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CHEMISTRY (12th)

BLUE PRINT

S.No.	Unit	VSA (1 marks)	SA I (2 marks)	SA II (3 marks)	LA (5 marks)	Total
1.	Solid State	1(1)		3(1)		4(2)
2.	Solutions				5(1)	5(1)
3.	Electrochemistry	1(1)		4*(1)		5(2)
4.	Chemical kinetics		2(1)	3(1)		5(2)
5.	Surface chemistry	1(1)		3(1)		4(2)
6.	General principles and processes of isolation of elements			3(1)		3(1)
7.	p-block elements		2(1)	6(2)		8(3)
8	d and f block elements				5(1)	5(1)
9.	Co-ordination compounds			3(1)		3(1)
10.	Halo alkanes and halo arenes		4(2)			4(2)
11.	Alcohals , Phenols and Ethers		2(1)	3(1)		5(2)
12.	Aldehydes , ketones and Carboxylic acids				5(1)	5(1)
13.	Organic compounds containing nitrogen	1(1)		3(1)		4(2)
14.	Bio-molecules	1(1)		3(1)		4(2)
15.	Polymers			3(1)		3(1)
16.	Chemistry in everyday life			3(1)		3(1)
Total		5(5)	10(5)	36+4 (12+1)	15(3)	70(26)

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Chemistry Question paper

Time:3 hours   **M.M:70**

General Instructions:

1) All questions are compulsory.
2) Q.no.1to 5 are very short answer questions and carry 1 mark each.
3) Q.no.6 to 10 are short answer questions and carry 2 marks each.
4) Q.no.11 to 22 are also short answer questions and carry 3 marks each.
5) Q.no.23 isvalue based question and carry 4 mark.
6) Q.no.24 to 26 are long answer questions and carry 5 mark each.
7) Use log table if necessary. Use of calculator is not allowed.

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1. Why are aryl diazonium salts more stable than alkyl diazonium salts ?
2. Name the compound which shows both Schottky and Frankel defect.
3. Which of the following is most effective electrolyte in the coagulation of AgI / Ag^+ Sol?

   K_2SO_4 , $MgCl_2$, $K_4[Fe(CN)_6]$

4. What are anomers?
5. State the law which helps to determine the limiting molar conductivity of weak electrolyte.
6. Do the following conversions
   (i)   Methyl bromide to acetone
   (ii)   Benzyl bromide to 2-phenyl acetic acid
7. How will you distinguish between the following pairs of compounds?
   (i)   Chloroform and carbon tetrachloride.
   (ii)   Benzyl chloride and chlorobenzene.

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8. For a chemical reaction variation in rate with concentration is shown below :

Rate

concentration
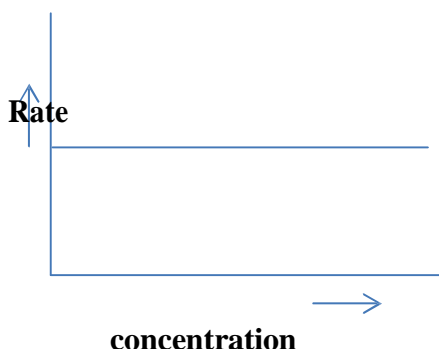
What is order of the reaction?

What is the unit of rate constant K for the reaction?

9. Give reason :

   (i)   Although electron gain enthalpy of F is less negative as compared to Cl but F is stronger O.A. than Cl, Why?

   (ii)   Why is ICl more reactive than I_2?

10. Explain why ortho - nitrophenol is more acidic than ortho-methoxyphenol?

11. Rate constant K for first order reaction has been found to be 2.54×10^{-3} s^{-1}. Calculate its three-fourth life.

<center>OR</center>

A first order gas reaction, $A_2B_{2\,(g)} \longrightarrow 2A_{(g)} + 2B_{(g)}$ at the temperature $400^{o}C$ has the rate constant $K = 2.0 \times 10^{-4}$ s^{-1}. What percentage of A_2B_2 is decomposed on heating for 900 seconds.

12. Give the electronic configuration of d-orbitals of $K_3[Fe(CN)_6]$ and $K_3[FeF_6]$ and explain why these complexes give different colour with same solution.

   (At. No. of Fe = 26)

13. Explain the following

   a.   o- toludine is more basic than aniline.

   b.   Tertiary amines do not undergo acetylation reaction.

   c.   Garbriel phthalimide reaction.

14. Silver metal crystallizes with a fcc lattice. The length of a unit cell is found to be 4.077×10^{-8} cm. Calculate atomic radius and density of silver.

   (Atomic mass of Ag = 108 u)

15. Give a reason for following :

   (i)   Rough surface of catalyst is more effective than smooth surface.

   (ii)   Smoke passed through charged plates before allowing it to come out of chimneys in factories.

   (iii)   Ne gets easily adsorbed over charcoal than He.

16. (a) Give one example of each of following:

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(i)   Acidic flux

(ii)   Basic flux

(b) What happens when:

(i) Cu_2O undergoes self reduction in silica line converter.

(ii)   Haematite oxidises carbon to carbon monoxide.

<center>OR</center>

(a) What role does cryolite play in hall heraoult process?

(b) How can alumina be separated from silica in a bauxite ore associated with silica? Give equations also.

17. Write balanced chemical equation for the following reactions:

    (i) $KMnO_4$ reacts with HCl.

    (ii) SO_2 gas is passed through an aqueous solution of Fe^{3+} salt.

    (iii) PH_3 is passed through $CuSO_4$ solution.

18. (i) Draw the structure of sulphuric acid.

    (ii) A sparkless current is passed through hot and concentrated solution of sodium hydroxide.

    (iii)   Bleaching action of sulphur is a temporary action. Comment.

19. (i) Give one structural difference between amylose and amylopectin.

    (ii) Name the protein and its shape present in oxygen carrier in human body.

    (iii) Name two fat storing tissues in human body.

20. Define the following by giving one example of each:

    (i)   Antibiotics

    (ii)   Artificial sweetener

    (iii)   Disinfectant

21. (a) Write the name of monomers of polymer used for making unbreakable crockery.

    (b) Write the reaction of preparation of neoprene.

    (c) Arrange the following polymers in decreasing order of intermolecular forces

         PVC, Nylon 66, natural rubber.

22. Write the mechanism for preparation of ethanol from ethene.

23. Shyam's father wants to buy a new car. In the market various options are available. Shyam persuades his father to buy a hybrid car which can run both on electricity as well as on petrel.

  (i) Mention the values associated with this decision.

  (ii) Name the battery used for running the car.

  (iii) Write the reactions taking place at the anode and cathode of battery.

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24   (*a*) **Define the following terms**
    (*i*) **Mole fraction**   (*ii*) **Van't Hoff factor**
    (*b*) **100 mg of a protein is dissolved in enough water to make 100 mL of a solution. If this solution has an osmotic pressure 13.3 mm Hg at 25°C, what is the molar mass of protein? ($R = 0.0821$ L atm mol^{-1} K^{-1} and 760 mm Hg = 1 atm.)**
    OR
    What is meant by:
    (*i*) **Colligative properties**
    (*ii*) **Molality of a solution.**
    (*b*) **What concentration of nitrogen should be present in a glass of water at room temperature? Assume a temperature of 25°C, total pressure of 1 atmosphere and mole fraction of nitrogen in air of 0.78. [K$_H$ for nitrogen = $8.42 \times 10_{-7}$ M/mm Hg**

25.

   . Assign reasons for the following:
    (*i*)   The enthalpies of atomisation of transition elements are high.
    (*ii*) The transition metals and many of their compounds act as good catalysts.
    (*iii*) From element to element the actinoid contraction is greater than the lanthanoid contraction.
    (*iv*) The $E°$ value for the Mn^{3+}/Mn^{2+} couple is much more positive than that of Cr^{3+}/Cr^{2+}.
    (*v*) Scandium ($Z = 21$) does not exhibit variable oxidation states and yet it is regarded as a transition element.
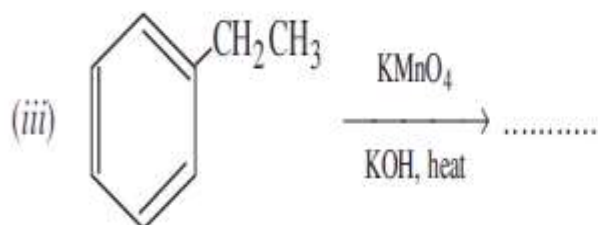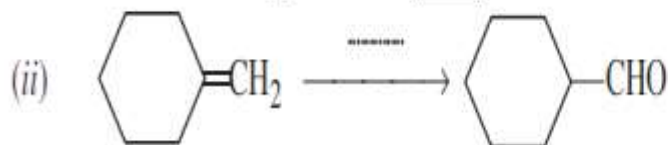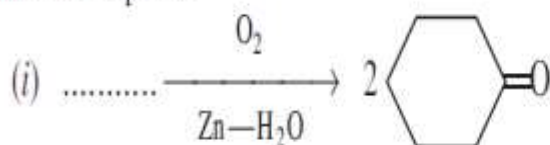
<div align="center">OR</div>

    (*a*) What may be the possible oxidation states of the transition metals with the following *d* electronic configurations in the ground state of their atoms:
      $3d^3 4s^2$, $3d^5 4s^2$ and $3d^6 4s^2$. Indicate relative stability of oxidation states in each case.
    (*b*) Write steps involved in the preparation of (i) Na$_2$CrO$_4$ from chromite ore and (ii) K$_2$MnO$_4$ from pyrolusite ore.

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). (a) Complete the following reaction statements by giving the missing starting material, reagent or product as required:

(i) .... $\xrightarrow[\text{Zn}-\text{H}_2\text{O}]{\text{O}_2}$ 2 (cyclohexanone)

(ii) (cyclohexane)=CH$_2$ $\xrightarrow{\text{..........}}$ (cyclohexane)—CHO

(iii) (benzene)—CH$_2$CH$_3$ $\xrightarrow[\text{KOH, heat}]{\text{KMnO}_4}$ ....

(b) Describe the following reactions:
   (i) Cannizaro reaction   (ii) Cross aldol condensation

OR

(a) How would you account for the following:
   (i) Aldehydes are more reactive than ketones towards nucelophiles.

   (ii) The boiling points of aldehydes and ketones are lower than of the corresponding acids.

   (iii) The aldehydes and ketones undergo a number of addition reactions.

(b) Give chemical tests to distinguish between:
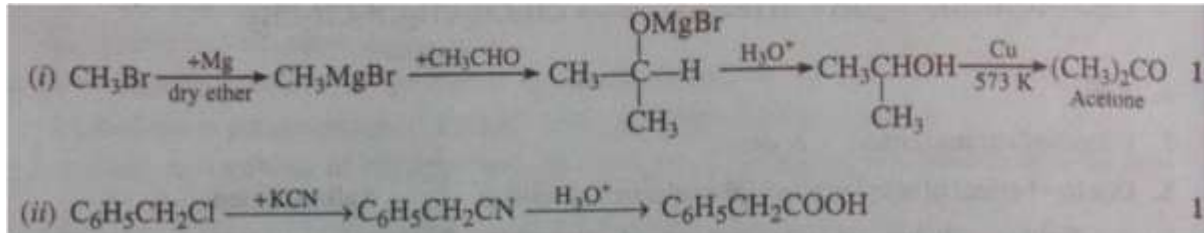   (i) Acetaldehyde and benzaldehyde
   (ii) Propanone and propanol.

Marking scheme

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1. due to resonance.

2. AgBr

3. $K_4[Fe(CN)_6]$

4. Monoscchrides which differ in configuration around first carbon are called anomers

5. **Kolarausch law of independent migration of ions** – The limiting molar conductivity of an electrolyte is the sum of individual contribution of the anions and the cations of the electrolytes.
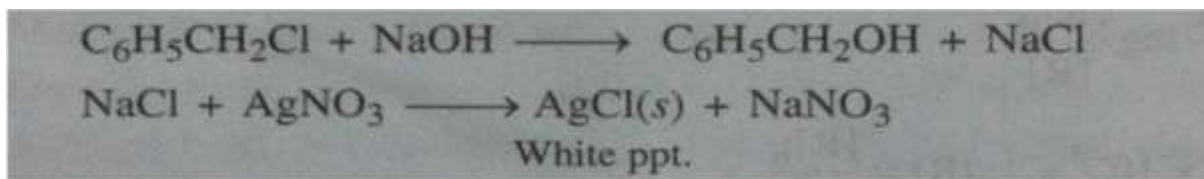
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6.

(i) $CH_3Br \xrightarrow[\text{dry ether}]{+Mg} CH_3MgBr \xrightarrow{+CH_3CHO} CH_3-\overset{\overset{\displaystyle OMgBr}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}}-H \xrightarrow{H_3O^+} CH_3\underset{\underset{\displaystyle CH_3}{|}}{CHOH} \xrightarrow[573\ K]{Cu} (CH_3)_2CO$ 1
                                                                                 Acetone

(ii) $C_6H_5CH_2Cl \xrightarrow{+KCN} C_6H_5CH_2CN \xrightarrow{H_3O^+} C_6H_5CH_2COOH$ 1

7. (i) on heating chloroform and carbon tetrachloride with aniline and ethanolic KOH separately chloroform pungent smelling isocyanide but carbon tetrachloride does not form this compound.

$C_6H_5NH_2 + CHCl_3 + 3KOH \text{ (ethanolic)} \xrightarrow{\Delta} \underset{\text{Phenyl isocyanide}}{C_6H_5NC} + 3KCl + 3H_2O$
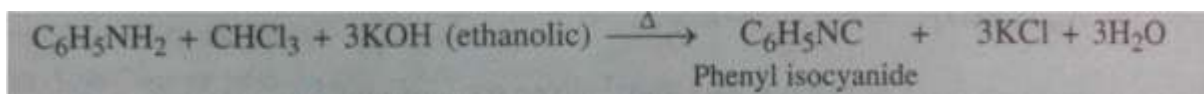
(ii)benzyl chloride forms white ppts with NaOH and $AgNO_3$ but chlorobenzene does not.

$C_6H_5CH_2Cl + NaOH \longrightarrow C_6H_5CH_2OH + NaCl$

$NaCl + AgNO_3 \longrightarrow \underset{\text{White ppt.}}{AgCl(s)} + NaNO_3$

8. (a) zero order reaction

   (b) Units of rate constant is mol $L^{-1}\ s^{-1}$

9. (i) due to low dissociation enthalpy of F-F bond and high hydration enthalpy of F^-.

   (ii) Due to low bond enthalpy.

10. due to strong –R and –I-effect of the $-NO_2$ group, electron density in the O – H bond decreases and hence the loss of a proton becomes easy.

Now after the loss of proton, the o-nitrophenoxide ion left behind is stabilized by resonance and thus making o-nitrophenol a strong acid.

In contrast , due to +R effect, OCH_3 increases the electron density in the O – H bond thereby making the loss of proton difficult.

11. $t = 2.303/K \quad \log [R]_0/[R]$ ———————— (i)

       $K = 2.54 \times 10^{-3}\ s^{-1}; \quad [R] = [R]_0/4$

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Substituting these values in equation (i) , we get

$T_{3/4}$ = 2.303 /2.54 x 10^{-3} log $[R]_o/[R]_o/4$

= 0.9066 x 10^3 log 4

= 0.9066 x 10^3 x 0.6021 s

= 5.46 x 10^2 s

<div align="center">OR</div>

K = 2.303 / t log $[R]_o/ [R]$

2 x 10-4 s-1 = 2.303 / 900 log $[R]_o/ [R]$

log $[R]_o/ [R]$ = 2 x 10^{-4} x 900 / 2.303 = 0.0781

log $[R] / [R]_o$ = -0.0781

$[R] / [R]_o$ = Antilog 1.9219

$[R] / [R]_o$=0.835

$[R]$ = 0.835 $[R]_o$

If $[R]_o$ = 100 , then

$[R]$ = 83.5

$[R]_o − [R]$ = 100 – 83.5 = 16.5

i.e. ,16.5 % of initial concentration has changed into products.

12. Oxidation state of Fe in K_3 [Fe(CN)$_6$] is +3

Configuration of Fe^{3+} is [Ar] $3d^5$

It has five unpaired electrons in 3d orbital which get paired leaving behind one unpaired electron only.

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In K3[FeF6] oxidation state of Fe is +3 and 5 unpaired electrons are there in 3d orbitals.

Because of the presence of differernt number of unpaired electrons these impart different colours to the same solution.

13. (i) orthotoludine is more basic than aniline due to the presence of electron releasing methyl group (+I effect) electron density at nitrogen of NH_2 in o-toludine increases.

(ii) due to the absence of replaceable hydrogen atom at nitrogen.

(iii) Gabriel phathalimidereaction :
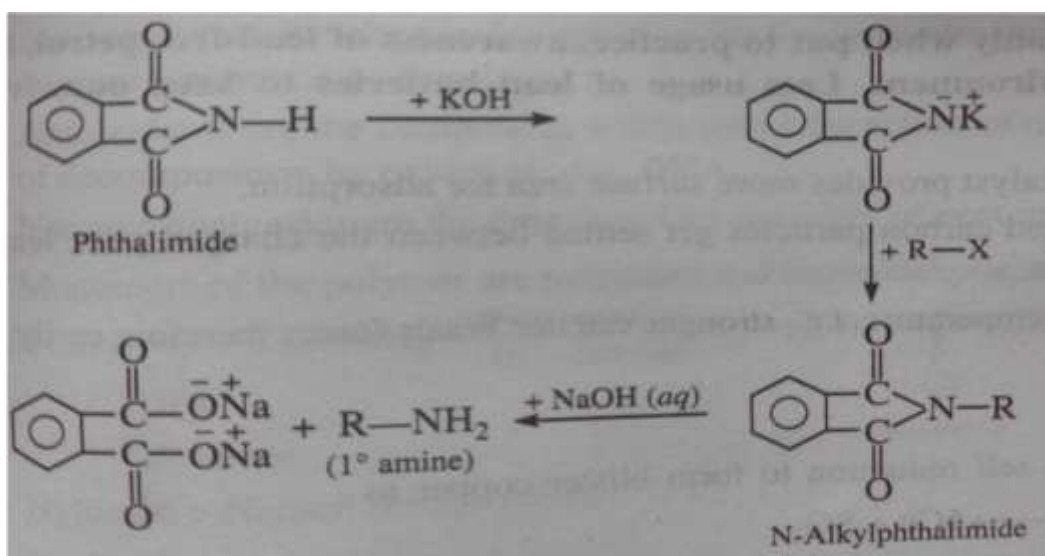
14. $d = Z \times M / a^3 \times N_A$ ————————————— (i)

Given: a = 4.077 x 10^{-8}cm , Z = 4 , M = 108 g mol^{-1} , N_A = 6.022 x 10^{23}

Substituting these values in (i) , we get

   $d = 4 \times 108$ g $mol^{-1}/ (4.077 \times 10^{-8}$ cm$)^3 \times 6.022 \times 10^{23}$ mol^{-1}

   d = 10.58 g cm^{-3}

   $r = a / 2\sqrt{2} = 4.077 \times 10^{-8}/\sqrt{2}$ cm

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$r = 1.44 \times 10^{-8}$ cm

15.(i) Rough surface of a catalyst provides more surface area for the adsorption.
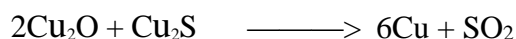
(ii) so that unburnt charged carbon particles get settled between the charged plate leaving behind air free from pollutants.

(iii) Ne has higher critical temperature, i.e., stronger van der Waals forces therefore easily absorbed.

16.　(a) Acidic flux : SiO_2

　　　Basic flux :CaO

　　(b) (i) Cu2O undergo self reduction to form blister copper as

$$2Cu_2O + Cu_2S \longrightarrow 6Cu + SO_2$$

　　(ii)　$Fe_2O_3 + 3C \longrightarrow 3CO + 2Fe$
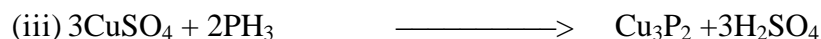
OR

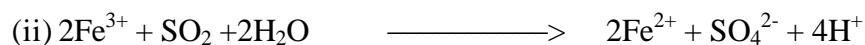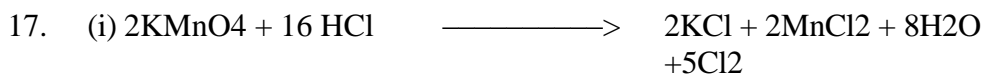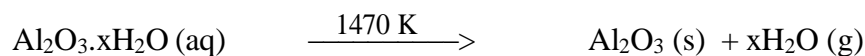(a) Cryolite reduces melting point of alumina.

(b) Concentration of ore is carried out by digesting the powdered ore with a concentrated solution of NaOH at 473-523 K and 35-36 bar pressure. Al_2O_3 is leached out as sodium meta aluminate and SiO2 as sodium silicate leaving behind impurities.

$$Al_2O_3(s) + 2NaOH \ (aq) + 3H_2O \longrightarrow 2Na[Al(OH)_4] \ (aq)$$
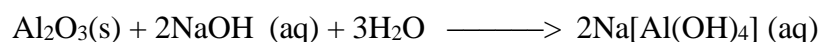
The resulting solution is filtered, cooled and neutralisied by passing CO_2 gas throung it. Then hydrated Al_2O_3 gets precipitated leaving sodium silicate in the solution.
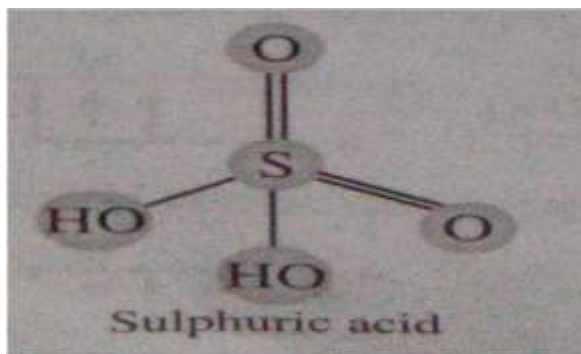
$$2Na[Al(OH)_4] \ (aq) + CO_2 \ (g) \longrightarrow Al_2O_3.xH_2O \ (s) + 2NaHCO_3 \ (aq)$$
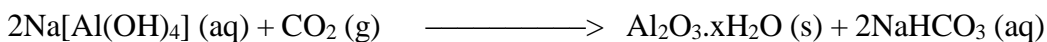
Sodium silicates remain in the solution and hydrated alumina is filtered, washed, dried and heated to get pure alumina (Al_2O_3).

$$Al_2O_3.xH_2O \ (aq) \xrightarrow{1470 \ K} Al_2O_3 \ (s) \ + xH_2O \ (g)$$

17.　(i) $2KMnO4 + 16 \ HCl \longrightarrow 2KCl + 2MnCl2 + 8H2O + 5Cl2$

　　(ii) $2Fe^{3+} + SO_2 + 2H_2O \longrightarrow 2Fe^{2+} + SO_4^{2-} + 4H^+$

　　(iii) $3CuSO_4 + 2PH_3 \longrightarrow Cu_3P_2 + 3H_2SO_4$

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18. (i)

Sulphuric acid

(ii) The formation of ozone from oxygen is endothermic reaction silent electric discharge prevent its decomposition.

(iii) Bleaching by SO_2 because of its reducing nature

19. (i) Amylose is a long unbranched chain polymers of α-D(+)glucose.

Amylopectin is a branched chain polymer of α-D glucose.

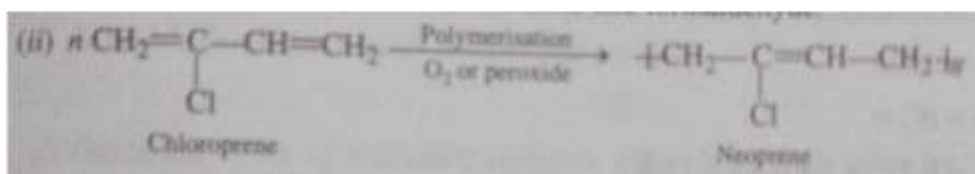(ii) globular protein and its shape is spherical .

(iii) Liver and adipose tissue.

20. (i) Chemical substance which are obtained from one class of micro-organism and are used to kill or stop the growth of other class of micro-organism.

(ii) Chemical substance which are sweet in taste but do not provide any calories to our body.

(iii) Chemical substance which used to kill microorganism but are not safe to use to living tissues
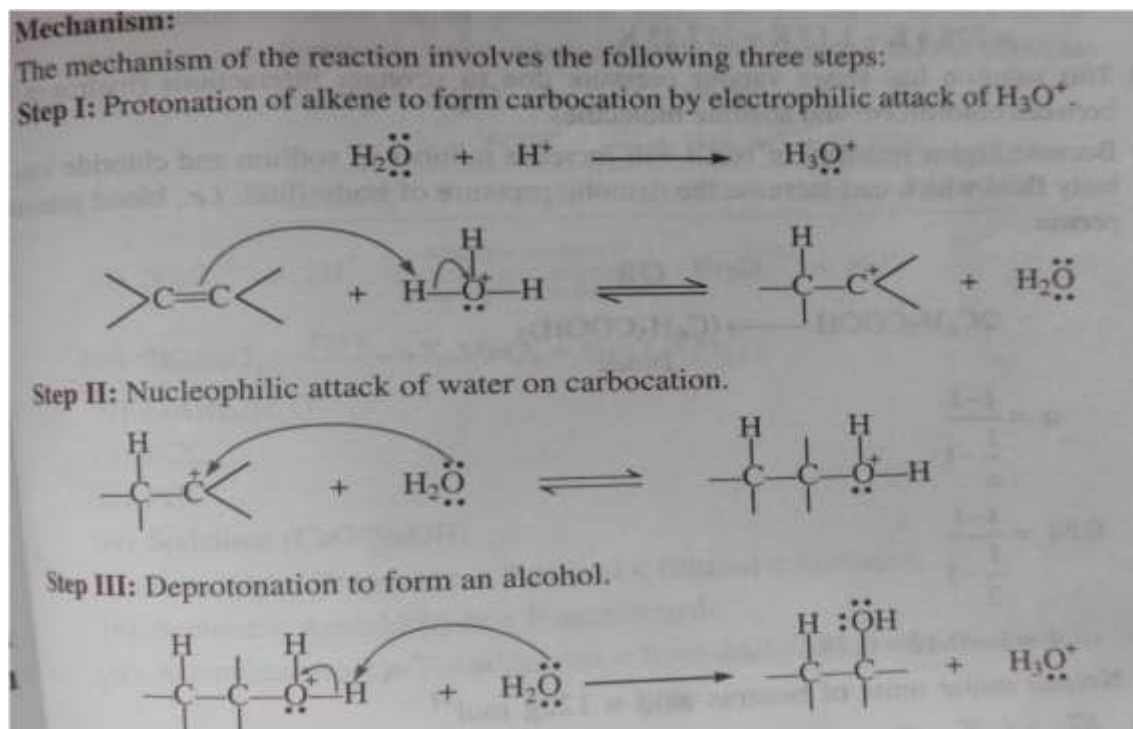
21. (i) Monomers of the polymers are melamine and formaldehyde.

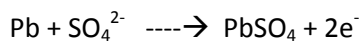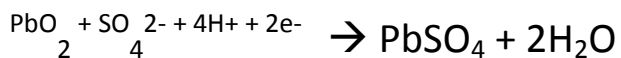(iii) Nylon 66 > natural rubber > PVC

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22.

Mechanism:

The mechanism of the reaction involves the following three steps:

Step I: Protonation of alkene to form carbocation by electrophilic attack of H_3O^+.

$$H_2\ddot{O} \quad + \quad H^+ \quad \longrightarrow \quad H_3\ddot{O}^+$$

Step II: Nucleophilic attack of water on carbocation.

Step III: Deprotonation to form an alcohol.

23. (a) Enviromental conservation

b) Lead storage battery

(c)

At Anode

$Pb + SO_4^{2-}$ ----$\rightarrow$ $PbSO_4 + 2e^-$

At cathode

$PbO_2 + SO_4^{2-} + 4H+ + 2e- \rightarrow PbSO_4 + 2H_2O$

24. (a) M = 78 g/mol , T_f^o = 278.4 K, ΔH_{fus} = 10.042kj/mol

$K_f = RT_f^2 M / 1000 \times \Delta H_{fus}$

K_f = 8.314 x 10^{-3} x $(278.4)^2$ x 78 / 1000 x 10.042 = 5.0 K kg/mol

$\qquad$ 2CH₃COOH $\qquad \longrightarrow \qquad$ (CH₃COOH)₂
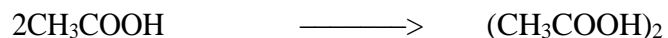
$\alpha = i - 1 / (1/n) - 1$

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$0.85 = i - 1 / (1/2) - 1$

$i = 1 - 0.425$

$i = 0.575$

$\Delta T_f = iK_f\, m$

$= 0.575 \times 5 \times 0.4 = 1.15\ K$

$T_f = T_f^O - \Delta T_f$

$= 278.4\ K - 1.15\ K = 277.25\ K$

(b) (i) This solution has lesser vapour pressure due to stronger interaction (hydrogen bond) between chloroform and acetone molecules.

(ii) because higher quantity of NaCl will increase number of sodium and chloride ions in the body fluid which can increase the osmotic pressure of body fluid, i.e. blood pressure of a person.

<div align="center">OR</div>

(a) $2C_6H_5COOH \longrightarrow (C_6H_5COOH)_2$
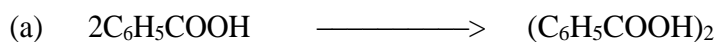
$\alpha = i - 1 / (1/n) - 1$

$0.84 = i - 1 / (1/2) - 1$

$i = 1 - 0.42 = 0.58$

normal molar mass of benzoic acid $= 122g/mol$

$\Delta T_b = i.\ K_b\ .m$

$= 0.58 \times 2.3 \times 1$

$= 1.334\ K\ or\ 1.334\ ^OC$

$T_b = T_b^O + \Delta T_b$

$= 46.2^OC + 1.334\ ^OC$

$= 47.534^OC$

(b) **Raoult'slaw :** The relative lowering of vapour pressure of the solvent over a solution is equal to the mole fraction of non volatile solute present in the solution.

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Mathematical expression, $\chi_B = P_A{}^O - P/P_A{}^O$

25

(i) This is because transition metals have strong metallic bonds as they have a large number of unpaired electrons.

(ii) The catalytic activity of transition metals is attributed to the following reasons:

    (a) Because of their variable oxidation states transition metals form unstable intermediate compounds and provide a new path with lower activation energy for the reaction.

    (b) In some cases, the transition metal provides a suitable large surface area with free valencies on which reactants are adsorbed.

(iii) This is due to poorer shielding by $5f$ electrons in actinoids than that by $4f$ electron in the lanthanoids.

(iv) This is because half filled d-subshell ($3d^5$) in Mn^{2+} is more stable.

(v) This is because scandium has partially filled d orbitals in the ground state ($3d^1 4s^2$).

OR

(a)

Electronic Configuration	Element	Possible O.S.	More stable O.S.
$3d^2 4s^2$	Vanadium	$+2, +3, +4, +5$	$+5$
$3d^5 4s^2$	Manganese	$+2, +3, +4, +5, +6, +7$	$+2, +7$
$3d^6 4s^2$	Iron	$+2, +3, +4, +6$	$+2, +3$

(b) (i) Chromite ore is fused with sodium carbonate in excess of air.

$$4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \longrightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$$
    Chromite ore   Sod. chromate

(ii) Pyrolusite ore (MnO_2) is fused with KOH in the presence of O_2 or oxidising agent such as KNO_3.

$$2MnO_2 + 4KOH + O_2 \longrightarrow 2K_2MnO_4 + 2H_2O$$
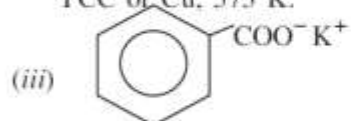   Pyrolusite ore   Potassium maganate

26.

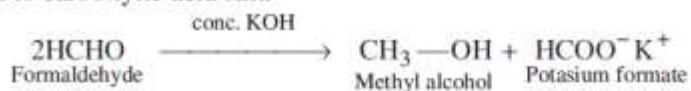# PAPER- 8

(a) (i)
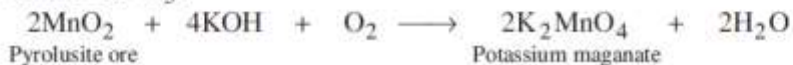
(ii) BH_3 / THF, H_2O_2 / OH^-,
PCC or Cu, 573 K.

(iii)

(b) (i) **Cannizzaro reaction:** Aldehydes which do not have an α-hydrogen, undergo self oxidation and reduction (disproportionation) reaction on treatment with concentrated alkali. In this reaction one molecule of the aldehyde is reduced to alcohol while another is oxidised to carboxylic acid salt.

$$2HCHO \xrightarrow{\text{conc. KOH}} CH_3-OH + HCOO^-K^+$$

Formaldehyde Methyl alcohol Potassium formate

(ii) **Cross aldol condensation:** When aldol condensation is carried out between two different aldehydes and/or ketones, it is called cross aldol condensation.
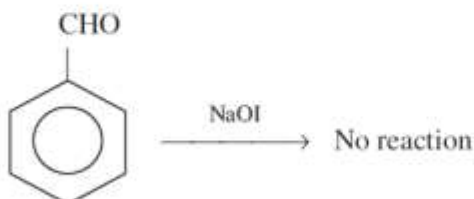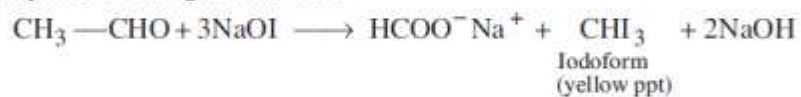

Benzaldehyde   Acetophenone   Benzal acetophenone
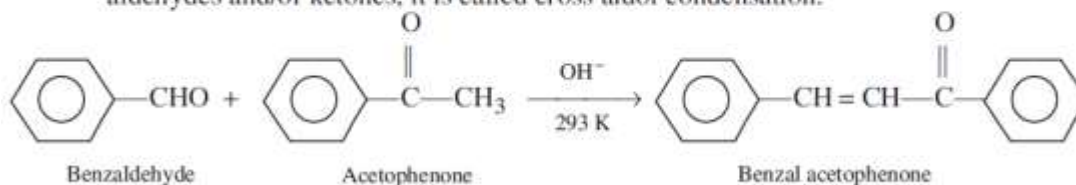
If both of them contain α-hydrogen atoms. It gives a mixture of four products.

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OR

(a) (i) This is due to steric and electronic reasons. 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 two alkyl groups reduce the positivity of the carbonyl carbon more effectively in ketones than in aldehydes.

(ii) This is due to intermolecular hydrogen bonding in carboxylic acids.

(iii) Due to greater electronegativity of oxygen than carbon the C atom of the $>C = O$ bond acquires a partial positive charge in aldehydes and ketones and hence readily undergo nucleophilic addition reactions.

(b) (i) Acetaldehyde reacts with NaOI (I_2 / NaOH) to form yellow ppt of iodoform while benzaldehyde does not give this test.

$$CH_3—CHO + 3NaOI \longrightarrow HCOO^-Na^+ + \underset{\substack{\text{Iodoform} \\ \text{(yellow ppt)}}}{CHI_3} + 2NaOH$$

CHO
|

⬡ $\xrightarrow{\text{NaOI}}$ No reaction

(ii) Propanone give orange-red ppt with 2, 4-DNP reagent and yellow ppt of iodoform with sodium hypoiodite, whereas 1-propanol does not give these tests.

$$CH_3—COCH_3 + 3NaOI \longrightarrow \underset{\substack{\text{Iodoform} \\ \text{yellow ppt.}}}{CHI_3} + CH_3—COO^-Na^+ + 2NaOH$$

$$CH_3—CH_2—CH_2—OH \xrightarrow{\text{NaOI}} \text{No yellow ppt. of iodoform}$$