

CBSE Board Paper Solution-2020

Class	: XII
Subject	: Chemistry
Set	: 1
Code No	: 56/3/1

General Instructions

Read the following instructions very carefully and strictly follow them:

- i. This question paper comprises **four** Sections – **A, B, C** and **D**. There are 37 questions in the question paper. All questions are compulsory.
- ii. **Section A** – Questions no. 1 to 20 are very short answer type questions carrying 1 mark each. Answer these questions in one word or one sentence.
- iii. **Section B** – Questions no. 21 to 27 are short answer type questions, carrying 2 marks each.
- iv. **Section C** – Questions no. 28 to 34 are long answer type-I questions, carrying 3 marks each.
- v. **Section D** – Questions no. 35 to 37 are long answer type-II questions, carrying 5 marks each.
- vi. There is no overall choice in the question paper. However, an internal choice has been provided in 2 questions of two marks, 2 questions of three marks and all the 3 questions of five marks. You have to attempt only one of the choices in such questions.
- vii. In addition to this, separate instructions are given with each section and question, wherever necessary.
- viii. Use of calculators and log tables is not permitted.

SECTION A

Read the given passage and answer the questions number 1 to 5 that follow: $1 \times 5 = 5$

The d-block of the periodic table contains the elements of the groups 3-12 and are known as transition elements. In general, the electronic configuration of these elements is $(n - 1) d^{1-10} ns^{1-2}$. The d-orbitals of the penultimate energy level in their atoms receive electrons giving rise to the three rows of the transition metals i.e., 3d, 4d and 5d series. However, Zn, Cd and Hg are not regarded as transition elements. Transition elements exhibit certain characteristic properties like variable oxidation states, complex formation, formation of coloured ions and alloys, catalytic activity, etc. Transition metals are hard (except Zn, Cd and Hg) and have a high melting point.

1) Why are Zn, Cd and Hg non-transition elements?

Answer.

Transition elements have incomplete d-subshell in ground state with exceptions of group 11 and 12 elements.

Zn, Cd and Hg have general configuration $(n-1) d^{10} ns^2$, i.e., they have completely filled d-orbitals. Therefore, they are non-transition elements but are d-block

elements as the last electron enters in the d-orbital of the penultimate shell.

2) Which transition metal of 3d series does not show variable oxidation states?

Answer:

Scandium (Sc)

3) Why do transition metals and their compounds show catalytic activity?

Answer:

Transition metals and their compounds show catalytic activity due to the presence of incomplete or empty d-orbitals, large surface area and variable oxidation state. They combine with reactant molecules to give transition states and lower their activation energy.

4) Why are melting points of transition metals high?

Answer:

Melting points of transition metals are high due to formation of strong metallic bonds by ns and (n-1)d electrons.

5) Why is Cu^{2+} ion coloured while Zn^{2+} ion is colourless in aqueous solution?

Answer:

Transition metal ions are coloured in aqueous solution due to the presence of partially filled d-orbitals.

Electronic configuration of $\text{Cu}^{2+} = [\text{Ar}]3d^9$

Since Cu^{2+} ion has partially filled 3d-orbital, it is coloured in aqueous solution.

$\text{Zn}^{2+} = [\text{Ar}]3d^{10}$

Zn^{2+} is colourless in aqueous solution due to the presence of completely filled d-orbitals.

Questions number 6 to 10 are one word answer:

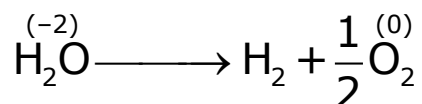
$1 \times 5 = 5$

6) Name the cell which was used in the Apollo Space Programme.

Answer: Fuel cell

7) How many coulombs are required for the oxidation of 1 mol of H_2O to O_2 ?

Answer:



Electricity required for the oxidation of 1 mole of H_2O to $\text{O}_2 = nF$

Here, $n = 2$

Therefore,

Electricity required = $2F$

We know that,

$1F = 96500$ coulombs

So, charge required = $2F$

$$= 2 \times 96500$$

$$= 1.93 \times 10^5 \text{ coulombs}$$

8) Write the slope value obtained in the plot of $\ln[R]$ vs. time for a first order reaction.

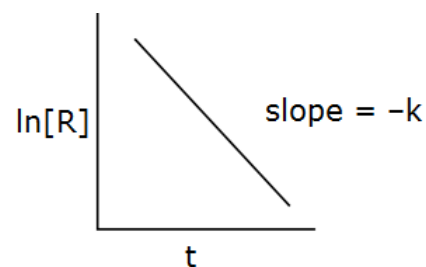
Answer:

For first order

Reaction

$$kt = \ln \frac{[A]_0}{[A]_+}$$

$$\ln[R] = \ln [R_0] - kt$$



9) Name the disaccharide which on hydrolysis gives two molecules of glucose.

Answer: Maltose

10) Name the class of the synthetic detergent which is used in toothpaste.

Answer: Anionic detergents

Questions number 11 to 15 are multiple choice questions: 1×5=5

11) Which of the following is refined by the zone refining process?

(A) Cu

(B) Zn

(C) Ge

(D) Sn

Answer: (C)

12) Racemisation occurs in

(A) S_N2 reaction

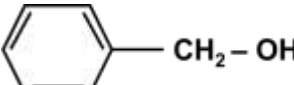
(B) S_N1 reaction

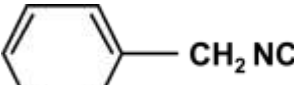
(C) Neither S_N2 nor S_N1 reactions

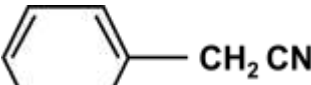
(D) S_N2 reaction as well S_N1 reaction

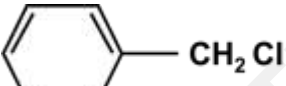
Answer: (B)

13)  on heating with CHCl_3 and alcoholic KOH gives foul smell of

(A) 

(B) 

(C) 

(D) 

Answer: (B)

14) One mole of $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ compound reacts with excess AgNO_3 solution to yield two moles of $\text{AgCl}(s)$. The structural formula of the compound is

(A) $[\text{Cr}(\text{H}_2\text{O})_5 \text{Cl}] \text{Cl}_2 \cdot \text{H}_2\text{O}$

(B) $[\text{Cr}(\text{H}_2\text{O})_3 \text{Cl}_3] \cdot 3\text{H}_2\text{O}$

(C) $[\text{Cr}(\text{H}_2\text{O})_4 \text{Cl}_2] \text{Cl} \cdot 2\text{H}_2\text{O}$

(D) $[\text{Cr}(\text{H}_2\text{O})_6] \text{Cl}_3$

Answer: (A)

15) Peptide linkage is present in

(A) Carbohydrates

(B) Vitamins

(C) Proteins

(D) Rubber

Answer: (C)

For questions number 16 to 20, two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (i), (ii), (iii) and (iv) as given below: $1 \times 5 = 5$

- (i) Both Assertion (A) and Reason (R) are correct, statements, and Reason (R) is the correct explanation of the Assertion (A).
- (ii) Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explanation of the Assertion (A).
- (iii) Assertion (A) is correct, but Reason (R) is incorrect statement.
- (iv) Assertion (A) is incorrect, but Reason (R) is correct statement.

16) Assertion (A): Conductivity of an electrolyte decreases with decrease in concentration.

Reason (R): Number of ions per unit volume increases on dilution.

Answer: (iii)

17) Assertion (A): The C – O – H bond angle in alcohols is slightly less than the tetrahedral angle.

Reason (R): This is due to the repulsive interaction between the two lone electron pairs on oxygen.

Answer: (i)

18) Assertion (A): $[\text{Pt}(\text{en})_2 \text{Cl}_2]^{2+}$ complex is less stable than $[\text{Pt}(\text{NH}_3)_4 \text{Cl}_2]^{2+}$ complex.

Reason (R): $[\text{Pt}(\text{en})_2 \text{Cl}_2]^{2+}$ complex shows chelate effect.

Answer: (iv)

19) Assertion (A): Osmotic pressure is a colligative property.

Reason (R): Osmotic pressure is directly proportional to molarity.

Answer: (ii)

20) Assertion (A): Reactivity of ketones is more than aldehydes.

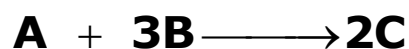
Reason (R): The carbonyl carbon of ketones is less electrophilic as compared to aldehydes.

Answer: (iv)

Section - B

21) In the given reaction

2



The rate of formation of C is $2.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$,

Calculate the

(i) rate of reaction, and

(ii) rate of disappearance of B.

Answer:

Solution:

Given Reaction :



Rate of formation of C = $2.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$

According to rate law;

$$\text{Rate of reaction} = \frac{-d[A]}{dt} = -\frac{1}{3} \frac{d[B]}{dt} = \frac{1}{2} \frac{d[C]}{dt}$$

$$\begin{aligned} \text{(i) Rate of reaction} &= \frac{1}{2} \times 2.5 \times 10^{-4} \\ &= 1.25 \times 10^{-4} \text{ molL}^{-1} \text{ s}^{-1} \end{aligned}$$

$$\text{(ii) Rate of disappearance of B} = -\frac{d[B]}{dt} = ?$$

From rate law;

$$\begin{aligned} -\frac{1}{3} \frac{d[B]}{dt} &= \frac{1}{2} \frac{[dC]}{dt} \\ -\frac{d[B]}{dt} &= \frac{3}{2} \times 2.5 \times 10^{-4} \\ &= 3.75 \times 10^{-4} \text{ molL}^{-1} \text{ s}^{-1} \end{aligned}$$

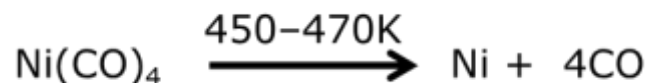
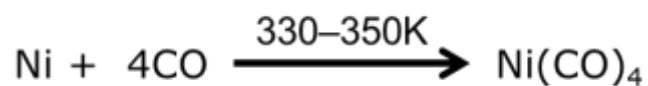
22) Write the role of the following: (1 + 1 = 2)

(i) NaAlF₄ in the extraction of Aluminium

(ii) CO in the refining of Ni

Answer:

- (i)** NaAlF₄ lowers the melting temperature of the alumina and increases the electrical conductivity.
- (ii)** When nickel is heated in a stream of carbon monoxide, it forms a volatile complex nickel tetracarbonyl which on further heating at higher temperature decomposes to give pure nickel.

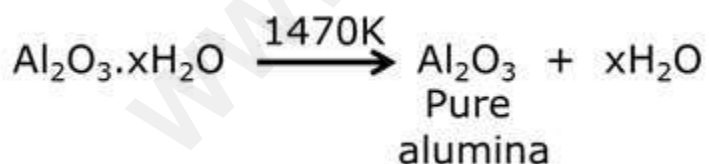
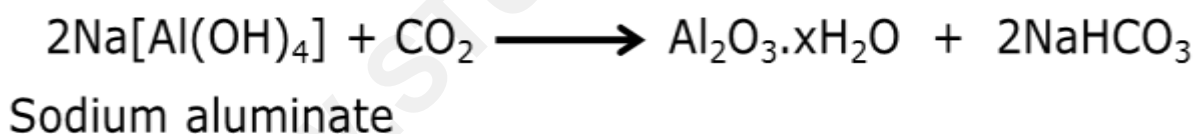
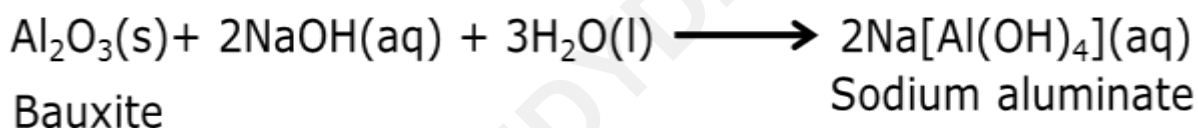


OR

Write the chemical equations involved in the leaching of bauxite ore to prepare pure alumina.

Answer

The chemical equations involved in the leaching of bauxite ore to prepare pure alumina are as follows:



23) Write two differences between physisorption and chemisorption. 2

Answer:

Differences between physisorption and chemisorption are as follows:

S.N.	Physisorption	Chemisorption
1.	It arises due to weak van der Waals forces.	It involves the formation of strong chemical bonds.
2.	It is reversible in nature.	It is irreversible in nature.

OR

Define the following terms with a suitable example of each:

2

- (i) Associated colloids**
- (ii) O/W emulsion**

Answer:

- (i) Associated colloids: These are the substances whose molecules aggregate spontaneously in a given dispersion medium yielding stable particles of colloidal range. They behave as normal electrolytes at low concentrations, but behave like colloids at higher concentrations. E.g., Soaps and synthetic detergents

- (ii) O/W emulsion: Oil in water emulsion (O/W) is the emulsion in which oil is present as a dispersed phase

and water as a dispersion medium. For example, milk.

In milk, liquid fat globules are dispersed in water.

24) (a) Write the IUPAC name and hybridization of the complex $[\text{CoF}_6]^{3-}$. 2

(Given : Atomic number of Co = 27)

(b) What type of isomerism is shown by the complex $[\text{Co}(\text{en})_2\text{Cl}_2]^{2+}$?

Name the structure of an isomer of this complex which is optically active.

Answer:

(a) IUPAC name of the complex $[\text{CoF}_6]^{3-}$:

Hexafluorocobaltate(III)ion

Hybridisation of the complex $[\text{CoF}_6]^{3-}$: sp^3d^2

(b) Geometrical isomerism and optical isomerism are shown by the complex $[\text{Co}(\text{en})_2\text{Cl}_2]^{2+}$.

Only cis-Dichlorobis(ethylenediamine)cobalt(IV) isomer will show the optical activity.

25) Give reasons : 2

(i) Shaving soaps contain glycerol.

(ii) Antacids should not be used for longer time.

Answer:

- (i) Shaving soaps contain glycerol to prevent rapid drying.
- (ii) Antacids should not be used for longer time as they can make the stomach alkaline and cause the production of even more acid.

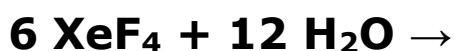
26) Define the following terms: 2

- (i) **Oligosaccharides**
- (ii) **Invert sugar**

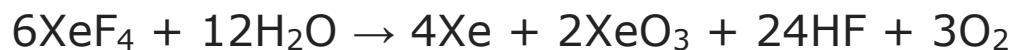
Answer:

- (i) **Oligosaccharides:** Carbohydrates that yield 2–10 molecules of monosaccharides on hydrolysis are called as oligosaccharides.
- (ii) **Invert sugar:** The hydrolysis of sucrose involving a change of the optical activity of solution from dextrorotation to laevorotation is called the inversion of cane sugar. The product thus formed is called invert sugar.

27) Write the products of the following reaction:



**Is this reaction a disproportionation reaction?
Give reasons in support of your answer. 2**

Answer:

Yes, this is a disproportionation reaction.

Reason Oxidation of Xe is +4 in XeF_4 , 0 in Xe and +6 in XeF_6 . Since, two different compounds of Xe are formed and the oxidation state of Xe is different in both of them, therefore, it is a disproportionation reaction.

SECTION C

28. Calculate the maximum work and $\log K_c$ for the given reaction at 298 K: **3**



Given :

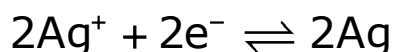
$$E_{\text{Ni}^{2+}/\text{Ni}}^0 = -0.25\text{V}, E_{\text{Ag}^+/\text{Ag}}^0 = +0.80\text{V}$$

$$1\text{F} = 96500\text{ C mol}^{-1}$$

Answers:

Given :

$$E_{\text{Ni}^{2+}/\text{Ni}}^0 = -0.25\text{V}, E_{\text{Ag}^+/\text{Ag}}^0 = 0.80\text{V}$$



$$E_{\text{Cell}}^0 = E_{\text{Cathode}}^0 - E_{\text{Anode}}^0$$

$$E_{\text{Cell}}^0 = E_{\text{Ag}^+/\text{Ag}}^0 - E_{\text{Ni}^{2+}/\text{Ni}}^0$$

$$E_{\text{Cell}}^0 = 0.80 - (-0.25)$$

$$E_{\text{Cell}}^0 = 1.05 \text{ V}$$

$$\begin{aligned}\Delta G &= -n F E_{\text{Cell}}^0 \\ &= -2 \times 96500 \times 1.05 \\ &= -202650 \text{ kJ/mol}\end{aligned}$$

$$E_{\text{Cell}}^0 = \frac{2.303 RT}{n F} \log K_c$$

$$\begin{aligned}\log K_c &= \frac{n F E_{\text{Cell}}^0}{2.303 RT} \\ &= \frac{2 \times 96500 \times 1.05}{2.303 \times 298 \times 8.314} \\ &= 35.516\end{aligned}$$

29. A first order reaction is 40% complete in 80 minutes. Calculate the value of rate constant (k). In what time will the reaction be 90% completed? **3**

[Given : $\log 2 = 0.3010$, $\log 3 = 0.4771$, $\log 4 = 0.6021$,
 $\log 5 = 0.6771$, $\log 6 = 0.7782$]

Answer:

For a first order Reaction:

$$kt = 2.303 \log \frac{[A]_0}{[A]_t}$$

$$kt = 2.303 \log \frac{a}{a-x}$$

Here, given that $x = \frac{40}{100}a = 0.4a$

$t = 80$ minutes (given)

$$k = \frac{2.303}{80} \log \frac{a}{a-0.4a}$$

$$= \frac{2.303}{80} \log \frac{a}{0.6a}$$

$$= \frac{2.303}{80} \log \frac{10}{6}$$

$$= 0.00638 \text{ min}^{-1}$$

When the reaction is 90% complete

$$x = \frac{90}{100}a = 0.9a, \quad t = ?$$

$$k = \frac{2.303}{t} \log \frac{a}{a-0.9a}$$

$$t = \frac{2.303}{0.00638} \log 10$$

$$= 360.971 \text{ min}$$

30. Write the names and structures of the monomers in the following polymers:

3

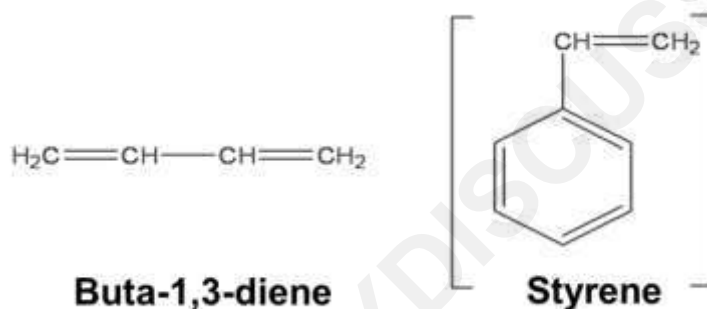
(i) Buna-S

(ii) Nylon-6,6

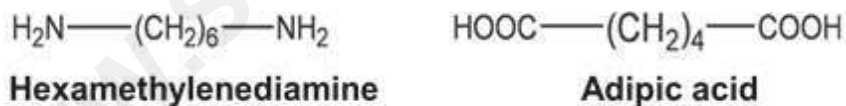
(iii) Bakelite

Answer:

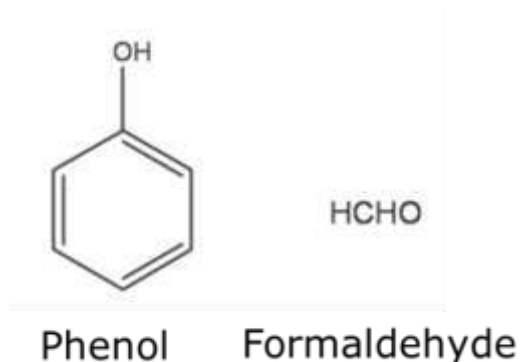
(i) Monomers of Buna-S: Styrene and 1,3-butadiene



(ii) Monomers of Nylon 6, 6 : Hexamethylenediamine and adipic acid

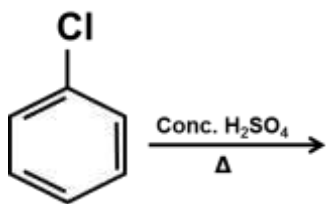


(iii) Bakelite : Phenol and formaldehyde

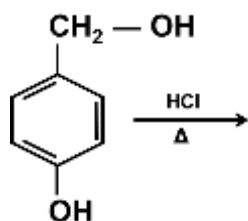


31. Write the major product(s) of the following reactions: 3

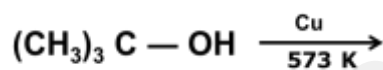
(i)



(ii)

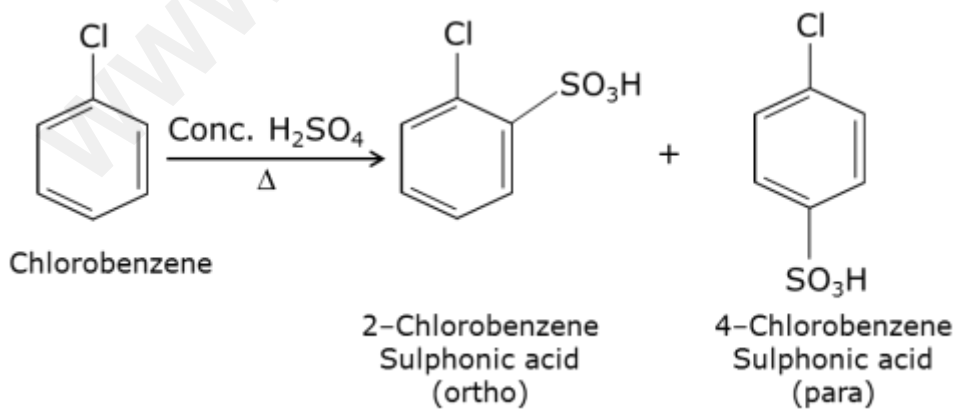


(iii)

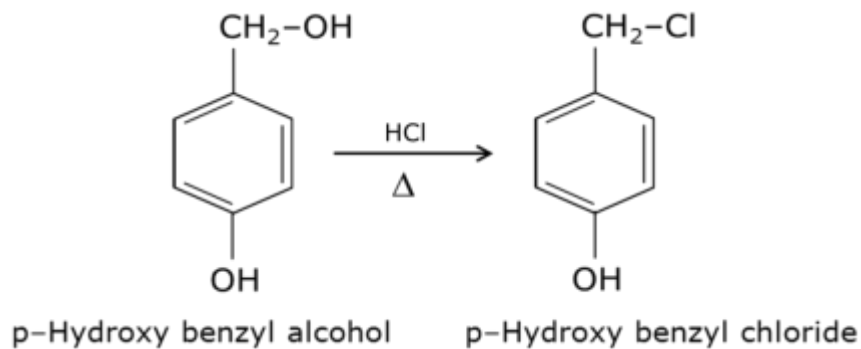


Answer:

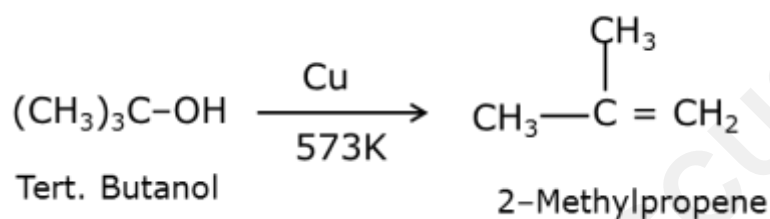
(i)



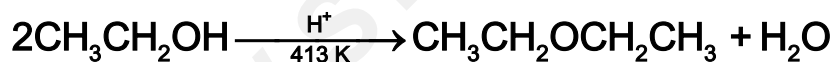
(ii)



(iii)



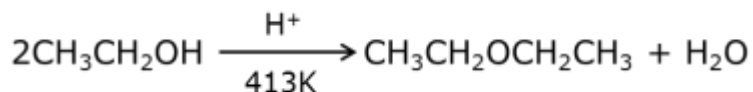
32) (a) Write the mechanism of the following reaction: 2+1=3

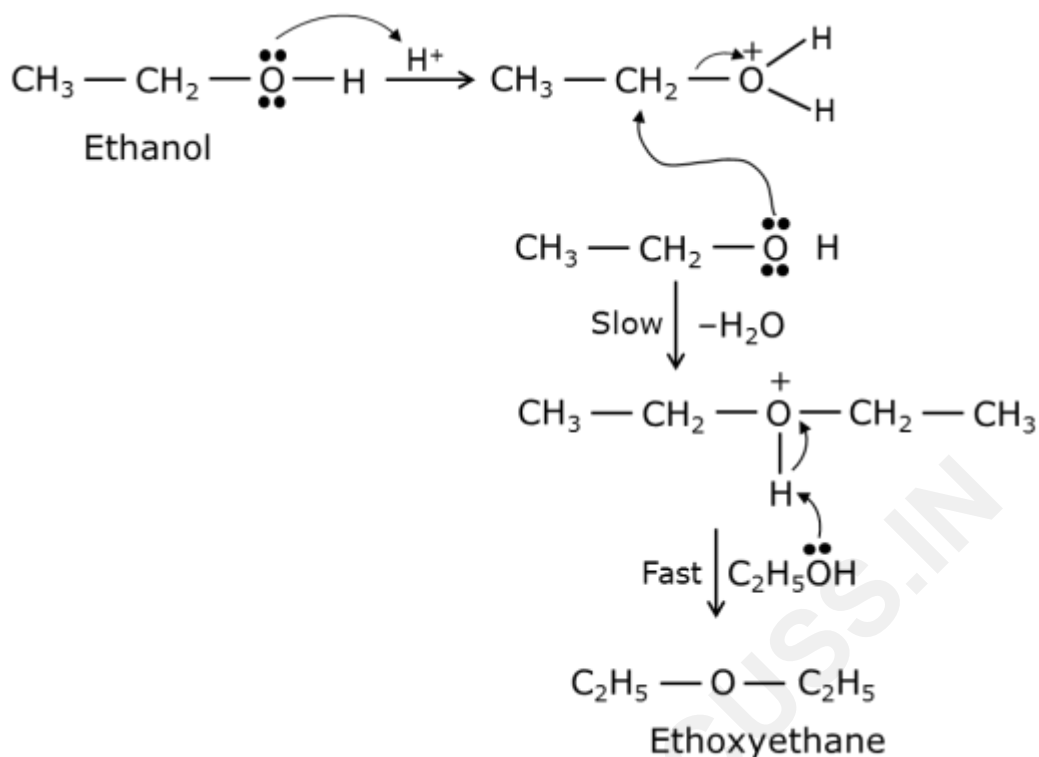


(b) Write the preparation of phenol from cumene.

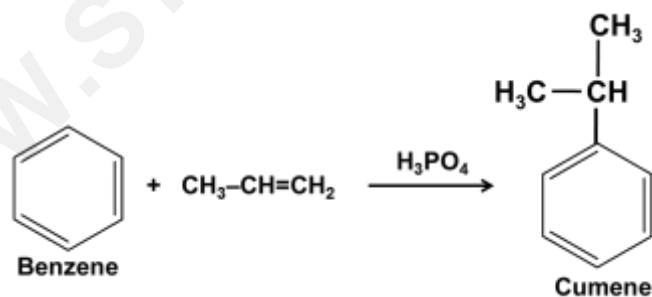
Answer:

(a)

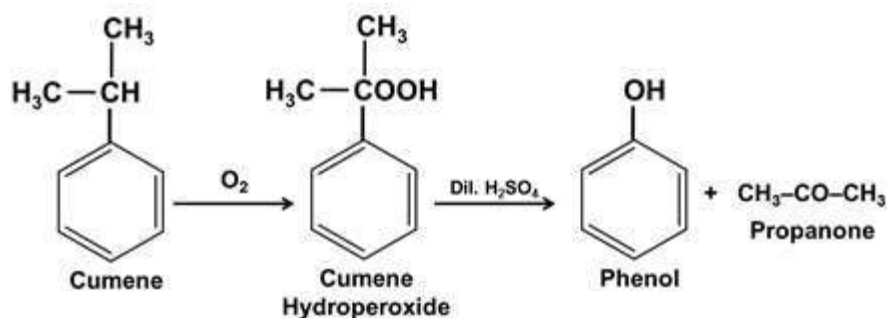




- (b) Preparation of phenol from cumene: It is the commercial method for the preparation of phenol. In this method, cumene is first prepared by the Friedel-Craft alkylation of benzene with propene in the presence of phosphoric acid.



Cumene (isopropyl benzene) is oxidised in the presence of air to cumene hydroperoxide. It is then converted to phenol and acetone by treating it with dilute acid.



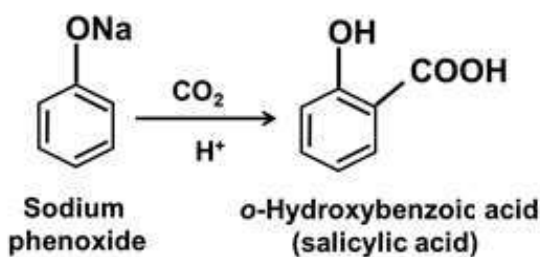
OR

How can you convert the following:

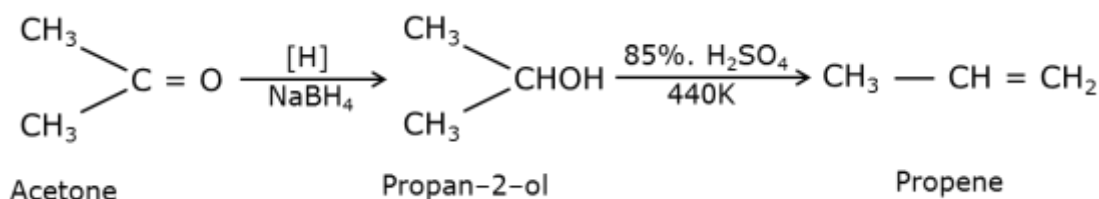
- (i) Sodium phenoxide to *o*-hydroxybenzoic acid**
- (ii) Acetone to propene**
- (iii) Phenol to chlorobenzene**

Answer:

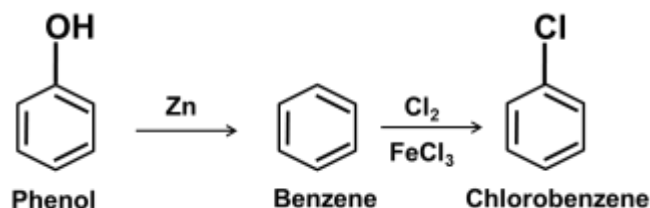
- (i) Sodium phenoxide to *o*-hydroxybenzoic acid



- (ii) Acetone to propene



(iii) Phenol to chlorobenzene



33) Write the products formed when $(\text{CH}_3)_3\text{C} - \text{CHO}$ reacts with the following reagents: 3

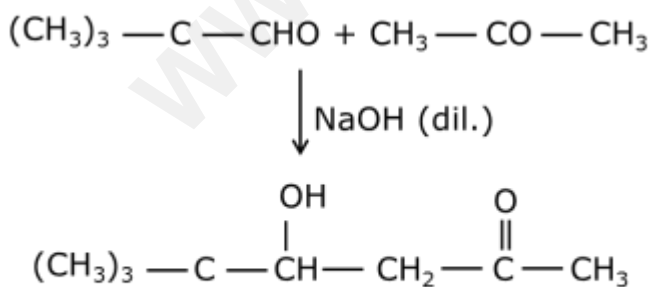
(i) CH_3COCH_3 in the presence of dilute NaOH

(ii) HCN

(iii) Conc. NaOH

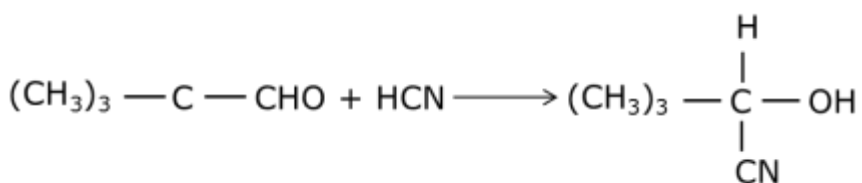
Answer:

(i)

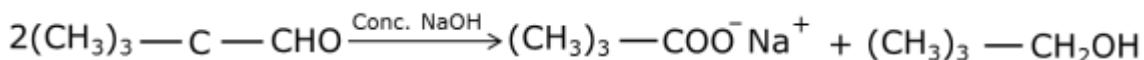


4-Hydroxy-5,5-dimethylhexa-2-one

(ii)



(iii)



34) Define Lyophobic and Lyophilic sol with a suitable example of each. Why is coagulation of Lyophilic sol difficult as compared to Lyophobic sol? **3**

Answer:

Lyophilic sols:

Colloidal sols that are formed by mixing substances such as gum, gelatin, starch, etc. with a suitable liquid (dispersion medium) are called lyophilic sols. These sols are reversible in nature.

Examples of lyophilic sols are starch, gum, gelatin, egg albumin etc.

Lyophobic sols:

When substances such as metals and their sulphides etc. are mixed with the dispersion medium, they do not form colloidal sols. Their colloidal sols can be prepared only by

special methods. Such sols are called lyophobic sols. These sols are irreversible in nature. For example: sols of metals.

The coagulation of lyophilic sols is difficult as compared to lyophobic sol because lyophilic sols are more stable than lyophobic sols.

This is due to the fact that lyophilic sols are solvated, i.e., they are highly hydrated.

OR

Define the following terms:

3

(i) Shape-selective catalysis

(ii) Kraft temperature

(iii) Peptization

Answer:

(i) **Shape-selective catalysis:** A catalytic reaction which depends upon the pore structure of the catalyst and on the size of the reactant and the product molecules is called shape-selective catalysis. For example, catalysis by zeolites is a shape-selective catalysis.

(ii) **Kraft temperature:** Associated colloids are obtained by the formation of aggregated particles or micelles at higher concentrations. The formation of micelles takes place only above a particular temperature called Kraft temperature.

(iii) **Peptization:** It is defined as the process of converting a precipitate into colloidal sol by shaking it with dispersion medium in the presence of a small amount of electrolyte.

SECTION D

35) (a) Give reasons: 3

(i) **Helium does not form compounds like Xenon.**

(ii) **HClO₄ is a stronger acid than HOCl.**

(iii) **Sulphur is a polyatomic solid whereas Oxygen is a diatomic gas.**

(b) Write one reaction as an example of each, to show that conc. H₂SO₄ acts as 2

(i) an oxidizing agent, and

(ii) a dehydrating agent.

Answer:

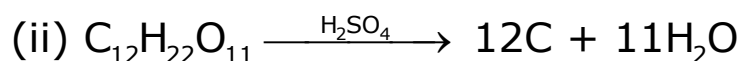
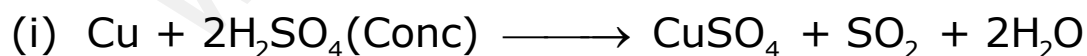
(a) (i) He has $1s^2$ configuration and it is stable. Its ionisation enthalpy is very high and it does not have vacant d orbital. Whereas Xe has comparatively less

ionisation enthalpy and has vacant d orbitals.
Therefore, helium does not form compounds like Xe.

(ii) Oxidation number of Cl in HOCl is + 1 and +7 in HClO₄. With the increase in oxidation number the acidic character increases. Therefore, HClO₄ is a stronger and than HOCl.

(iii) The size of oxygen atom is very small due to which it effectively forms pπ- pπ bonding and exist as oxygen molecule. Due to smaller size van der Waal forces existing between the oxygen molecules are very weak hence; it is a diatomic gas at room temperature. On the other hand the size of sulphur atom is larger than oxygen atom. It forms a single bond with another sulphur atom and forms a polyatomic molecule. Due to larger size van der Waal forces existing between the sulphur molecules are stronger hence; it is solid at room temperature.

(b)



OR

(a) Account for the following:

(i) Hydration enthalpy of F⁻ ion is more than Cl⁻ ion. 1

(ii) SO₂ is a reducing agent, whereas TeO₂ is an oxidizing agent in group- 16 oxides. 1

(b) Write the reaction of F₂ with water. Why does I₂ not react with water? 1+1 = 2

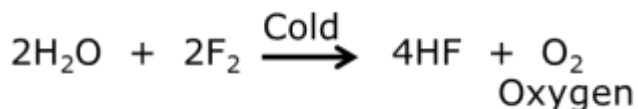
(c) Draw the structure of XeF₂. 1

Answer:

(a) (i) Smaller the size of the ion, more will be the hydration. Due to smaller size, F⁻ is more hydrated as compared to Cl⁻. Therefore, enthalpy of hydration (ΔH hydration) for F⁻ is more than Cl⁻.

(ii) Sulphur dioxide behaves like a reducing agent because sulphur has d-orbital, therefore it can easily expand its oxidation state from +4 to +6. But in the case of TeO₂, Te is a heavier element and it does not expand its oxidation state from +4 to +6 due to inert pair effect.

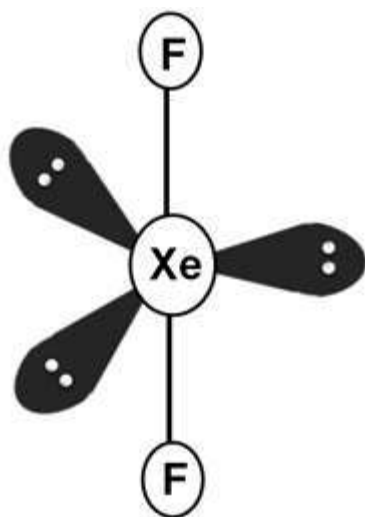
(b) Fluorine reacts vigorously with water and give oxygen in cold water and ozone in hot water.





Iodine does not react with water due to its low electrode potential. Its reaction with water is non-spontaneous.

(c)



Linear structure

36) (a) Give reasons :

3

- (i) Although $-\text{NH}_2$ group is *o/p* directing in electrophilic substitution reactions, yet aniline, on nitration gives good yield of *m*-nitroaniline.
- (ii) $(\text{CH}_3)_2\text{NH}$ is more basic than $(\text{CH}_3)_3\text{N}$ in an aqueous solution.

(iii) Ammonolysis of alkyl halides is not a good method to prepare pure primary amines.

(b) Distinguish between the following: 2

(i) $\text{CH}_3\text{CH}_2\text{NH}_2$ and $(\text{CH}_3\text{CH}_2)_2\text{NH}$

(ii) Aniline and CH_3NH_2

Answer:

- a) (i) During nitration, aniline is protonated to form the anilinium ion which is meta directing. That is why besides the ortho and para derivatives, significant amount of meta derivative is also formed.
- (ii) $(\text{CH}_3)_2\text{NH}$ is a secondary amine and $(\text{CH}_3)_3\text{N}$ is a tertiary amine. Tertiary amine due to the presence of three alkyl groups is more hindered than secondary amine which has only two alkyl group attached to it. Therefore formation of ammonium ion is easier in secondary amine than tertiary amine. Henceforth, makes secondary amine less basic than tertiary amine.
- (iii) The ammonolysis of alkyl halide leads to the formation of a mixture of primary, secondary and tertiary amine along with the formation of quaternary salt. It is very difficult to separate pure primary amine from this mixture.

b) (i)

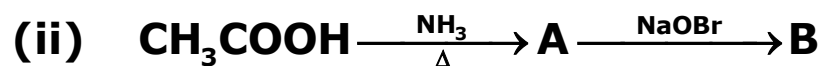
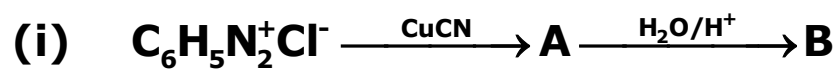
Test	CH₃CH₂NH₂	(CH₃CH₂)₂NH
Carbylamine test (add chloroform and alcoholic KOH to the both the compounds separately in a test tube)	Forms a foul smelling compound (positive test)	No reaction (negative test)

(ii)

Azo dye Test	Aniline	Methyl Amine (CH₃NH₂)
Add a small amount of nitrous acid with aq. HCl	Forms a yellow coloured dye (positive test)	No dye is formed (negative test)

OR

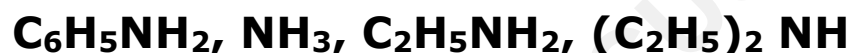
(a) Write the structures of A and B in the following reactions: 1 + 1 = 2



(b) Write the chemical reaction of methyl amine with benzoyl chloride and write the IUPAC name of the product obtained

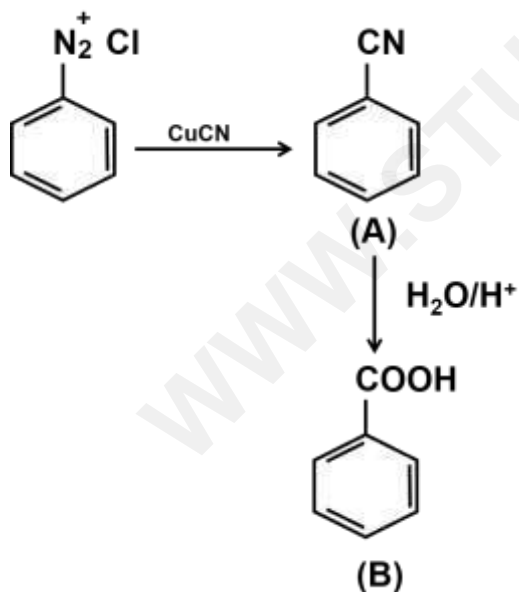
1 + 1 = 2

(c) Arrange the following in the increasing order of their pK_b values : 1

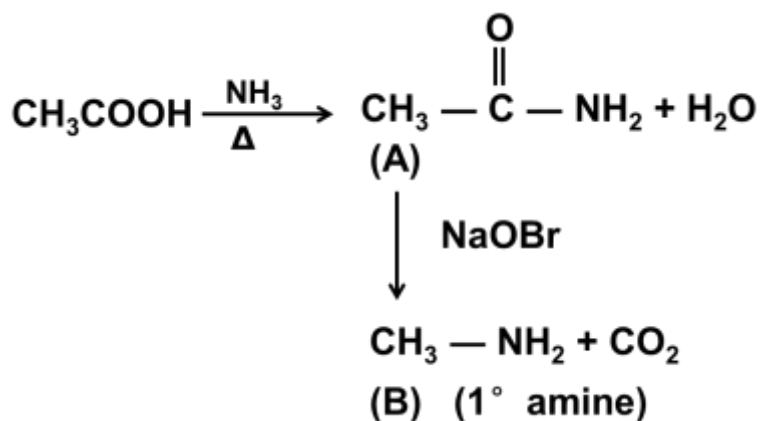


Answer:

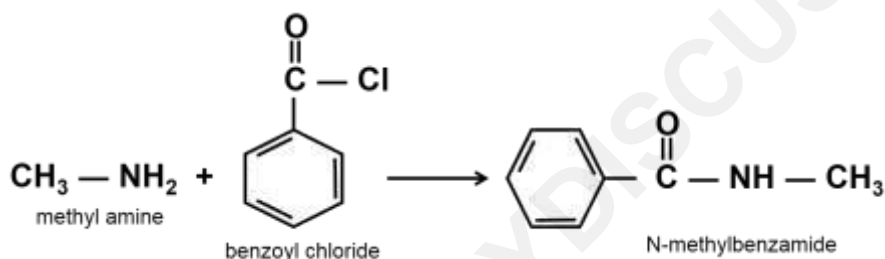
(a) (i)



(ii)

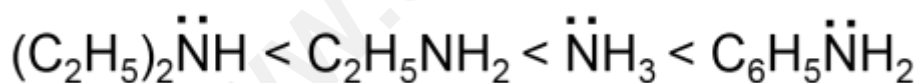


(b)



(c)

increasing order of pK_b values



37) (a) A solution contains 5.85 g NaCl (Molar mass = 58.5 g mol⁻¹) per litre of solution. It has an osmotic pressure of 4.75 atm at 27°C. Calculate the degree of dissociation of NaCl in this solution.

3

(Given : R = 0.082 L atm K⁻¹ mol⁻¹)

(b) State Henry's law. Why is air diluted with helium in the tanks used by scuba divers?

1 + 1 = 2

Answer:

(a)

Given:

Weight of NaCl given = 5.85g

molecular mass of NaCl = 58.5g/mol

Osmotic pressure = 4.75 atm

Temperature T = 27°C

$$= (27 + 273)K$$

$$= 300 K$$

degree of dissociation of NaCl = ?

We know that,

$$\pi = iCRT, C = \frac{5.85}{58.5 \times 1} M$$

$$4.75 = \frac{i \times 5.85}{58.5 / 1} \times 0.082 \times 300$$

$$i = \frac{4.75 \times 58.5}{5.85 \times 0.082 \times 300}$$

$$i = 1.93$$

For dissociation,

Here n = 2

$$i = 1 + \alpha(n - 1)$$

$$1.93 = 1 + (2 - 1)\alpha$$

$$1 + \alpha = 1.93$$

$$\alpha = 1.93 - 1$$

$$= 0.93 \text{ or } 93\%$$

(b) Henry's law: At a constant temperature, the solubility of a gas in a liquid is directly proportional to the partial pressure of the gas present above the surface of liquid or solution.

Air diluted with helium in the tanks used by scuba divers to avoid bends, as well as, the toxic effects of high concentrations of nitrogen in the blood because of increase in pressure underwater and decreasing pressure towards the water surface.

OR

(a) When 19.5 g of F – CH₂ – COOH (Molar mass = 78 g mol⁻¹) is dissolved in 500 g of water, the depression in freezing point is observed to be 1°C. Calculate the degree of dissociation of F – CH₂ – COOH. 3
[Given : K_f for water = 1.86 K kg mol⁻¹]

(b) Give reasons : 1 + 1 = 2
(i) 0.1 M KCl has higher boiling point than 0.1 M Glucose.
(ii) Meat is preserved for a longer time by salting.

Answer:

(a)

mass of solute = 19.5g

molar mass of solute (F - CH₂ - COOH) = 78gmol⁻¹

mass of solvent = 500 g ; k_f = 1.86 k Kg mol⁻¹

depression in freezing point = 1°C

degree of dissociation of solute = ?

No. of moles of solute = $\frac{19.5}{78} = 0.25$

molality is the no. of moles of solute in
1 Kg of Solvent

$$\text{molality} = \frac{0.25}{\frac{500}{1000}} = 0.50 \text{ m}$$

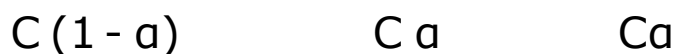
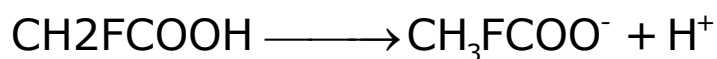
Calculated depression in freezing point;

$$\begin{aligned}\Delta T_f &= K_f \times m \\ &= 1.86 \times 0.50 = 0.93 \text{ K}\end{aligned}$$

$$i = \frac{\text{Observed freezing point}}{\text{Calculated freezing point}}$$

$$i = \frac{1.0}{0.93} = 1.0753$$

Let, C is the initial conc. of fluoroacetic acid and α be its degree of dissociation.



$$\begin{aligned} \text{Total no. of moles} &= C(1 - \alpha) + C\alpha + C\alpha \\ &= C(1 + 2\alpha) \end{aligned}$$

$$1.0753 = 1 + \alpha$$

$$\alpha = 0.0753$$

(b)

(i) KCl dissociates in the solution and forms ions K^+ and Cl^- and glucose does not dissociate. Since boiling point is a colligative property and depends on number of particles. Therefore, 0.1 M KCl has higher boiling point than 0.1 M glucose.

(ii) Meat is preserved for a longer time by salting to protect it against bacterial action.