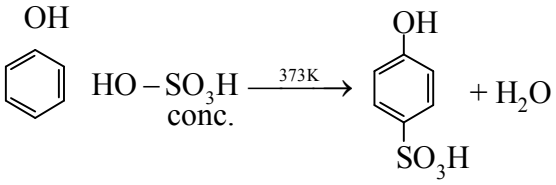
(ii) High efficiency of 70% compared to ordinary galvanic cells. [½ M]

Limitation of fuel cell :

(i) Expensive electrodes like Pt, Pd [½ M]

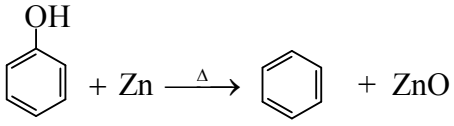
(ii) H_2 gas in expensive and hazardous (or any others point) [½ M]

22. (a)



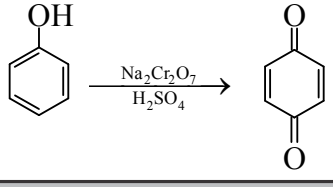
p-phenol sulphonic acid [1 M]

(b)



Benzene [1 M]

(c)



Benzoquinone [1 M]

23. **Given :**

Solution :

$W_{max} = 17.33$ kJ

$= -17330$ J

Number of moles of $N_2 = n = \dfrac{W}{M_{N_2}}$ [½ M]

$= \dfrac{2.8 \times 10^{-2}}{28 \times 10^{-3}} = 1$ mol [½ M]

$W_{max} = -2.303\ nRT \log_{10} \dfrac{P_1}{P_2}$ [1 M]

$$17330 = 2.303 \times 1 \times 8.314 \times 300 \times \log_{10} \frac{1.515 \times 10^6}{P_2}$$

$$\therefore \quad \frac{17330}{2.303 \times 1 \times 8.314 \times 300} = [\log_{10} 1.515 \times 10^6 - \log_{10} P_2]$$

$\therefore \quad 3.017 = 6.1804 - \log_{10} P_2$

$\therefore \quad \log_{10} P_2 = 6.1804 - 3.017 = 3.1634$

$\therefore \quad P_2 = AL(3.1634)$

$= 1456.8\ Nm^{-2}$ [1 M]

24. A reaction is which rate of the reaction does not depend on the concentration of any reactant taking part in the reaction is called zero-order reaction. [1 M]

$A \rightarrow$ products

Rate of the reaction is

$\text{Rate} = \dfrac{-d[A]}{dt}$ [½ M]

By rate law.

$\text{Rate} = k \times [A]^o = k$

$\therefore \quad -d[A] = k \times dt$

Integrating the above equation

$$\int_{[A]_0}^{[A]_t} -d[A] = \int_{t=0}^{t=t} k\,dt$$

$$-\int_{[A]_0}^{[A]_t} d[A] = k\int_0^t dt$$ [½ M]

$$-[A]_{[A]_0}^{[A]_t} = k[t]_0^t$$

$$-\left([A]_t - [A]_0\right) = kt$$

$\therefore \quad [A]_0 - [A]_t = kt$

$\therefore \quad k = \dfrac{[A]_0 - [A]_t}{t}$ This is the rate law expression [1 M]

OR

$\therefore \quad [A]_t = -kt + [A]_0$

25. (a) It gives Mn_2O_7 (an explosive oil) which on warming decomposes to MnO_2

$2KMnO_4 + 2H_2SO_4 \longrightarrow Mn_2O_7 + 2KHSO_4 + H_2O$ [1 M]

$2Mn_2O_7 \longrightarrow 4MnO_2 + 3O_2\uparrow$

(b) O_2 gas is evolved

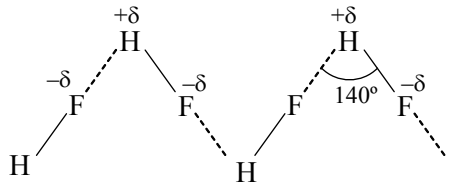
$4KMnO_4 + 6H_2SO_4 \longrightarrow 2K_2SO_4 + 4MnSO_4 + 6H_2O + 5O_2$ [1 M]

(c) $2KMnO_4 + 5H_2 \xrightarrow{\Delta} 2KOH + 2MnO + 4H_2O$ [1 M]

26. (i) F has the highest electronegativity compared to other halogens. [½ M]

(ii) H-F bond has the highest bond polarity. [½ M]

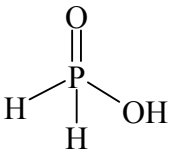
(iii) The presence of strong intermolecular hydrogen bonding leads to the association of HF molecules as follows.



[½ M]

(iv) Other hydrogen halides do not show hydrogen bonding due to their larger atomic size. [½ M]
Hence HF is a liquid while other hydrogen halides are gases.

Hypophosphorus acid (H_3PO_2)



[1 M]

SECTION D

27. (a) $nCH_2 = CH - CN \xrightarrow{\text{Polymerization}} -CH_2 - \underset{|}{\overset{CN}{CH}} - \rightarrow \left[CH_2 - \underset{|}{\overset{CN}{CH}} \right]_n$ [1 M]

Acrylonitrile — Repeating unit — Orlon

(b) $nCF_2 = CF_2 \xrightarrow{\text{Polymerization}} -CF_2 - CF_2 \rightarrow \left[CF_2 - CF_2 \right]_n$ [1 M]

Tetra fluoro ethylene — Repeating unit — Teflon

Given :

Solution : $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$ [1 M]

$\because \Delta H = \Delta G^\circ + T\Delta S^\circ$

$= 2879 + 298\ (-0.210)$

$= 2879 - 62.58$

$= 2816.42\ kJ\ mol^{-1}$

$\therefore \Delta H^\circ > 0$. The reaction is endothermic and system absorbs heat from surroundings. Hence surroundings lose heat. [½ M]

$\therefore \quad \Delta H^\circ_{surr} = -2816.42\ kJ\ mol^{-1}$

$\therefore \quad \Delta S^\circ_{surr} = \dfrac{\Delta H^\circ_{surr}}{T} = \dfrac{-2816.42}{298} = -9.45\ kJ\ K^{-1}$ [½ M]

The process in which ore of the metal is heated to a high temperature below the melting point of metal in absence of air or limited supply of air. [1 M]

OR

27.

		Class of polymer	Name of monomer/s	
(a)	Superglue	Homopolymer	Methyl α-cyanoacrylate	[1 M]
(b)	Saran	Copolymer	Vinyl chloride and vinylidene chloride	[1 M]

- **Given :**

  Solution : Since ΔH is negative, the reaction is exothermic [½ M]

  $\Delta G = \Delta H - T\Delta S$ [½ M]

  $= -110 - 400 \times 0.04$

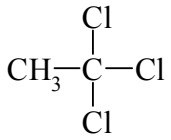
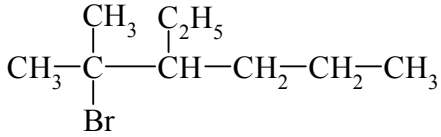
  $= -110 - 16 = -126$ kJ [½ M]

  Since ΔG is negative, the reaction is spontaneous [½ M]

- It is a process of extraction of metals by converting their ores into aqueous solutions of metal compounds and reducing them by suitable reducing agents. [1 M]

28. •

$$\underset{\text{White phosphorus}}{P_4} + 3NaOH + 3H_2O \xrightarrow{\text{hot conc.}} \underset{\text{Phosphine}}{PH_3} + 3\underset{\text{Sodium hypophosphite}}{NaH_2PO_2}$$ [1 M]

- (a)  (b)  [1 + 1 M]

- On the basis of molecular shape, proteins are classified into two types.

  (i) **Fibrous proteins :** Insoluble in water, long, thread like. The polypeptide chains are held together by hydrogen bonds. [1 M]

  e.g. keratin in hair, fibroin in silk etc.

  (ii) **Globular proteins :** Soluble in water and aqueous solutions of bases acids and salts. They are folded to form spherical shape and have intramolecular hydrogen bonding. [1 M]

  e.g. haemoglobin, albumin etc.

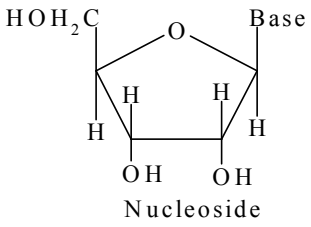
OR

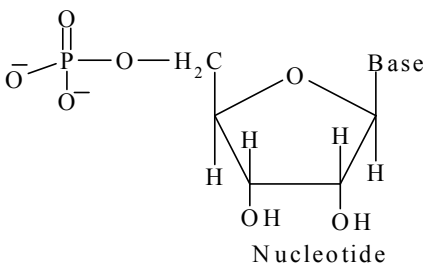
28. •

$$3Na + As \xrightarrow{\Delta} \underset{\text{Sodium Arsenide}}{Na_3As}$$ [1 M]

(a) Bromophenyl methane [1 M]

(b) 2-Chlorobutane [1 M]

- 
Nucleoside


Nucleotide

[1 + 1 M]

29. • (a) $S + 6HNO_3 \xrightarrow{Hot} H_2SO_4 + 6NO_2 + 2H_2O$ [1 M]

• (b) $2S + C \longrightarrow CS_2$ [1 M]
Carbon disulphide

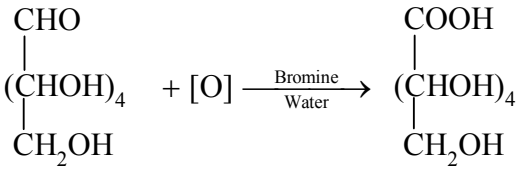
• (i) It could not explain why only certain elements possess the property of forming co-ordination compounds. [½ M]

(ii) It could not explain why bonds in the co-ordination compounds have directional properties. [½ M]

(iii) It could not explain why co-ordination compounds have characteristic magnetic and optical properties. [½ M]

(iv) It could not explain structures of co-ordination compound properly. [½ M]

• Glucose on oxidation by a mild oxidizing agent like Bromine water gives gluconic acid, which shows that the carbonyl group in glucose is aldehyde group.



[1 M]

Glucose Gluconic acid

OR

29. • (a) $Se + \underset{conc.}{4HNO_3} \xrightarrow{Hot} H_2SeO_3 + 4NO_2 + H_2O$ [1 M]

(b) $Se + 2Cl_2 \longrightarrow SeCl_4$ [1 M]

• (i) $_{24}Cr$: electronic configuration $[Ar]3d^5 4s^1$ [½ M]

(ii) Different possible oxidation states of Cr are
+1 ($3d^5$), +2($3d^4$), +3($3d^3$), +4($3d^2$), +5($3d^1$) and +6($3d^0$) [½ M]
Although in +1 state, Cr gets extra stability of half filled $3d^5$ orbital, it does not exhibit +1 state in common except with pyridine Cr^{+4} and Cr^{+5} are unstable oxidation states. [½ M]

(iii) Cr^{+6} is the most stable state due to inert gas electronic configuration and forms salts like $K_2Cr_2O_7$. [½ M]

• Vitamins are classified into two types

(i) Water soluble vitamins (eg. B and C) [½ M]

(ii) Fat soluble vitamins (eg. A, D, E, K and P) [½ M]