CBSE Board
Class XII Chemistry
Sample Paper- 1

Time : 3 Hrs   Total Marks: 70
_____

Solution

1.
   Dispersed phase: Liquid.   (1/2)
   Dispersion medium: Gas.   (1/2)

2. $A = 8 \times \dfrac{1}{8} = 1$

   $B = 6 \times \dfrac{1}{2} = 3$ (1/2)

   Formula = AB_3 (1/2)

3. Froth floatation method   (1)

4. $A_3B_2 \rightarrow 3\ A^{2+} + 2B^{3-}$
   Initial   1   0   0
After dissociation 1-α 3α 2α (1/2)

   $i = \dfrac{\text{Number of mole of particles after dissociation}}{\text{Number of mole of particles before dissociation}}$

   $i = \dfrac{1 - \alpha + 3\alpha + 2\alpha}{1}$

   $i = 1 + 4\alpha$ (1/2)

   $= 1 + 4(0.25)$

   $= 1 + 1 = 2$

5. It is a tribasic acid as it contains three O-H bonds.   (1)

6.
HCl<HBr< HI   (1/2)
This is because the bond dissociation energy increases in the order:
HI < HBr < HCl   (1/2)

7. Nitrogen is less reactive than phosphorus because nitrogen molecule contains N ≡ N triple bond which has a high bond dissociation enthalpy than P-P single bond present in phosphorus molecule.   (1)

8. Aldehydes are more reactive than ketones towards nucleophilic addition reactions due to inductive effect and steric effect.   (1/2)
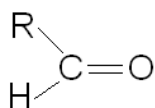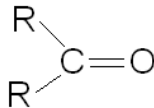
Aldehyde   Ketone

Sterically, the presence of two relatively large substituents in ketones hinders the approach of nucleophile to carbonyl carbon than in aldehydes having only one such substituent. Electronically, aldehydes are more reactive than ketones because two alkyl groups reduce the electrophilicity of the carbonyl more effectively in ketones.

(1/2)

9.

$w_B = 5.67\,g$

$w_A = 25.23\,g$

$M_B = 180\ g\,mol^{-1}$

$M_A = 18\,g\,mol^{-1}$

$n_B = \dfrac{5.67}{180} = 0.0315\ \ mol$

$n_A = \dfrac{25.23}{18} = 1.40\ \ mol$

Mole fraction of glucose $= x_B = \dfrac{n_B}{n_A + n_B}$

$$= \dfrac{0.0315}{0.0315 + 1.4}$$

$$= 0.022 \qquad\qquad (1/2)$$

$p^0_A = 23.8\ mmHg\ \ at\ 25\,°C$

We know that

Relative lowering of vapour pressure

$\dfrac{p^0_A - p_A}{p^0_A} = x_B$ $\qquad\qquad$ (1/2)

Vapour pressure lowering $= p^0_A - p_A = x_B \cdot p^0_A$

$$= 0.022\ x\ 23.8$$

$$= 0.524\ \ mmHg \qquad (1/2)$$

Also,

$\dfrac{23.8 - p_A}{23.8} = 0.022$

$23.8 - p_A = 0.022\,x\,23.8$

$$= 0.524$$

$p_A = 23.8 - 0.524$

$= 23.3\ \ mmHg$ $\qquad\qquad$ (1/2)

10.
(a) Zirconium is purified using van Arkel method. (1/2)

$$Zr + 2I_2 \longrightarrow ZrI_4 \xrightarrow[1800\,K]{Heat} Zr + 2I_2$$

Impure   Pure (1/2)
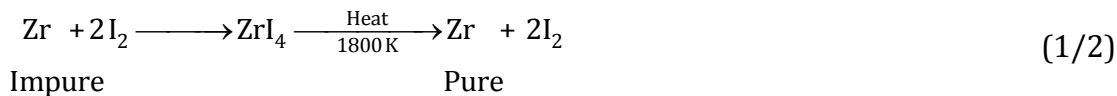
(b) Al_2O_3 can be used as a stationary phase in chromatography. (1)

11.

    a.   Amino acids which cannot be synthesized by the body and must be obtained from other sources are called essential amino acids. (1)
    b.   A process that changes the physical and biological properties of proteins without affecting its chemical composition is called denaturation. This can be done by change in pH, change in temperature, using chemical agents etc. (1)

12. p-Nitrophenol is more acidic than p-methoxyphenol. (1)
This is because p-nitrophenoxide ion is stabilized due to electron withdrawing inductive effect of $-NO_2$ group present on the para position. On the other hand, $-OCH_3$ group has electron releasing inductive effect which destabilizes p-methoxyphenoxide ion. (1)
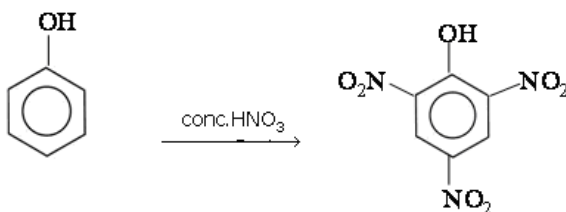
<div align="center">OR</div>

(i) When phenol reacts with Br_2 in CS_2 at 273K, a mixture of o- and p- bromo phenol is formed in which p- bromo phenol is the major product.
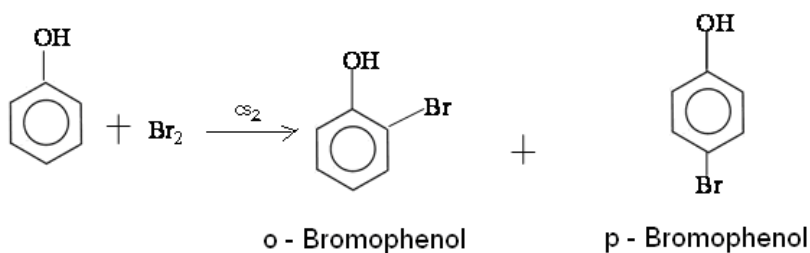
(1)

   (ii) When phenol reacts with conc. HNO_3, 2, 4, 6-trinitrophenol is formed.

(1)

13.

(i) Hex-4-en-2-ol
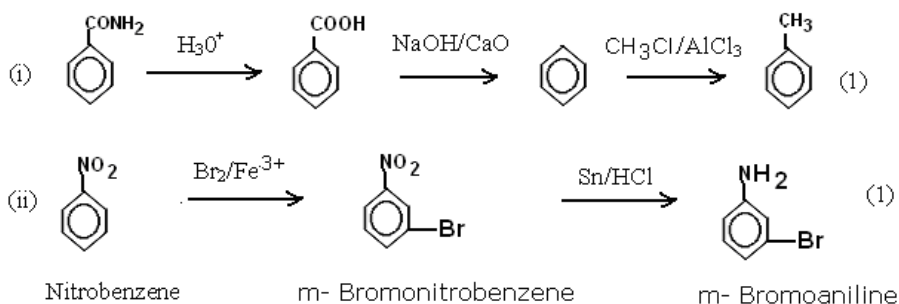
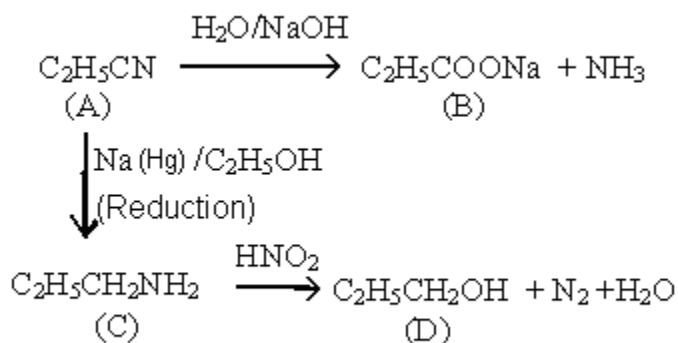(ii) 2, 4-Dimethoxypentane   (1)

14.

15.   (2)

(1 mark for correct identification of A, B, C, D)
(1 mark for correct reactions)

16.

DNA	RNA	Marks
1) It has a double stranded structure	1) It has single stranded structure	1
2) Sugar moiety is β-D-2-deoxyribose	2) Sugar moiety is β-D-ribose	1

17. A one molar (1M) solution contains 1mole of solute in 1 L of solution while a one molal (1m) solution contains 1 mole of solute in 1000g of solvent.   (1/2)
   Density of water is almost 1 g mL^{-1}.So, for 1 molal solution, 1mole of solute is present in 1000mL of waterAnd for 1 molar solution, 1mole of solute is present in 1000 mL of solution i.e less than 1000mL of water (Since 1000mL solution=volume of solute + volume of solvent).   (1)
Thus, 1M solution is more concentrated than 1m solution.   (1/2)

18.

$$\log \frac{k_2}{k_1} = \frac{E_a}{R \times 2.303}[\frac{1}{T_1} - \frac{1}{T_2}] \qquad (1/2)$$

$$E_a = 110\,kJmol^{-1}$$
$$T_1 = 400\,°C = 673K$$
$$k_1 = 7.8\,mol^{-1}Ls^{-1}$$
$$T_2 = 430\,°C = 703K$$
$$k_2 = ?$$

Substituting the values,

$$\log \frac{k_2}{7.8} = \frac{110 \times 1000}{2.303 \times 8.314}[\frac{1}{673} - \frac{1}{703}] \qquad (1/2)$$

$$k_2 = 18.0\,mol^{-1}\,Ls^{-1} \qquad (1/2)$$

19.
(i) Schottky defect
(ii) Si doped with Al produces p-type semiconductor, positively charged holes are created. Thus, holes appear to be responsible for semi conducting properties. When Si is doped with P, n-type semiconductor is formed in which semi conducting properties is due to flow of electrons. (1)
(iii) Antiferromagetic substances possess zero net magnetic moment while ferromagnetic substances are strongly attracted by magnetic field. This is because in presence of magnetic field, antiferromagetic substances contain equal number of electrons with opposite spin whereas in ferromagnetic substances electrons are placed in such a way that dipoles are oriented in one direction. (1)

20.
(i) For a first order reaction,
$$k = \frac{2.303}{t} \log \frac{a}{a - x} \qquad ....(1) \qquad (1/2)$$
Here, a = 0.062 atm
    a - x = 0.044 atm
    t = 55 s
$$k = \frac{2.303}{55} \log \frac{0.062}{0.044}$$
$$= 6.24 \times 10^{-3} s^{-1} \qquad (1)$$
(ii) To calculate a - x when t = 100 s, a = 0.062 atm (1)
we use equation
$$\therefore 6.24 \times 10^{-3} = \frac{2.303}{100} \log \frac{0.062}{a - x} \qquad (1/2)$$
$$\therefore a - x = 0.033 atm \qquad (1)$$

21.

(i)River water is muddy and contains charged colloidal particles of clay, sand and many other materials. Sea water contains in it a number of dissolved electrolytes. When sea water and river water come in contact with each other, the electrolytes present in the sea water coagulate the suspended colloidal particles which ultimately settle down at the point of contact. Thus, there is a formation of delta at the point where river enters the sea.(1)

(ii)
1. Catalysts are highly selective. A catalyst is able to direct a reaction to give a particular product.   (1/2)
2. Catalysts are highly active. A catalyst is able to increase the rate of a chemical reaction.   (1/2)

(iii) A colloid in which the particles of dispersed phase are sufficiently big in size to be of colloidal dimensions is called a macromolecular colloid. Example: Starch (1)

OR

(i) The movement of colloidal particles under an applied electric potential is called electrophoresis.   (1)
(ii) The process of settling of colloidal particles is called coagulation or precipitation of sol.   (1)
(iii) Emulsions are liquid – liquid colloidal systems in which the dispersed phase and dispersion medium both are liquids. Example: milk.   (1)

22.
(i) $I_2 + 6H2O + 5Cl_2 \rightarrow 2 HIO_3 + 10 HCl$ (1)

(ii) $P_4 + 8 SOCl_2 \rightarrow 4 PCl_3 + 4 SO_2 + 2S_2Cl_2$ (1)

(iii) $(NH_4)_2Cr_2O_7 \xrightarrow{\text{Heat}} N_2 + 4 H_2O + Cr_2O_3$ (1)

23:

When a nitrate salt is made to react with conc. H_2SO_4, following reaction occurs.
$XNO_3 + H_2SO_4 \rightarrow XHSO_4 + HNO_3$ (1)
When Cu turnings are added, it reacts with HNO_3 formed during the reaction giving intense brown fumes of NO_2.
$Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2 H_2O + 2NO_2$ (1)
When allowed to cool, NO_2 gets converted to colourless N_2O_4
$2 NO_2 \rightarrow N_2O_4$
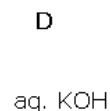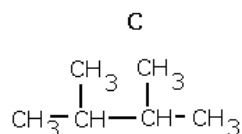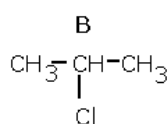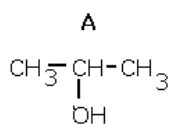(A)   (B)   (1)

24.
(i) Add small amount of aqueous KOH to both compounds. Acidify with dil HNO_3 and add $AgNO_3$. Benzyl chloride gives white precipitate while chlorobenzene does not.
                                                                                                                                                        (1)

(ii)

(1/2 mark each for correct identification of A, B, C, D)

25. The electrical switches are made of Bakelite should be used because Bakelite has electrical non - conductivity and heat-resistant properties in electrical insulators and is hence safe. (1)

Values associated: Scientific attitude since knowledge is useful only when put to practice, care for others, awareness and social responsibility. (2)

26.
   (i) The forces are ionic bonding, hydrogen bonding, van der Waals' forces of attraction or dipole-dipole attraction. (1)
   (ii) Chloramphenicol. It is broad-spectrum antibiotic. (1)
   (iii) Non-biodegradable detergents will lead to pollution. These detergents have branched alkyl chains and are thus not easily decomposed by micro-organisms.

27.
(i) Potassium trioxalatochromate (III)

(1)

(ii) $[CoF_6]^{3-}$
   Co (Z=27): [Ar] $3d^7 4s^2$
Co^{3+}: [Ar] $3d^6 4s^0$
F$^-$ is weak field ligand therefore does not cause pairing of electrons.
There are four unpaired electrons. (1/2)
$[Co (NH_3)_6]^{3+}$
 Co (Z=27): [Ar] $3d^7 4s^2$
Co^{3+}: [Ar] $3d^6 4s^0$
NH$_3$ is a strong field ligand and causes pairing of electrons .Hence there are no unpaired electrons. (1/2)

(iii) Hydrate isomerism (1)

28.
   (i) Au and Hg can show +1 oxidation state. (1)
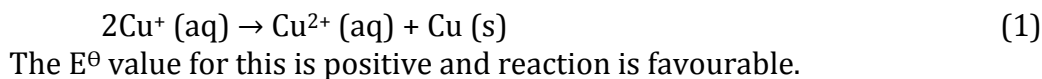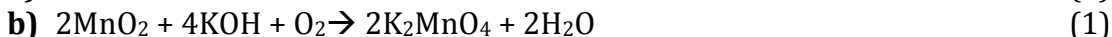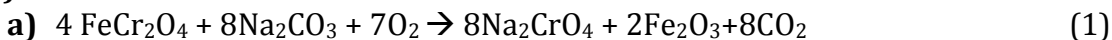
   (ii) Scandium (1)

   (iii) Transition elements exhibit variable oxidation state and can form complexes.
(1)

      Due to low charge density, Cu$^+$ has low enthalpy of hydration. Cu$^+$ in aqueous solution undergoes disproportionation. (1)
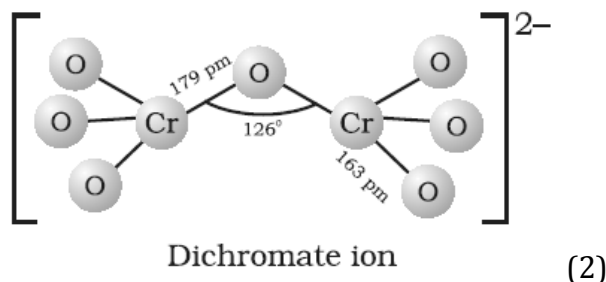
$$2Cu^+ (aq) \rightarrow Cu^{2+} (aq) + Cu (s) \tag{1}$$
The E^θ value for this is positive and reaction is favourable.

OR

(i)
   a) $4 FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$ (1)
   b) $2MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$ (1)
(ii) On increasing pH, the solution turns yellow due to the formation of chromate ion.
   $Cr_2O_7^{2-} + 2 OH^- \rightarrow 2CrO_4^{2-} + H_2O$ (1)
(iii)

Dichromate ion (2)

29.
(a) The cell reaction is
   $3Sn^{4+} + 2Cr \rightarrow 3Sn^{2+} + 2Cr^{3+}$
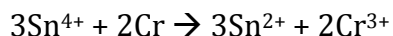
   $\Delta G^\theta = - n F E^\theta_{cell}$ (1/2)

   $E^\theta_{cell} = 0.89$ V,
   n = 6
   F = 96500 C mol^{-1}
   $\Delta G^\theta = - (6) \times (96500) \times (0.89)$ (1/2)
   $= -5.15 \times 10^5$
   $= -5.15 \times 10^5$ J (1)

(b) Calculation of K
   (i) $\Delta G^\theta = -2.303$ RT log K (1/2)
      $\Delta G^\theta = -5.15 \times 10^5$ J , R = 8.314 J mol^{-1} K^{-1}, T = 298 K

      log K = $- \Delta G^\theta$ / 2.303 RT
      $= - (-5.15 \times 10^5$ J)/ (2.303 \times 8.314 J mol^{-1} K^{-1} \times 298 K)
      log K = 90.259 (1/2)
      K= 1.8×10^{90} (1/2)

   (ii) log K = n F E^θ_{cell}/2.303 RT (1/2)
      $= \dfrac{(6) \times (96500 \text{ C mol}^{-1}) \times (0.89 \text{ V})}{2.303 \times (8.314 \text{ J mol}^{-1} \text{ K}^{-1}) \times (298 \text{ K})}$

= 90.313 (1/2)

K= 2.05 x 10^{90} (1/2)
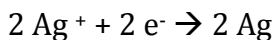
OR

29.

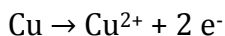**(a)** Since the reduction potential of Ag$^+$/Ag is more than that of Cu^{2+}/Cu, therefore, Ag$^+$ gets reduced to Ag at the cathode and Cu gets oxidized to Cu^{2+} at the anode.

(1)

At cathode:

2 Ag $^+$ + 2 e$^-$ → 2 Ag

At anode:

Cu → Cu^{2+} + 2 e$^-$

Therefore, the net reaction is:

2Ag $^+$ + Cu → 2Ag + Cu^{2+} (1)

(b) The cell is:

Cu(s) l Cu^{2+}(aq) ll Ag$^+$(aq) l Ag (s) (1)

(c)

$$E^\theta_{cell} = E^\theta_{Ag^+/Ag} - E^\theta_{Cu^{2+}/Cu}$$ (1/2)

$$= 0.80 - 0.34$$

$$= 0.46\,V$$ (1/2)

$$E_{cell} = E^\theta_{cell} - \frac{0.059}{n} \log \frac{[Cu^{2+}]}{[Ag^+]^2}$$ (1/2)

$$E_{cell} = E^\theta_{cell} - \frac{0.059}{n} \log \frac{[Cu^{2+}]}{[Ag^+]^2}$$
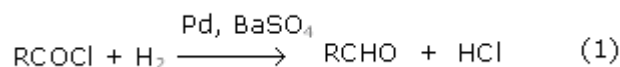
$$0 = 0.46 - \frac{0.059}{2} \log \frac{0.01}{[Ag^+]^2}$$

$$[Ag^+] = 1.59 \times 10^{-9}\,M$$ (1/2)

30.

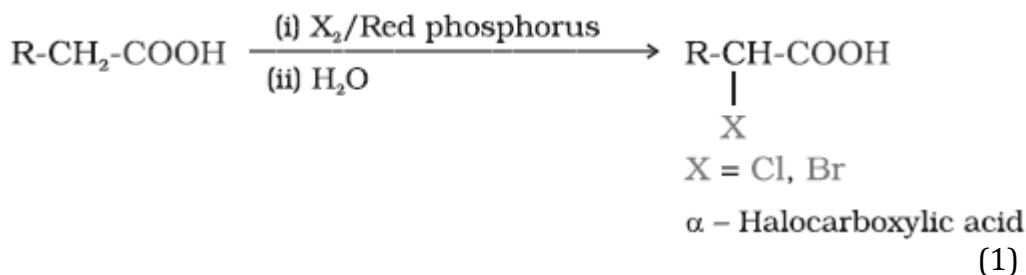**(a)** CH$_3$CH$_2$OH + CH$_3$COOH $\xrightarrow{\text{conc. H}_2\text{SO}_4}$ CH$_3$COOCH$_2$CH$_3$ + H$_2$O (1)
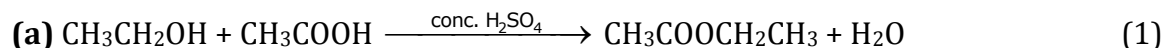
(b)

(i) In Rosenmund's reaction, acid chlorides are subjected to catalytic hydrogenation in the presence of Pd supported over BaSO$_4$ to yield corresponding aldehyde. The catalyst is poisoned by S or quinoline. (1)

$$RCOCl + H_2 \xrightarrow{\text{Pd, BaSO}_4} RCHO + HCl \quad (1)$$

(i) In Hell Volhard Zelinsky reaction, carboxylic acids react with chlorine or bromine in the presence of small amount of P, to give α-halogenated carboxylic acids. The reaction requires presence of α - hydrogen in the acid. (1)
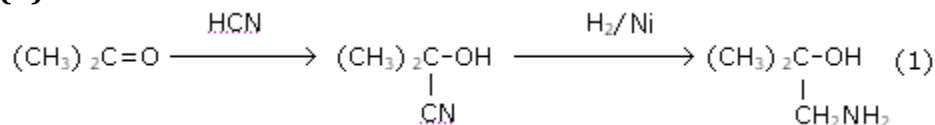
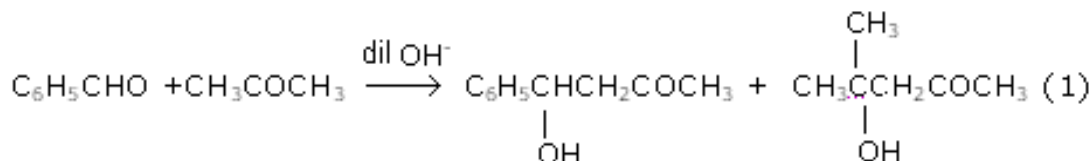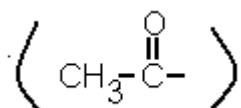$$R\text{-}CH_2\text{-}COOH \xrightarrow[\text{(ii) } H_2O]{\text{(i) } X_2/\text{Red phosphorus}} R\text{-}\underset{\underset{X}{|}}{CH}\text{-}COOH$$

X = Cl, Br

α – Halocarboxylic acid

(1)

OR

(i)

$$CH_3CH_2COOH \xrightarrow{NH_3} CH_3CH_2CONH_2 \xrightarrow{Br_2/KOH} CH_3CH_2NH_2 \quad (1)$$

(ii)

$$(CH_3)_2C=O \xrightarrow{HCN} (CH_3)_2\underset{\underset{CN}{|}}{C}\text{-}OH \xrightarrow{H_2/Ni} (CH_3)_2\underset{\underset{CH_2NH_2}{|}}{C}\text{-}OH \quad (1)$$

(iii)

$$C_6H_5CHO + CH_3COCH_3 \xrightarrow{\text{dil } OH^-} C_6H_5\underset{\underset{OH}{|}}{CH}CH_2COCH_3 + CH_3\underset{\underset{OH}{\overset{\overset{CH_3}{|}}{|}}}{C}CH_2COCH_3 \quad (1)$$

(b) $NH_2CONHNH_2$, semicarbazide contains two NH_2 groups but the one next to CO group is involved in resonance with C=O and, thus is not available. (1)

(c) Pentan-2-one will give a yellow precipitate with iodine and sodium hydroxide since it

contains the group $\left(CH_3\text{-}\overset{\overset{O}{\|}}{C}\text{-} \right)$. (1)