CBSE Sample Paper 10

Class XII 2022-23

Chemistry

Time: 3 Hours **Max. Marks: 70**

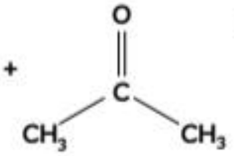
General Instructions:

1. There are 35 questions in this question paper with internal choice.
2. SECTION A consists of 18 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 7 very short answer questions carrying 2 marks each.
4. SECTION C consists of 5 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case-based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

SECTION - A

18 Marks

(The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.)

1. CS_2 +  follows:

(a) Raoult's law

(b) negative deviation from Raoult's law

(c) positive deviation from Raoult's law

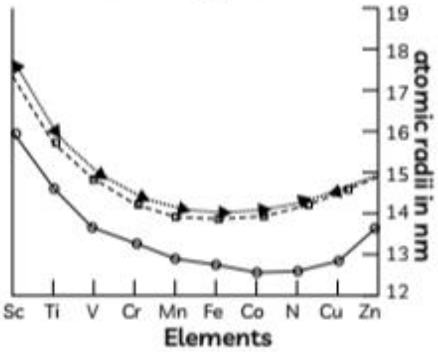
(d) Henry's law at all compositions 1

2. Which of the following is not the reducing sugar from the following?

(a) Fructose (b) Galactose

(c) Sucrose (d) Lactose 1

3. With the help of the graph given below answer the following question.



Why there are gradual decrease in ionic radii in going from Ti^+ ion to Cu^+ ?

(a) Due to decrease in effective nuclear charge.

(b) Due to increase in effective nuclear charge.

(c) Due to increase in ionic potential.

(d) Due to decrease in ionic potential. 1

4. Which of the following is the condition for solutions showing positive deviation in case of non-ideal solutions?

(I) $P = P_A + P_B = P°_A X_A + P°_B X_B$

i.e.,

$P_A = P°_A X_A; P_B = P°_B X_B$

(II) $P_A > P°_A X_A; P_B > P°_B X_B$

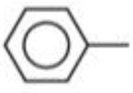
(III) $P_A < P°_A X_A; P_B < P°_B X_B$

(a) Only (I)

(b) Only (II)

(c) Both (I) and (III)

(d) All of the above 1

5. The common name of  N $(CH_3)_2$ is:

(a) N-Diethyl benzyl

(b) N-Bimethyl aniline

(c) N, N-Dimethyl-aniline

(d) 2° amine 1

6. The octahedral complexes are formed either by d^2sp^3 or sp^3d^2 hybridisation and can be grouped into two categories *i.e.* outer and inner orbital complex.

Which of the following is/are the example of outer orbital complex?

(a) $[CoF_6]^{3-}$ (b) $Zn(NH_3)_6]^{2+}$

(c) Both (a) and (b) (d) None of these 1

7. Write the odd one out from the following coordination complexes.

$[HgI_3]^-$, $[ZnCl_4]^{2-}$, $[Ni(CO)_4]$, $[MnCl_4]^{2-}$

(a) $[HgI_3]^-$ (b) $[ZnCl_4]^2$

(c) $[Ni(CO)_4]$ (d) $[MnCl_4]^{2-}$ 1

8. $R\text{-}NO_2 + 6H \longrightarrow RNH_2 + 2H_2O$

Write the missing reagent used in above reaction.

(a) HNO_3 (b) Sn/HCl

(c) H_2O_2 (d) K_2NO_3 1

9. Order of dehydration of alcohol follows:

(a) 2^0 alcohol>3^0 alcohol> 1^0 alcohol

(b) 3^0 alcohol> 2^0 alcohol > 1^0 alcohol

(c) 1^0 alcohol> 3^0 alcohol> 2^0 alcohol

(d) 3^0 alcohol<2^0 alcohol>1^0 alcohol 1

10. Glucose is a/an:

(a) aldopentose (b) ketohexose

(c) aldohexose (d) ketopentose 1

11. The term used for a solution that has higher osmotic pressure than its standard solution is:

(a) Hypotonic (b) Hypertonic

(c) Isotonic (d) Concentrated 1

12. The plant cell will shrink when placed in:

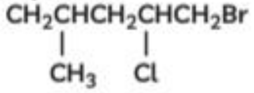
(a) water

(b) a hypotonic solution

(c) a hypertonic solution

(d) an isotonic solution 1

13. Which is the correct structure for the following compound?



$$\underset{\displaystyle CH_3}{CH_2CH}CH_2\underset{\displaystyle Cl}{CH}CH_2Br$$

(a) 1-Bromo-2-chloro-4-methylhexane

(b) 1-Bromo-2-chloro-4-methylpentane

(c) 1-Bromo-3-chloro-4-methylpentane

(d) 5-Bromo-4-chloro-4-methylpentane 1

14. Give the IUPAC name of the following:

$CH_3CH(Cl)CH(Br)CH_3$

(a) 3-Bromo-2-chloro butane

(b) 3-Bromo-3-chloro butane

(c) 2-Bromo-2-chloro butane

(d) 2-Bromo-3-chloro butane 1

In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both (A) and (R) are true and (R) is the correct explanation of (A).

(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).

(c) (A) is true but (R) is false

(d) (A) is false but (R) is true

15. Assertion: Alkylamines undergo electrophilic substitution reaction.

Reason: NH_2 group present on the benzene ring behaves as an o- and p- directing group and directs the incoming electrophile at the ortho and para-position of the aromating ring. 1

16. Assertion: Slowest elementary step is also refereed as rate determining step.

Reason: The rate of the reaction is determined by the rate of slowest elementary step. 1

17. Assertion: Acetaldehyde and formaldehyde can be distinguished by iodoform test

Reason: Acetaldehyde gives a yellow ppt when heated with iodine while formaldehyde does not give this test. 1

18. Assertion: Phenol develop red or pink color on long standing.

Reason: Phenol turns pink in colour on exposure to air due to slow reduction. 1

SECTION - B

14 Marks

(The following questions are very short answer type with internal choice in two questions and carry 2 marks each.)

19. Write the oxidation number of:

(A) Fe in $K_3[Fe(CN)_6]$

(B) Au in $H[AuCl_4]$

OR

What type of isomerism is shown by the following compounds?

(A) $[Cr(SCN)(H_2O)_5]^{2+}$ and $[Cr(NCS(H_2O)_5]^{2+}$

(B) $[Cu(NH_3)_4][PtCl_4]$ and $[Pt(NH_3)_4][CuCl_4]$ 2

20. Elaborate the composition and role of these following reagents in reactions:

(A) Fehling solution

(B) Tollen's reagent 2

21. Write the equation of the formation of following compounds showing nuceophilic substitution reaction.

(A) $CH_3CH_2CH_2CN$

(B) $CH_3CH_2CH_2CH_2NO_2$

OR

How will you carry out the conversion of chlorobenzene to:

(A) Salicyladehyde

(B) Phenol 2

22. Compute the graphical behavior of first order reaction by plotting on graph:

(A) concentration against time

(B) $\log_{10}[A]$ against time 2

23. (A) For a reaction $A + B \longrightarrow P$, the rate law is given by, $r = k\,[A]^{1/2}\,[B]^2$. What is the order of this reaction?

(B) A first-order reaction is found to have a rate constant $k = 5.5 \times 10^{-14}\ s^{-1}$. Find the half-life of the reaction. 2

24. Write down the deficiency disease and chemical names of following vitamins.

(A) Vitamin B_1 (B) Vitamin K 2

25. An alcohol 'A' of molecular formula (C_2H_6O) carried out with conc. Solution of HI and gives 'B'. 'A' is treated with HCl in the presence of dehydrating agent gives product 'C'. Find out 'A', 'B' and 'C'. 2

SECTION - C

15 Marks

(The following questions are short answer type with internal choice in one question and carry 3 marks each.)

26. Elaborate the oxidizing character of $KMnO_4$ in:

(A) Alkaline solutions

(B) Neutral solutions 3

27. Write down the basic strength of following amines in increasing order.

(A) *o*-nitro aniline, *m*-nitro aniline , *p*-nitro aniline, aniline

(B) Methylamine, ethylamine, aniline , benzylamine

(C) N, N-dimethyl aniline, aniline, N-methyl aniline 3

28. Account for any three of the following:

(A) Transition metals and their compounds are known to be the good catalysts in many of the processes.

(B) Zn, Cd and Hg are not regarded as transition elements.

(C) Ce^{3+} can be easily oxidized to Ce^{4+}

(D) Cr^{2+} is a stronger reducing agent than Fe^{2+} 3

29. Write any three tests for glucose.

OR

Write a short note on:

(A) Mutarotation

(B) Similarity between D– Lactose and D-maltose

(C) Furanose structures of fructose 3

30. Draw the structures of following complexes based on Werner's theory and state the total no. of ions participated.

(A) $CoCl_3.5NH_3$ (B) $CoCl_3.4NH_3$

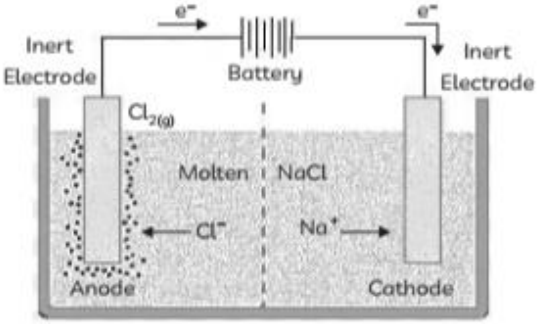
(C) $CoCl_3.6NH_3$ 3

SECTION - D

8 Marks

(The following questions are case-based questions. Each question has an internal choice and carries 4 (1 + 1 + 2) marks. each. Read the passage carefully and answer the questions that follow.)

31. *Atoms and molecules interact throughout all chemical processes. A few grammes of each chemical composition contain many atoms or molecules, changing in number depending on their atomic or molecular masses. The mole idea was developed to efficiently handle such a big quantity. The mole idea is also the foundation of all electrochemical cell processes. For instance, 400 mL of an aqueous NaCl solution with a 5.0 molar concentration is electrolyzed. As a result, chlorine gas develops at one of the electrodes.*



The mole idea may be used to determine how many items are produced:

(A) During reaction, what is the number of moles of Cl_2 gas evolved? 1

(B) Name any two strong electrolyte in an aqueous solution. 1

(C) (i) Write the unit of $\wedge_m$.

(ii) Calculate Λ°_m for acetic acid:

Given that Λ°_m (HCl) = 426 S cm^2 mol^{-1}

Λ°_m (NaCl) = 126 S cm^2 mol^{-1}

Λ°_m (CH_3COONa) = 91 S cm^2 mol^{-1}

OR

A current of 3 amperes passing through $AgNO_3$ solution for 20 minutes deposited 4.0g of silver. Calculate electron chemical equivalent of silver (Atomic of silver = 108). 2

32. *A hydroxy (-OH) group is directly joined to the aromatic ring in phenols. The term "phenolic group" often refers to a hydroxyl group that is joined to an aromatic ring. Phenols exhibit several reactions that are comparable to those of alcohols because they include the -OH group. However, because the -OH group is directly attached to the aromatic ring, it behaves quite differently from alcohols. Because of this, phenols act quite differently from alcohols in a variety of ways. The following categories can be used to group the chemical reactions of phenols.*

(I) Responses involving the -OH group.

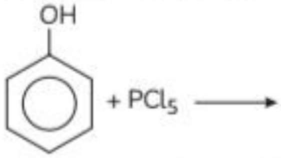
(II) Reactions using an aromatic ring, such as benzene.

(A) Which compounds are formed when phenol reacts with acid chlorides and acid anhydrides? 1

(B) Which is the reason behind acidic character of phenols? 1

(C) (i) What is the correct order of acidic strength of nitrophenols:

m-nitrophenol, o-nitrophenol, p-nitrophenol, phenol

(ii) 

In the above reaction , which is the major product formed?

OR

Give structures of the products you would expect when each of the following alcohol reacts with (a) HCl-$ZnCl_2$ (b) HBr

(i) Butan-1-ol

(ii) 2-Methylbutan-2-ol 2

SECTION - E

15 Marks

(The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.)

33. (A) When 0.0821*g* of hydroxyl benzaldehyde is dissolved in 20*g* of naphthalene. The freezing point of naphthalene is 80.1^0C. and the depression in freezing point is found to be 0.232^0C. then, find the molar depression constant and deduce the latent heat of fusion for naphthalene.

(B) Consider ΔT_b is the elevation of boiling point and m is the molality of solution. Then, show that ΔT_b is directly proportional to *m*. 5

34. Write down the following named reactions.

(A) Etard reaction.

(B) Gattermann- Koch reaction

OR

How will you distinguish between the following?

(A) Benzaldehyde and acetophenone

(B) Pentan-2one and pentan-3-one

(C) Diethyl ketone and acetone

(D) Formaldehyde and acetaldehyde

(E) Acetaldehyde and benzaldehyde 5

35. (A) State yes or no. Can nickel displace hydrogen from hydrochloric acid. Explain your answer.

$$E^0_{Ni^{2+}/Ni} = -0.25 \text{ V}$$

(B) State any four important features of electrochemical series .

(C) Draw the labelled diagram of Daniel cell and show:

(i) the reaction of half cells and the net cell reaction.

(ii) the direction of flow of current and direction of flow of electrons.

OR

(A) What are the criteria for product formation during electrolysis?

(B) State any three applications of Kohlrausch's law.

(C) Name the metal that can be obtained by the electrolysis of an aqueous solution of its salts. 5

SOLUTION

SECTION - A

1. *(c) positive deviation from Raoult's law*

   Explanation: A solution shows positive deviation from Raoult's law any composition, its vapour presseue is higher than that given by Raoult's law.

Related Theory

- *Solutions with weaker A-B interactions than A-A or B-B interactions demonstrate a positive divergence from Raoult's rule. These mixtures produce minimum boiling azeotropes. Solutions where the A-B interactions are stronger than the A-A or B-B interactions demonstrate a negative deviation from Raoult's law. These mixtures provide the highest boiling azeotropes.*

2. *(c) Surcrose*

   Explanation: All monosaccharides and disaccrides except sucrose are reducing sugars. Fructose and galactose are monosaccharides and lactose is a dissachrides.

Related Theory

- *Non-reducing sugars are the carbohydrates which do not contain free functional group and so they do not reduce Fehling's or Tollen's reagent. All polysaccharides are non reducing.*

3. *(b) Due to increase in effective nuclear charge.*

   Explanation: The nuclear charge gradually grows from left to right over time. The electron enters the same shell as the atomic number rises over time. They get increasingly drawn to the nucleus as a result. As a result of this force of attraction from the nucleus, the ionic radii gradually decreases.

4. *(b) Only (II)*

   Explanation: A solution is said to show positive deviation from Raoult's law at any composition, its vapour pressure is higher than that given by Raoult's Law.

5. *(c) N, N-Dimethyl-aniline*

   Explanation: As two methyl groups are attached to –N, so it is named as N,N-dimethyl aniline.

6. *(c) Both (a) and (b)*

   Explanation: Complexes which involves the sp^3d^2 hybridisation are called outer orbital complexes and both $[CoF_6]^{3-}$ and $Zn(NH_3)6]^{2+}$ are the examples of outer orbital complexes. Because they involves the participation of outer d-orbitals.

7. *(a) $[HgI_3]^-$*

   Explanation: $[HgI_3]^-$ have the geometry of trigonal planar while rest of the coordination complexes shows the geometry of tetrahedral.

8. *(b) Sn/HCl*

   Explanation: This is the reaction of reduction of nitro compound which is done in the presence of reducing agents. So, Sn/HCl is a reducing agent while other options are the oxidizing agents.

9. *(b) 3^0 alcohol > 2^0 alcohol > 1^0 alcohol*

   Explanation: the ease of formation of alkene i.e. the ease of dehydration of alcohol depends upon the stability of carbocation formed during dehydration of alcohol. Since, the stability of carboctaions follows the order $3^\circ > 2^\circ > 1^\circ$, the ease of dehydration also follows the same order.

10. *(c) aldohexose*

    Explanation: Glucose (also known as dextrose) is a carbohydrate compound consisting of six carbon atoms and an aldehyde group and they are referred to as aldohexose.

11. *(b) Hypertonic*

    Explanation: A solution having higher osmotic pressure than its standard solution is said to be called hypertonic solution. A solution having a lower osmotic pressure relative to its standard solution is called hypotonic solution. Solutions which have the same osmotic pressure as that of its standard solutions are termed as isotonic or iso-osmotic solutions.

12. *(c) a hypertonic solution*

    Explanation: Hypertonic solutions have higher osmotic pressure and therefore they have higher concentration. When a plant cell is kept in hypertonic solution, plant cell loses water and therefore the plant cell gets shrinked.

13. *(b) 1-Bromo-2-chloro-4-methylpenane*

Explanation: Alphabetically, the halogens are arranged bromo at position 1 and chloro at position 2 and word root for this unsaturated compound is pentane.

14. *(d) 2-Bromo-3-chloro butane*

Explanation: Alphabetically the bromo derivative is named first followed by chloro and word root is butane as it is a four carbon atom saturated chain.

15. *(c) (A) is true but (R) is false*

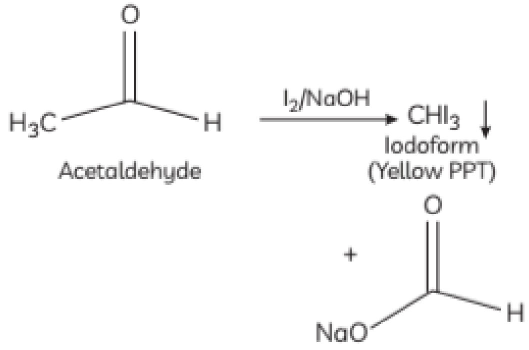
Explanation: Arylamines like aniline shows the mechanism of electrophilic substitution reaction at ortho and para positions of the ring as NH_2 group present on the benzene ring behaves as an o- and p- directing group and directs the incoming electrophile at the ortho and para- position of the aromating ring.

16. *(a) Both (A) and (R) are true and (R) is the correct explanation of (A).*

Explanation: Since the rate of the slowest elementary step determines the pace of the reaction, it is also known as the rate-determining step.

17. *(a) Both (A) and (R) are true and (R) is the correct explanation of (A).*

Explanation: Acetaldehyde and formaldehyde can be distinguished by iodoform test. Acetaldehyde gives a yellow ppt when heated with iodine while formaldehyde does not give this test.



18. *(d) (A) is false but (R) is true*

Explanation: When phenol is exposed to air, it slowly oxidises and becomes pink. Phenoquinone, which is pink in colour, is created when quinone, which was first created from phenol, is combined with phenol.

SECTION - B

19. (A) $+3 + X + (-1) \times 6 = 0$

$X = +3$

(B) $+1 + X + (-1) \times 4 = 1$

$X = +3$

OR

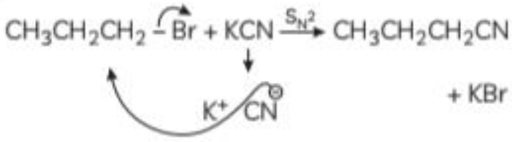
(A) Linkage isomerism

(B) Coordination isomerism

20. (A) Fehling's solution, an intensely blue alkaline solution, is used to detect the presence of aldehydes or groups containing any aldehyde functional group (–CHO), as well as to distinguish between reducing and non-reducing sugars using Tollen's reagent. To distinguish between a ketone group and water-soluble carbohydrates, utilise Fehling's solution.

(B) It is a ammonical solution of silver nitrate. It is formed by the addition of dilute solution of ammonium hydroxide to silver nitrate till the formed dirty white ppt of AgOH is dissolved.

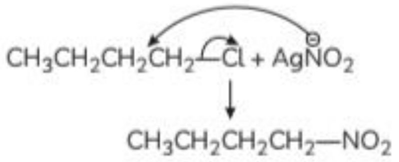
21. (A)



$CH_3CH_2CH_2-Br + KCN \xrightarrow{S_N2} CH_3CH_2CH_2CN + KBr$

$K^+ \overset{\ominus}{C}N$

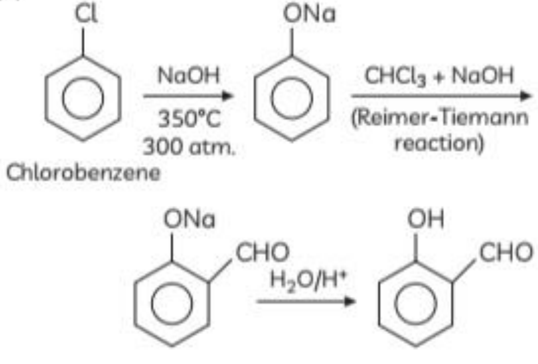
(B)



$CH_3CH_2CH_2CH_2-Cl + Ag\overset{\ominus}{N}O_2 \rightarrow CH_3CH_2CH_2CH_2-NO_2$

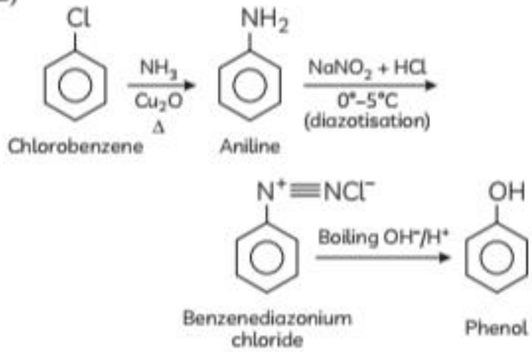
OR

(A)

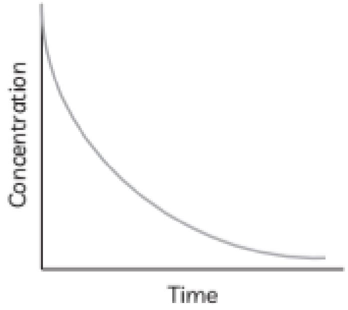


Salicylaldehyde

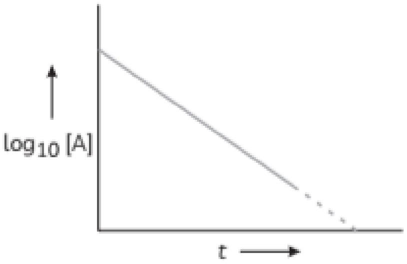
(B)



22. (A)



(B)



Related Theory

- *The plot of the logarithm of [A] versus time is a straight line with k = – slope of the line.*

23. (A) $\frac{5}{2}$

(B) $t_{½} = 1.26 \times 10^{13}$ s
(Hint: $r = k[A]^{½}[B]^2$, $t^{½} = 0.693/k$)

Caution

- *You can judge the reaction order by knowing the unit of rate constant. General formula for units of rate constant is found out using the following formula*

$$\text{Rate constant } (k) = \frac{\text{Rate}}{[A]^x[B]^y}$$

$$= \frac{\text{concentration}}{\text{time}} \times \frac{1}{(\text{concentration})^n}$$

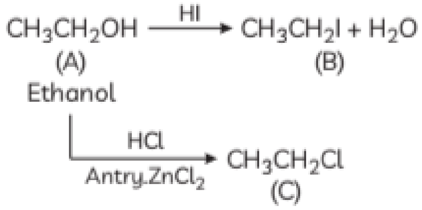
$$= \frac{\text{mol L}^{-1}}{\text{s}} \times \frac{1}{(\text{mol L}^{-1})^n}$$

$$= mol^{(1-n)} L^{(n-1)} s^{-1}.$$

24. (A) Disease: beri-beri , chemical name: thiamine

(B) Disease: haemorrhage, chemical name: phylloquinone

25.



$$\underset{\substack{(A)\\ \text{Ethanol}}}{CH_3CH_2OH} \xrightarrow{HI} \underset{(B)}{CH_3CH_2I} + H_2O$$

$$CH_3CH_2OH \xrightarrow[\text{Antry.}ZnCl_2]{HCl} \underset{(C)}{CH_3CH_2Cl}$$

SECTION - C

26. (A) In the presence of an alkali, purple coloured potassium permanganite reduces to green coloured potassium manganite. Potassium manganate further gets reduces to MnO_2 in presence of reducing agent.

$4\,KMnO_4 + 2H_2O \rightarrow 4MnO_2 + 3O_2 + 4KOH$

It oxidises potassium iodide to potassium iodate.

It oxidises nitrotoluene to nitrobenzoic acid.

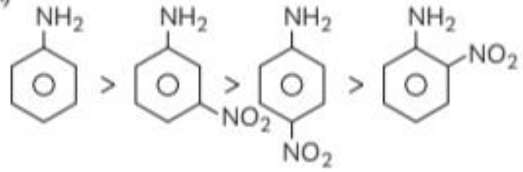
(B) In this, potassium permanganate behaves as moderate oxidizing agent as shown in the reaction:

$MnO_2 + 2H_2O + 3e^- \longrightarrow MnO_{2(s)} + 4OH^-$

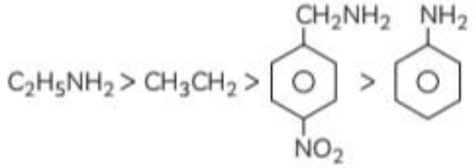
It oxidises manganous sulphate to manganese dioxide.

It oxidises hydrogen sulphide to sulphur.

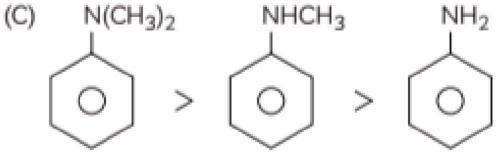
27. (A)



(B)



(C)



Caution

- *Students usually get confused between the acidic strength and basic strength of compounds. To answer this appropriately, student must understand the effect of electron-withdrawing and electron-releasing group towards the benzene and alkyl groups.*

28. (A) The capacity of transition metals and their compounds to change oxidation state or, in the case of the metals, to adsorb other substances on to their surface and activate them as a result, makes them catalysts.

(B) Due to their electrical makeup, elements like Zn, Cd, and Hg are not transition elements. These three parts' electrical arrangement can be represented generally as $(n-1)d^{10}\ ns^2$. Both in their ground state and in their overall oxidation state, these elements' orbitals are all filled. As a result, these components are not transitional elements.

(C) Ce^{4+} ions are formed when Ce^{3+} ions with the configuration $4f^15d^06d^0$ lose one electron and change to the configuration $4f^05d^06s^0$.

(D) This is because E°(Cr^{3+}/Cr^{2+}): $3d^5\ 4s^1/\ 3d^5$ is negative (–0.41V) whereas E°(Fe^{3+}/Fe^{2+}): ($3d^6/3d^5$) is positive (+0.77 V). Thus, Cr^{2+} is easily oxidised to Cr^3 but Fe^{2+} cannot be easily oxidised to Fe^{3+}.

Related Theory

- *Oxidation = electron loss; Reduction = electron gain.*
- *A reducing agent supplies electrons that go on to reduce another species. It is itself oxidised.*

29. Test for glucose are as follow:

(1) **Bromine water test:** when glucose is reacted with bromine water, the red color of bromine water disappears and solution turns colourless.

(2) **Silver mirror test:** when glucose is warmed with ammonical silver nitrate, silver mirror appears on the inner walls of the test tube.

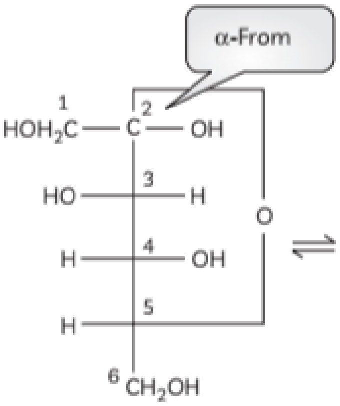
(3) **Fehlings solution test:** when glucose is heated with fehlings solution, a red precipitate of Cu_2O is formed.

OR

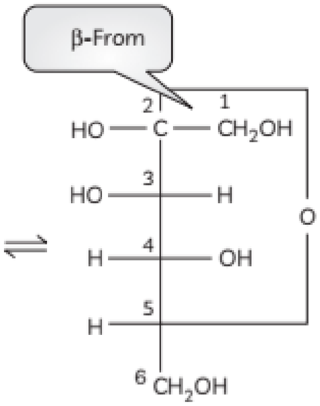
(A) Due to a shift in the equilibrium between two anomers in a solution, mutarotation refers to a variation in the specific rotation of plane-polarized light. A hemiketal or hemiacetal group is required for any molecule to exhibit mutarotation. Sugar is where the mutarotation characteristic was originally discovered. Different sugars rotate in aqueous solutions in different ways.

(B) Both have α and □ anomers that can undergo mutarotation

(C) The fructofuranose structure is obtained by the internal ketal formation by combining the keto group at C_2 carbon and the –OH group at C_5 carbon.

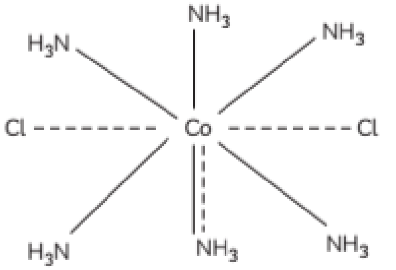


α-D-(-)-Fructofuranose



β-D-(-)-Fructofuranose

30. (A)

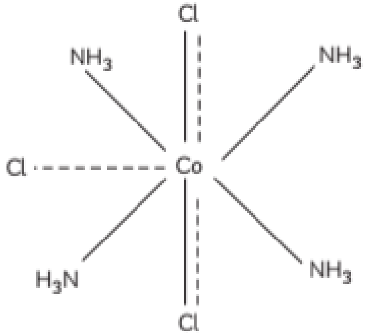


Structure of $COCl_3.5NH_3$ complex

Number of Cl^- ions precipiated = 2

Total number of ions = 3

(B)

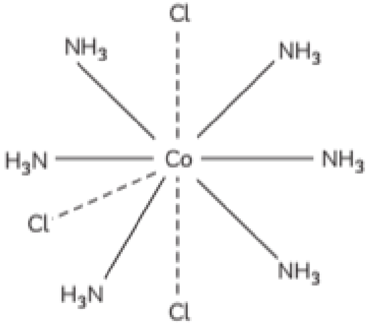


Structure of $COCl_3.4NH_3$ complex

Number of Cl^- ions precipiated = 1

Total number of ions = 2

(C)



Structure of $COCl_3.6NH_3$ complex

Number of Cl^- precipated = 3

Total number of ions = 4

SECTION - D

31. (A) Moles of NaCl = 5 × 0.4 = 2 moles.

2 moles of NaCl has 2 moles of Cl^-

$$2Cl \rightarrow Cl_2 + 2e^-$$

The balanced chemical equation clearly depicts that 2 moles of Cl^- yields 1 mole of Cl_2 gas.

Therefore, 1 mole of Cl_2 gas has been evolved.

(B) $AgNO_3$, HCl

(C) (i) $Sm^2\ mol^{-1}$

Explanation: The unit of molar conductivity is Seimen $m^2\ mol^{-1}$.

(ii) $\Lambda^\circ_m (CH_3COOH) = \Lambda^\circ_m(H^+) + \Lambda^\circ_m (CH_3COO^-)$

[Kohlraouch Law]

$\Lambda^\circ_m (HCl) = \Lambda^\circ_m(H^+) + \Lambda^\circ_m (Cl^-)$ ...(1)

$\Lambda^\circ_m (NaCl) = \Lambda^\circ_m(Na^+) + \Lambda^\circ_m (Cl^-)$ ...(2)

$\Lambda^\circ_m (CH_3COONa) = \Lambda^\circ_m(CH_3COO^-) + \Lambda^\circ_m (Na^+)$ ...(3)

On subtracting 2 from 3 and on addition of 1

we get,

$$= 96 - 126 + 426$$

$$= 396$$

$\Lambda^\circ_m (CH_3COOH) = 396\ Scm^2\ mol^{-1}$

OR

Given that:

$I = 3A$

$m = 4g$

$t = 20$ minutes $= 20 \times 60 = 1200$ seconds

$Z = ?$

We know that, $m = Z \times I \times t$

Also $Z = \frac{m}{I} \times t$

$$Z = \frac{4}{3} \times 1200$$

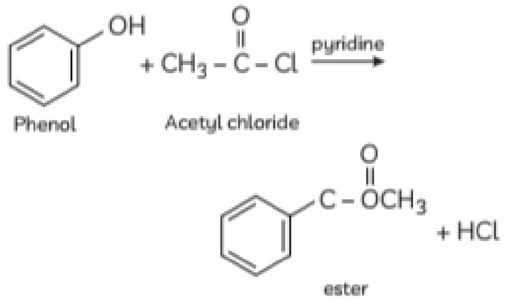
$$= \frac{1}{900} = 1.1 \times 10^{-3}$$

Related Theory

- *Chemical equivalent is the weight of the element corresponding to a unit weight of hydrogen, either as replacing it, or combining with it. It is often conveniently used in electrochemistry to avoid the necessity of dividing by the valency when atomic weights are used.*

32. (A) Esters

Explanation: Phenol reacts with acid chlorides and acid anhydrides and form esters. For example:



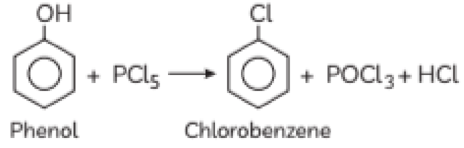
(B) The phenoxide ion also shows resonance. Both phenol and phenoxide ions are resonance stabilized but phenoxide ion acquires greater stability.

(C) (i) p-nitrophenol> o-nitrophenol> m-nitrophenol>phenol

Explanation: The effect of electron-withdrawing groups such as $-NO_2$ group is more pronounced at o- and p-positions than m-positions.

(ii) Triphenyl phosphate

Explanation:



$$\underset{\text{Phenol}}{3C_6H_5OH} + POCl_3 \longrightarrow \underset{\text{Triphenyl phosphate}}{(C_6H_5)_3PO_4} + 3HCl$$

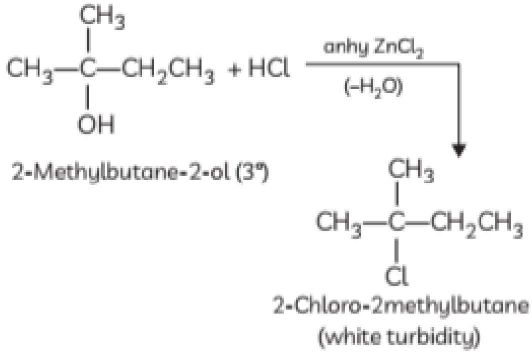
In the above reaction, the main product for the reaction is triphenyl phosphate.

OR

(i) With HCl–ZnCl₂

$$\underset{\text{Butan-1-ol (I°)}}{CH_3CH_2CH_2CH_2OH} + \underset{\text{(conc)}}{HCl} \xrightarrow[ZnCl_2]{anhy}$$

No reaction at room temperature



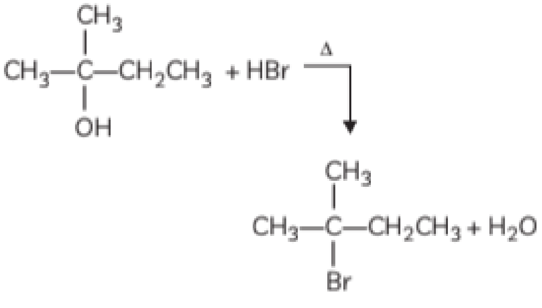
$$CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{OH}{|}}{C}}-CH_2CH_3 + HCl \xrightarrow[(-H_2O)]{anhy\ ZnCl_2} CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{Cl}{|}}{C}}-CH_2CH_3$$

2-Methylbutane-2-ol (3°)

2-Chloro-2methylbutane
(white turbidity)

(ii) With HBr

$$CH_3CH_2CH_2CH_2OH + HBr \xrightarrow{\Delta} \underset{\text{1-Bromobutane}}{CH_3CH_2CH_2CH_2Br} + H_2O$$



$$CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{OH}{|}}{C}}-CH_2CH_3 + HBr \xrightarrow{\Delta} CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{Br}{|}}{C}}-CH_2CH_3 + H_2O$$

2-Bromo-2-methylbutane

SECTION - E

33. (A) Mass of solute ($C_7H_6O_2$), w = 0.0821 g

Mass of solvent naphthalene, W = 20 g

Depression of freezing point, □T_f = 0.232°C

Molar mass of solute ($C_7H_6O_2$), M' = 84 + 6 + 32 = 122

$$M' = \frac{1000 \times K_f \times w}{W \times \Delta T_f}$$

$$K_f = \frac{M' \times W \times \Delta T_f}{1000 \times w}$$

$$= \frac{122 \times 20 \times 0.232}{1000 \times 0.0821}$$

$$= 6.895 \text{ K Kg mol}^{-1}$$

Molar depression constant K_f is given by,

$$K_f = \frac{RT_f^2}{1000 \times L_f}$$

$R = 1.987 \text{ cal K}^{-1} \text{ mol}^{-1}, T_f = 80.1°C = 353.1 \text{ K}$

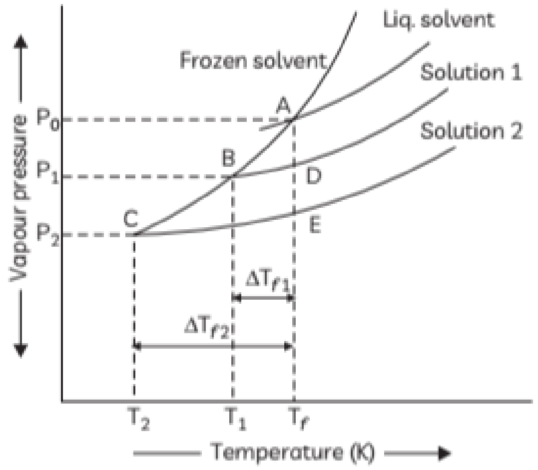
$$L_f = \frac{RT_f^2}{1000 \times L_f}$$

$$= \frac{1.987 \times (353.1)^2}{1000 \times 6.895}$$

$$= 35.93 \text{ cal g}^{-1}.$$

Hence, the molal depression constant for naphthalene is 6.895 K kg mol^{-1} and its latent heat of fusion is 35.93 cal g^{-1}.

(B) An expression for the depression of the freezing point can be derived in the same way as used for the elevation of boiling point. The derivation is as follows.



If the curves AB, AC, BD and CE shown in Fig. above are assumed to be straight lines, triangles lines, triangles ABD and ACE may be regarded as similar triangles.

For similar triangles ABD and ACE, we have

$$\frac{BD}{CE} = \frac{AD}{AE}$$

or $$\frac{T_f - T_1}{T_f - T_2} = \frac{p° - p_1}{p° - p_2} \quad ...(1)$$

where, $p°$ = Vapour pressure of liquid solvent at its freezing point T_f

p_1 = Vapour pressure of solution 1 at temperature T_1

p_2 = Vapour pressure of solution 2 at temperature T_2.

Eq. (i) can be written as

$$\frac{\Delta T_{f_1}}{\Delta T_{f_2}} = \frac{\Delta_{p_1}}{\Delta_{p_2}} \quad ...(ii)$$

If follows from eq. (ii) that in general,

$$\Delta T_f \propto \Delta_p \quad ...(iii)$$

Thus, depression of freezing point is directly proportional to the lowering of vapour pressure.

According to Raoult's law, for a dilute solution,

or $$\frac{p° - p}{p°} = \frac{wM}{WM'}$$

or $$\frac{\Delta p}{p°} = \frac{wM}{WM'}$$

$$\Delta p = p°M \times \frac{w}{WM'}$$

Since $p°M$ is a constant for a particular solvent, we have

$$\Delta_p \propto \frac{w}{WM'} \quad ...(iv)$$

Comparing eqs. (iii) and (iv), we have

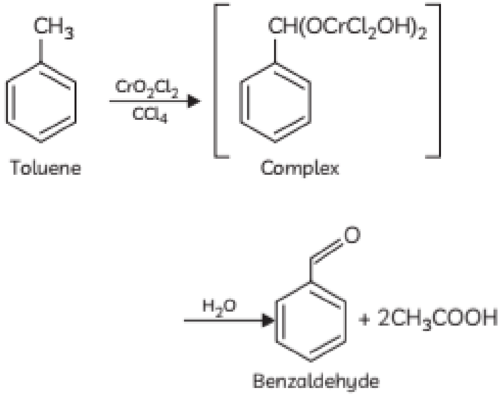
$$\Delta T_f \propto \frac{w}{WM'}$$

If W (mass of solvent) = 1 kg, $\frac{w}{WM'}$ represents the molality m of the solution. Therefore,

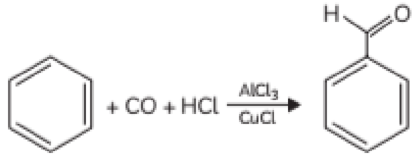
$$\Delta T_f \propto m$$

$$\Delta T_f = K_f m$$

34. (A)



(B)



OR

(A) They can be distinguished by silver mirror test and iodoform test. Benzaldehyde gives silver mirror when heated with tollen's reagent but acetophenone does not.

(B) They can be distinguished by iodoform test as pentan-2-one being a methyl ketone gives yellow ppt of iodoform while pentan-3-one does not form yellow ppt when heated with iodine and alkali.

(C) They are distinguished by sodium bisulphite test as acetone being a methyl ketone gives white ppt of bisulphite compound when treated with saturated solution of sodium bisulphite while diethyl ketone does not give this test.

(D) They are distinguished by iodoform test. Acetaldehyde gives yellow ppt of iodoform while formaldehyde does not give this test.

(E) They are distinguished by iodoform test as acetaldehyde gives thi test while benzaldehyde does not.

35. (A) Yes, nickel can displace hydrogen from hydrochloric acid. This is beacause, E^0 for the reaction is positive.

$$Ni_{(s)} + 2H^+_{(aq)} \longrightarrow Ni^{2+}_{(aq)} + H_2$$

(B) The features of electrochemical series are:

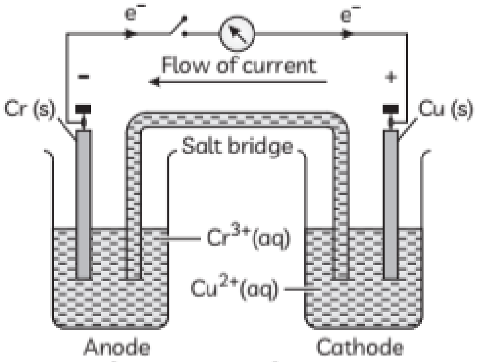
(i) The reactivity of metals decreases on moving down the group.

(ii) Elements placed at the end of the series have the highest value of standard reduction potential.

(iii) A metal can displace any other metal placed below it in the series from its salt solutions.

(iv) The elements placed at the top of the electrochemical series have the minimum value of standard reduction potential.

(C)



$Cr(s) \rightarrow Cr^{3+}(aq) + 3e^-$ $Cr^{2+}(aq) + 2e^- \rightarrow Cu(s)$

OR

(A) The crieteria for product formation during electiolysis.

(i) The substance which possesses higher standard electrode potential is reduced at the cathode.

(ii) The substance which has lower standard reduction potential is oxidized at the anode.

(B) Applications of Kohlrausch's law are as follows:

(i) Determination of $\wedge_m{}^\infty$ for weak electrolytes.

(ii) Determination of degree of dissociation of a weak electrolyte.

(iii) Determination of the solubility of a sparingly soluble salt.

(C) Silver