CBSE Class 12 - Chemistry
Sample Paper - 09 (2019-20)

Maximum Marks:70
Time Allowed: 3 hours

General Instructions:

a. All questions are compulsory.
b. Section A: Q.no. 1 to 16 are very short answer questions (objective type) and carry 1 mark each.
c. Section B: Q.no. 17 to 23 are short answer questions and carry 2 marks each.
d. Section C: Q.no. 24 to 30 are long answer questions and carry 3 marks each.
e. Section D: Q.no. 31 to 33 are also long answer questions and carry 5 marks each.
f. There is no overall choice. However an internal choice has been provided in two questions of two marks, two questions of three marks and all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.
g. Use log tables if necessary, use of calculators is not allowed.

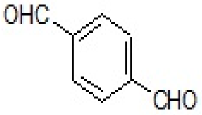
Section A

1. The solutions which boil at a constant temperature like a pure liquid and possess the same composition in liquid, as well as vapour state are called azeotropes. The components of azeotropes cannot be separated by fractional distillation. Only non-ideal solutions form azeotropes. Solutions with negative deviation form maximum boiling azeotrope and the solutions with positive deviation form minimum boiling azeotrope. The boiling point of azeotrope is never equal to the boiling points of any of the components of the azeotrope.
   Answer the following questions:

   i. The azeotropic solutions of two miscible liquids show what type of deviation from Raoult's law?
   ii. The solutions which distil without a change in composition or temperature are

    called ________.
  iii. The azeotropic mixture of water & HCI boils at $108.5^\circ C$. What type of deviation is shown by the solution? Does this solution behave as ideal or non-ideal?
  iv. Do ideal solutions form azeotropes?
  v. Out of pure liquid and azeotrope showing positive deviation, Which one has a higher boiling point?

2. What is the role of CO_2 in the extractive metallurgy of aluminium from its ore?
3. State a use of streptokinase in protein.
4. Write functional differences between RNA & DNA.
5. Which of the following is fibre? Nylon, neoprene, PVC.
6. Name the following compound according to IUPAC system of nomenclature.



or p-$CHOC_6H_4CHO$

7. The major product formed when 3, 3-dimethyl butan-2-ol is heated with concentrated sulphuric acid is
   a. 2, 3-dimethyl-2-butane
   b. 2,3-dimethyl-1-butane
   c. cis- and trans- isomers of 2,3-dimethyl-1-1butane
   d. 3,3-dimethyl-1-butane
8. Which among the following is a chemical process?
   a. Magnetic separation
   b. Froth floatation
   c. Gravity separation
   d. Leaching
9. Maximum oxidation state is shown by
   a. Co
   b. Cr
   c. Mn
   d. Os
10. The hardness of water is estimated by
    a. Titration with EDTA
    b. Gravimetric method
    c. Distillation method

d. Conductivity method

11. Which of the following fibres are made of polyamides?
    a. Rayon
    b. Orlon
    c. Nylon
    d. Dacron
12. **Assertion:** A solution of sucrose in water is dextrorotatory but on hydrolysis in presence of little hydrochloric acid it becomes laevorotatory.

    Reason: Sucrose on hydrolysis gives unequal amounts of glucose and fructose as a result of which change in sign of rotation is observed.
    a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
    b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
    c. Assertion is CORRECT but, reason is INCORRECT.
    d. Assertion is INCORRECT but, reason is CORRECT.
13. **Assertion:** Addition of HBr to 1 - butene in the presence of peroxide gives 1-bromobutane.

    Reason: It involves the formation of primary radical.
    a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
    b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
    c. Assertion is CORRECT but, reason is INCORRECT.
    d. Assertion is INCORRECT but, reason is CORRECT.
14. **Assertion:** Iodine dissolves in aqueous solution of potassium iodide.

    Reason: Potassium iodide behaves as an organic solvent and therefore, dissolves non-polar iodine.
    a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
    b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
    c. Assertion is CORRECT but, reason is INCORRECT.

d. Assertion is INCORRECT but, reason is CORRECT.

15. **Assertion:** Tert. butyl methyl ether is not prepared by the reaction of tert. butyl bromide with sodium methoxide.

    Reason: Sodium methoxide is a strong nucleophile.

    a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
    b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
    c. Assertion is CORRECT but, reason is INCORRECT.
    d. Assertion is INCORRECT but, reason is CORRECT.

16. **Assertion:** The micelle formed by sodium stearate in water has - COO^- groups at the surface.

    Reason: Surface tension of water is reduced by addition of stearate.

    a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
    b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
    c. Assertion is CORRECT but, reason is INCORRECT.
    d. Assertion is INCORRECT but, reason is CORRECT.

Section B

17. Name the four categories in which polymers have been classified on the basis of magnitude of forces present in them.

18. Consider a reaction which is first order in A and second order in B. Then

    i. Write the differential rate equation.
    ii. How is the rate affected on increasing the concentration of B three times?
    iii. How is the rate affected when the concentration of both A and B are doubled?

19. Define corrosion. What is the chemical formula of rust?

20. Write the IUPAC name of the ionization isomer of $[Ni(NH_3)_5NO_3]Cl$.

21. State reason for each of the following:

i. CO is stronger complexing reagent than NH_3.

ii. The molecular shape of $Ni(CO)_4$ is not the same as that of $[Ni(CN)_4]^{2-}$.

OR

What is meant by hexadentate ligand? Give one example. How is such ligand useful for measuring hardness of water.

22. How is leaching carried out in case of low grade copper ores?

OR

What is meant by rate constant, k of a reaction? If the concentration be expressed in mol L^{-1}units and time in seconds, what would be the unit of k

i. for a zero order reaction and

ii. for a first order reaction?

23. Give chemical reaction for formation of Ethene to 1, 2 -ethanediol

Section C

24. Calculate the emf of the cell

$$\mathrm{Mg(s)|Mg^{+2}(0.1M)||Cu^{+2}(1\times10^{-3}M|Cu(s))}$$
$$\mathrm{Given, E^{\ominus}_{Cu^{2+}/Cu}=+0.34V, E^{\ominus}_{Mg^{+2}/Mg}=-2.37V)}$$

25. The following results have been obtained during the kinetic studies of the reaction.

$$2A+B\rightarrow C+D$$

Experiment	[A]/mol L^{-1}	[B]/mol L^{-1}	Initial rate of formation of D/mol $L^{-1}\text{min}^{-1}$
I	0.1	0.1	6.0×10^{-3}
II	0.3	0.2	7.2×10^{-2}
III	0.3	0.4	2.88×10^{-1}
IV	0.4	0.1	2.40×10^{-2}

Determine the rate law and the rate constant for the reaction.

OR

The rate of a particular reaction triples when temperature changes from 50°C to 100°C. Calculate the activation energy of the reaction.

[Given log 3 = 0.4771; R = 8.314 K^{-1} mol^{-1}]

26. Calculate the emf of the cell $Mg(s) \,||\, Mg^{2+}(0.1\ M)\ |\,|\ Cu^{2+}\ (1 \times 10^{-3}\ M)\ |\ Cu(s)$

    Given : $E^0(Cu^{2+}/Cu) = +0.34V$

    $E^0(Mg^{2+}/Mg) = -2.37V$

27. Why is dioxygen a gas but sulphur a solid?

28. Out of $C_6H_5CH_2Cl$ and $C_6H_5CHClC_6H_5$ which is more easily hydrolysed by aqueous KOH?

29. Write chemical reactions to show that open structure of D-glucose contains the following:

    i. Straight chain
    ii. Five alcohol groups
    iii. Aldehyde as carbonyl group

OR

Write the steps for the conversion of ethyl alcohol to acetone.

30. Label the hydrophilic and hydrophobic parts in the following compounds.

    i. $CH_3(CH_2)_{10}CH_2OSO_3^{-}\ \overset{+}{N}a$
    ii. $CH_3(CH_2)_{15}\overset{+}{N}(CH_3)_3\overset{-}{B}r$
    iii. $CH_3(CH_2)_{16}COO(CH_2CH_2O)_6CH_2CH_2OH$

Section D

31. Compare physical adsorption and chemical adsorption in terms of rate and prevailing temperature.

OR

a. What is electrochemical equivalent?

b. Calculate the cell emf and $\Delta G°$ for the cell reaction at 25^0C. Zn / Zn^{+2}(0.1M) // Cu^{+2}(0.01M) /Cu electrode potential for Zn is - 0.403 volt and for Cu is -0.763 volt

32. i. Write the structure of main products when aniline reacts with the following reagents :
    a. Br_2 water
    b. HCl
    c. $(CH_3CO)_2O$/pyridine

    ii. Arrange the following in the increasing order of their boiling point:

    $C_2H_5NH_2$, C_2H_5OH, $(CH_3)_3N$

    iii. Give a simple chemical test to distinguish between the following pair of compounds :
    $(CH_3)_2NH$ and $(CH_3)_3N$.

OR

I. Show how p-aminoazobenzene can be obtained from aniline.

II. Write structures for the following compounds:
    a. Benzene diazonium chloride

    b. p-Nitrotoluene

    c. SuIphanilic acid

33. A violet compound of manganese (A) decomposes on heating to liberate oxygen and compounds (B) and (C) of manganese are formed. Compound (C) reacts with KOH in the presence of oxygen to give compound (B). On heating compound (C) with concentrated H_2SO_4 and NaCl, chlorine gas is liberated and a compound (D) of manganese along with other products is formed. Identify A to D and also explain the reactions involved.

OR

Give examples and suggest reasons for the following features of the transition metal chemistry:

i. The lowest oxide of transition metal is basic, the highest is amphoteric/acidic.

ii. A transition metal exhibits highest oxidation state in oxides and fluorides.

iii. The highest oxidation state is exhibited in oxyanions of a metal.

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Solution
Section A

1.
   1. The azeotropic solutions of two miscible liquids may show positive or negative deviation from Raoult's law.
   2. Azeotrope.
   3. The solution is non-ideal and shows a negative deviation.
   4. No, ideal solutions don't form azeotropes. Only the non-ideal solution form azeotrope.
   5. The boiling point of a pure liquid is higher as compared to azeotrope showing positive deviation.

2. The aluminate in solution is neutralised by passing CO_2 and hydrated AI_2O_3 is precipitated.
   $2Na\,[AI\,(OH)_4\,]\,(aq) + CO_2(g) \longrightarrow AI_2O_3 \cdot xH_2O(s) + 2NaHCO_3(aq)$

3. It dissolves blood clots and used in the treatment of heart diseases.

4. DNA is very important for passing of hereditary information from one generation to other. In RNA, protein synthesis takes place.

5. Nylon is a fibre.

6. Benzene-1,4-dicarbaldehyde

7. (a) 2, 3-dimethyl-2-butane
   Explanation: 2, 3-dimethyl-2-butane
8. (d) Leaching
   Explanation: Leaching is a process in which ore is digested with a solvent to form a soluble complex.
   Example: Leaching of aluminia from bauxite.
9. (d) Os
   Explanation: Os shows maximum oxidation state of +8.

10. (a) Titration with EDTA

    Explanation: Hardness of water is because of presence of Ca^{2+} and Mg^{2+} ions which can form stable complexes with EDTA. So by simple titration with EDTA, hardness of water can be estimated. The selective estimation of these ions can be done due to difference in the stability constants of their complexes with EDTA.

11. (c) Nylon

    Explanation: Polyamides are polymers possessing amide linkages and are important examples of synthetic fibres. These are termed as nylons. The general method of preparation consists of the condensation polymerisation of diamines with dicarboxylic acids and also of amino acids and their lactams.

12. (c) Assertion is CORRECT but, reason is INCORRECT.

    Explanation: Assertion is CORRECT but, reason is INCORRECT.

13. (c) Assertion is CORRECT but, reason is INCORRECT.

    Explanation: Assertion is CORRECT but, reason is INCORRECT.

14. (c) Assertion is CORRECT but, reason is INCORRECT.

    Explanation: Assertion is CORRECT but, reason is INCORRECT.

15. (b) Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

    Explanation: Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

16. (a) Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

    Explanation: Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

Section B

17. i. Elastomers
    ii. Fibres
    iii. Thermoplastics
    iv. Thermosetting

18. i. As the rate is first order in A and second order in B, so the differential rate equation is given as

    $$Rate = \frac{dx}{dt} = k\,[A]\,[B]^2$$

    where k=rate constant

ii. If concentration of B is increased three times
$Rate' = \frac{dx}{dt} = k\,[A]\,[3B]^2 = 9k[A][B]^2 = 9Rate$
So the rate will increase to 9 times the original rate.
iii. When concentration of both A and B are doubled,
$Rate'' = \frac{dx}{dt} = k\,[2A]\,[2B]^2 = 8k[A][B]^2 = 8Rate$
So the rate will increase to 8 times the original rate.

19. Corrosion is the slow eating of the surface of the metal due to attack of atmospheric gases. The formula of rust is $Fe_2O_3.xH_2O$

20. Pentaammine chloridonickel (II) nitrate

21. i. As CO is a good σ-sigma donor and a good π-acceptor ligand, there exists a back bonding in CO complexes in which CO accepts an appreciable amount of electron density from the filled d-orbitals of metal atom into their empty π or π^* orbitals. These π interactions increase the value of Δ_0. Whereas NH_3 can form only σ-bonds and no π-bonds with metals, therefore CO is a better complexing reagent than NH_3.

ii. In $[Ni(CO)_4]^{-2}$, Ni has an oxidation state equal to zero and involves sp^3-hybridisation, hence possesses a tetrahedral shape.
On the other hand, in $[Ni(CN)_4]^{2-}$, the oxidation state of Ni is +2 and it involves dsp^2-hybridisation, hence, possesses a square planar structure.

OR

Hexadentate ligand is a ligand which has 6 donor atoms, e.g. EDTA.

EDTA forms complex with Ca^{2+} and Mg^{2+} therefore it is used for estimating hardness of water.

22. The leaching of the low grade copper ores is carried out with acids in presence of air, when copper goes into solution as Cu^{2+} ions. The following reaction is involved:
$2Cu(s) + 2H_2SO_4(aq) + O_2(g) \rightarrow 2CuSO_4(aq) + 2H_2O(l)$

or

$Cu(s) + 2H^+(aq) + \frac{1}{2}O_2(g) \rightarrow Cu^{2+}(aq) + H_2O(l)$

OR

The rate constant, k is equal to the rate of a reaction when the concentration of the reactants is unity. Its unit depends upon the order of reaction.

unit of k

i. For a zero order reaction, rate= k $[R]^0$

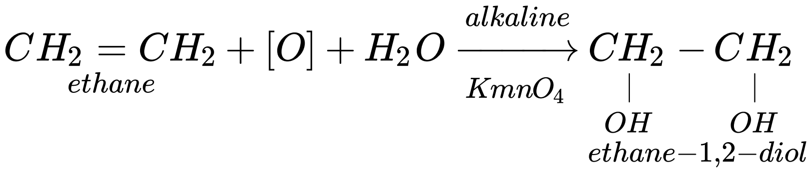
   $$k=\frac{\text{Rate}}{[R]^0}=\frac{\text{mol}\,\mathbf{L}^{-1}\mathbf{s}^{-1}}{\left[\text{mol}\,\mathbf{L}^{-1}\right]^0}$$

   k = mol $L^{-1}s^{-1}$

ii. For first order reaction, rate = k [R]

   $$k=\frac{\text{Rate}}{[R]}=\frac{\text{mol}\,\text{L}^{-1}\text{s}^{-1}}{\text{molL}^{-1}}=\text{s}^{-1}$$

23. 1, 2 -ethanediol (Ethylene glycol) is produced from ethylene (ethene), via the intermediate ethylene oxide. Ethylene oxide reacts with water to produce ethylene glycol according to the chemical equation:



$$\underset{ethane}{CH_2 = CH_2} + [O] + H_2O \xrightarrow[KmnO_4]{alkaline} \begin{array}{c} CH_2 - CH_2 \\ | \qquad\quad | \\ OH \qquad OH \\ ethane-1{,}2-diol \end{array}$$

Section C

24. We have

$$\text{Mg(s)}|\text{Mg}^{+2}(0.1\text{M})||\text{Cu}^{+2}(1\times10^{-3}\text{M}|\text{Cu(s)})$$

Half cell reactions of this cell are:

At Cathode (Reduction):

$$Cu^{2+}(aq)+2e^{-}\rightarrow Cu(s)$$

At Anode (Oxidation):

$$Mg(s)\rightarrow Mg^{2+}(aq)+2e^{-}$$

For this cell, we have, n=2 moles of electrons.

$$(\text{Given},\text{E}^{\ominus}_{Cu^{2+}/Cu}=+0.34\,\text{V},\text{E}^{\ominus}_{Mg^{+2}/Mg}=-2.37\text{V})$$

$$E^{\ominus}_{cell} \ = \ E^{\ominus}_{reduction} - E^{\ominus}_{oxidation}$$

$$E^{\ominus}_{cell} = E^{\ominus}_{(Cu^{2+}/Cu)} - E^{\ominus}_{(Mg^{2+}/Mg)}$$

= 0.34 - (-2.37)V

= 2.71V

According to Nernst equation

$$E_{cell} = E^{\ominus}_{cell} - \frac{0.059}{n} \log \frac{[Mg^{2+}]}{[Cu^{2+}]}$$

$$E_{cell} = E^{\ominus}_{cell} \ - \ \frac{0.059}{2} \log \left[\frac{0.1}{10^{-3}} \right]$$

= 2.71 - 0.0295 $\log 10^2$

$$= 2.71 - 0.0295 \times 2$$

= 2.651

$$\therefore E_{cell} = 2.651 \ V$$

25. From experiments I and IV, it may be noted that [B] is same but [A] has been made four times, the rate of reaction has also becomes four times. This means w.r.t A

Rate $\propto [A]$

From experiments II and III it may be noted that [A] is kept same an [B] has been doubled, the rate of reaction has become four times. This means w.r.t B,

Rate $\propto [B]^2$

Combining (i) and (ii), we get the rate law for the given reaction as:

Rate $= k\,[A]\,[B]^2$

Thus order w.r.t A = 1

Order w.r.t B = 2

The overall order of the reaction

= 1 + 2 = 3

The rate constant and its units can be calculated from the data of each experiment using the expression.

$$k = \frac{rate}{[A][B]^2}$$

$$= \frac{mol\,L^{-1}\text{min}^{-1}}{\left(mol\,L^{-1}\right)\left(mol\,L^{-1}\right)^2}$$

$= mol^{-2}L^{-2}\text{min}^{-1}$

Expt. $k = mol^{-2}L^{-2}\text{min}^{-1}$

i. $\frac{6.0\times10^{-3}}{0.1\times(0.1)^2} = 6.0$

ii. $\frac{7.2\times10^{-2}}{0.3\times(0.2)^2} = 6.0$

iii. $\frac{2.88\times10^{-1}}{0.3\times(0.4)^2} = 6.0$

iv. $\frac{2.4\times10^{-2}}{0.4\times(0.1)^2} = 6.0$

Rate constant $k = 6.0\, mol^{-2}L^{-2}\text{min}^{-1}$

OR

T_1= 273 + 50 = 323 K

T_2= 273 + 100 = 373 K

K_1= K

K_2 = 3K

Using the formula,

$$log\frac{K_2}{K_1} = \frac{E_a}{2.303R}\left[\frac{T_2-T_1}{T_1T_2}\right]$$

$$\log\frac{3K}{K} = \frac{E_a}{2.303\times8.314}\left[\frac{373-323}{373\times323}\right]$$

$$\log 3 = \frac{E_a\times50}{2.303\times8.314\times373\times323}$$

$$E_a = 22011.76\, J\, mol^{-1}$$

26.

$$\begin{array}{l} Mg(s) \longrightarrow Mg^{2+}(aq) + 2e^- \\ Cu^{2+}(aq) + 2e^- \longrightarrow Cu(s) \\ \hline Mg(s) + Cu^{2+}(aq) \longrightarrow Mg^{2+}(aq) + Cu(s) \end{array}$$

$$E_{cell} = E^0_{cell} - \frac{0.0591}{2}\log\frac{[Mg^{2+}]}{[Cu^{2+}]}$$

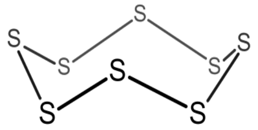
$$E^0_{cell} = \left[E^0\,\frac{(Cu^{2+})}{(Cu)} - E^0(Mg^{2+}/Mg)\right]$$

$$E_{cell} = [+0.34V - (-2.37V)] - \frac{0.0591}{2}\log 10^2$$

= (0.271 V - 0.0591)V

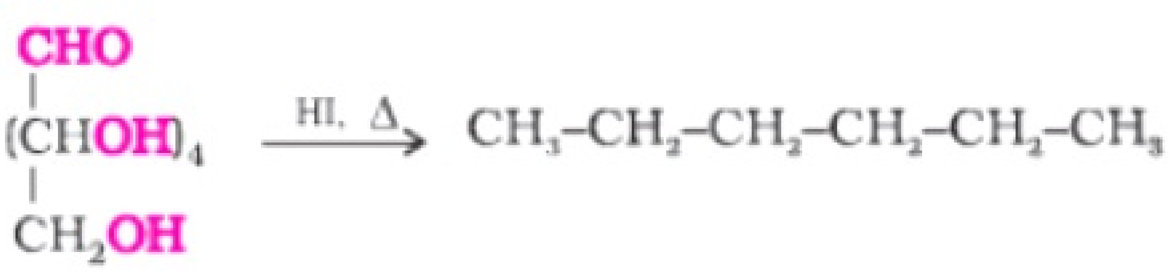
= 2.65 V

27. Oxygen is smaller in size as compared to sulphur. Due to its smaller size, it can effectively form $p\pi - p\pi$ bonds and form O_2 (O = O) molecule. Also, the intermolecular forces in oxygen are weak van der Waal's, which cause it to exist as gas. On the other hand, sulphur does not form M_2 molecule but exists as a puckered structure held together by strong covalent bonds. Hence, it is a solid.



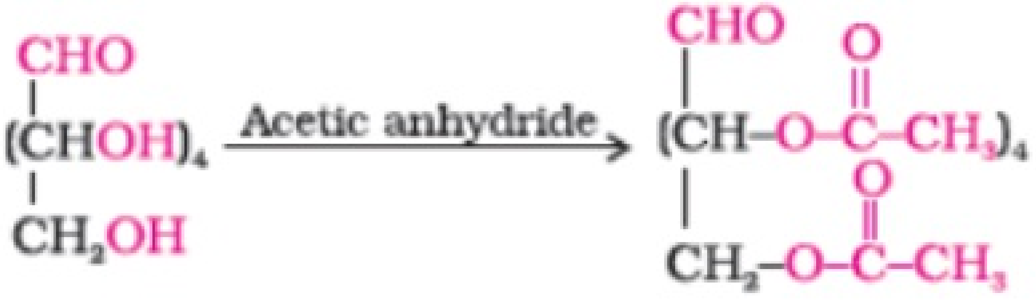
28. In $C_6H_5CH_2Cl$, the carbocation formed after loss of halogen is stabilized by resonance effect of one phenyl group whereas in $C_6H_5 - \overset{\overset{Cl}{|}}{C}H - C_6H_5$ the carbocation formed will be stabilized by resonance effect of two phenyl groups, that is why $C_6H_5CHClC_6H_5$ is more easily hydrolysed by aq KOH.

29. i. Chemical reaction to show that open structure of D-glucose contains straight chain:



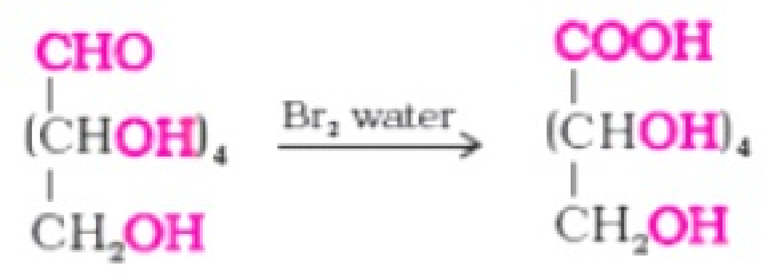
$$\underset{\underset{CH_2OH}{|}}{\overset{\overset{CHO}{|}}{(CHOH)_4}} \xrightarrow{HI,\ \Delta} CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$$

ii. Chemical reaction to show that open structure of D-glucose contains five alcohol groups:



$$\underset{\underset{CH_2OH}{|}}{\overset{\overset{CHO}{|}}{(CHOH)_4}} \xrightarrow{\text{Acetic anhydride}} \underset{\underset{CH_2-O-\overset{\overset{O}{||}}{C}-CH_3}{|}}{\overset{\overset{CHO}{|}}{(CH-O-\overset{\overset{O}{||}}{C}-CH_3)_4}}$$

iii. Chemical reaction to show that open structure of D-glucose contains the aldehyde as carbonyl group:



OR

$$CH_3CH_2OH \xrightarrow[KMnO_4]{(O)} CH_3COOH \xrightarrow{slaked\ lime,\ Ca(OH)_2} Ca(CH_3\ COO)_2$$

30. Hydrophobilic part (water hating) is always long carbon chain part while hydrophilic part (water loving) is ionic part or polar part of the molecule. Hydrophobic and hydrophilic part of the given question are mentioned below :

i. $\underbrace{CH_3(CH_2)_{10}CH_2}_{Hydrophobic\ part} - \underbrace{OSO_3^- Na^+}_{Hydrophilic\ part}$

ii. $\underbrace{CH_3(CH_2)_{15}}_{Hydrophobic\ part} - \underbrace{N^+(CH_3)_3Br^-}_{Hydrophilic\ part}$

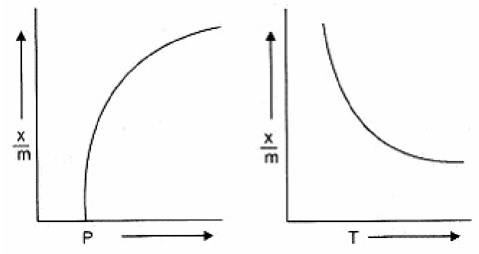
iii. $\underbrace{CH_3(CH_2)_{16}}_{Hydrophobic\ part} - \underbrace{COO(CH_2CH_2O)_6CH_2CH_2OH}_{Hydrophilic\ part}$

Section D

31. i. Physical adsorption takes place usually at low temperature. To the contrary chemical adsorption takes place at relatively high temperature.

ii. Physical adsorption takes place with an appreciably good rate. The later increases with rise in temperature.

The chemical adsorption takes place with a pretty good rate with rise in temperature. After a limit its rate decrease with rise in temperature.



OR

a. The electrochemical equivalent is the mass of ions deposited or liberated on an electrode during the electrolysis, when 1C of charge is passed through it.

b. $E^{\Theta}_{cell} = E^{\Theta}_{right} - E^{\Theta}_{left}$

= -0.403 - (- 0.763V)

= 0.36V

$$E_{cell} = E^{\Theta}_{cell} - \frac{0.059}{n}\log\frac{[Zn^{2+}]}{[Cu^{2+}]}$$

$$E_{cell} = 0.36 - \frac{0.059}{n}\log\frac{0.1}{0.01}\ [\because n = 2]$$

$$E_{cell} = 0.36 - 0.0295\log 10$$

$$= 0.36 - 0.0295 \times 1$$

= 0.3305V

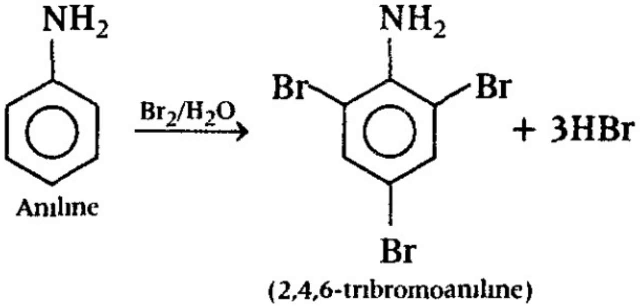
$$\Delta G^{\Theta} = -nFE^{\Theta}_{cell}$$

$$= -2 \times 96500 \times 0.36$$

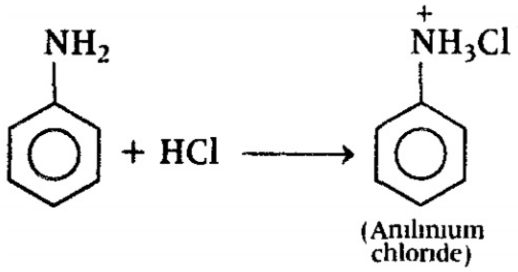
$$\Delta G^{\Theta} = 69480 J\,mol^{-1}$$

= 69.48J mol^{-1}

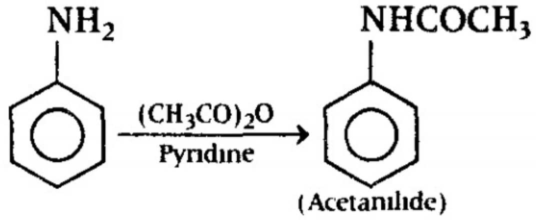
32. i. a.



b.

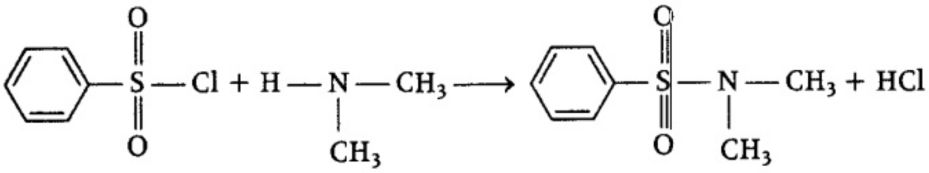


c.



ii. Increasing order of boiling point $(CH_3)_3N < C_2H_5NH_2 < C_2H_5OH$ Alcohols have a higher boiling point as compared to that of amines because oxygen being more electronegative forms stronger hydrogen bond as compared to that of nitrogen. In tertiary amine, there is no hydrogen bond formation due to the absence of H-atoms and hence, has the lowest boiling point.

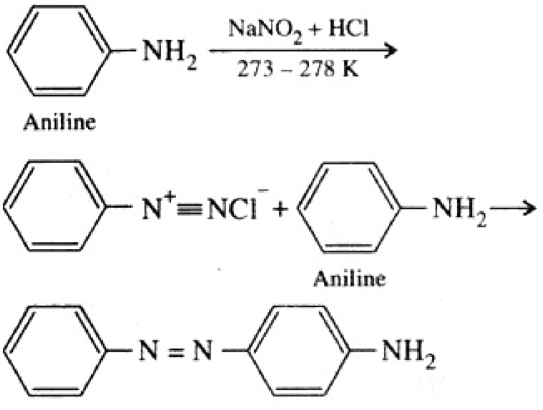
iii. $(CH_3)_2NH$ and $(CH_3)_3N$ are secondary and tertiary amines respectively. These are distinguished by Hinsberg's reagent which gives sulphonamide with secondary amines and no reaction with tertiary amines. $(CH_3)_2NH$ reacts with benzene sulphonyl chloride to give N, N-dimethyl benzene sulphonamide, which is insoluble in alkali. The reaction is as follows:



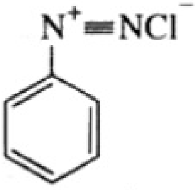
N,N-dimethylbenzene sulphonamide
(insoluble alkali)

OR

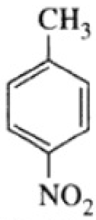
I. Steps involved in the conversion are given below:



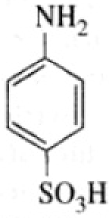
II.

a. 

Benzene diazonium
chloride

b. 

p-Nitrotoluene

c. 

Sulphanilic acid

33. $$\underset{(A)}{KMnO_4} \xrightarrow{Heat} \underset{(B)}{K_2MnO_4} + \underset{(C)}{MnO_2} + O_2$$

$$MnO_2 + KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$$

$$MnO_2 + 4NaCl + 4H_2SO_4 \rightarrow \underset{(D)}{MnCl_2} + 2NaHSO_4 + Cl_2 + H_2O$$

From the above set of reaction we can deduce that:

(A) = $KMnO_4$

(B) = K_2MnO_4

(C) = MnO_2

(D) = $MnCl_2$

OR

i. In the case of a lower oxide of a transition metal, the metal atom has a low oxidation state. This means that some of the valence electrons of the metal atom are not involved in bonding. As a result, it can donate electrons and behave as a base.
   On the other hand, in the case of a higher oxide of a transition metal, the metal atom has a high oxidation state. This means that the valence electrons are involved in bonding and so, they are unavailable. There is also a high effective nuclear charge.As a result, it can accept electrons and behave as an acid.
   For example, $Mn^{II}O$is basic and $M\overset{VII}{n_2}O_7$ is acidic.
ii. Oxygen and fluorine act as strong oxidising agents because of their high

electronegativities and small sizes. Hence, they can oxidise any metal to its higher oxidation state.. In other words, a transition metal exhibits higher oxidation states in oxides and fluorides. For example, in $OsF_6 \ and \ V_2O_5$,the oxidation states of Os and V are +6 and +5 respectively.

iii. Oxygen is a strong oxidising agent due to its high electronegativity and small size. So, oxo-anions of a metal have the highest oxidation state. For example, in MnO_4^-,the oxidation state of Mn is +7.