CBSE Sample Paper 12

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.)

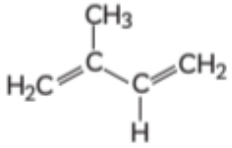
1. Which of the following is correct about H-bonding in nucleotide?

(a) A-T, G-C (b) A-G, T-C
(c) G-T, A-C (d) A-A, T-T 1

2. Which of the following is not a base of RNA?

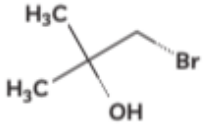
(a) Thymine (b) Adenine
(c) Uracil (d) Cytosine 1

3. The correct IUPAC name of the compound is:



(a) 2-Methyl 1,3-butadiene
(b) 3-Methyl 1,4-butadiene
(c) 2-Methyl pentadiene
(d) 3-Pentadiene 1

4. Write the IUPAC name of:



(a) 2-Bromo-2-methylpropan-1-ol
(b) 3-Bromo-2 –methylpropanol-1-ol
(c) Bromo-2-methylpropanol
(d) 3-Bromo-2-methylpropane-1-ol 1

5. Which of the following is formed by the reaction of benzoic acid with a mixture of concentrated sulphuric acid and nitric acid?

(a) *o, p*-dinitrobenzoic acid
(b) *m*-nitrobenzoic acid
(c) *o*-nitrobenzoic acid
(d) *p*-nitrobenzoic acid 1

6. Which product is obtained in hydroboration oxidation reaction?

(a) Pentanol (b) Propene
(c) Propanol (d) But-1-ene 1

7. Which reagent is used while converting ammonium acetate to methyl cyanide?

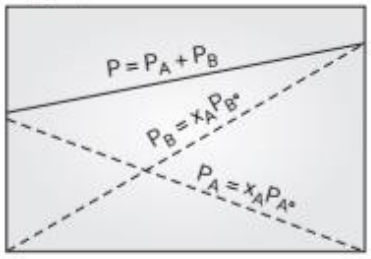
(a) Dry ether (b) P_2O_5
(c) Ni (d) Pyridine 1

8. When ethyl bromide reacts with silver cyanide, the main product will be:

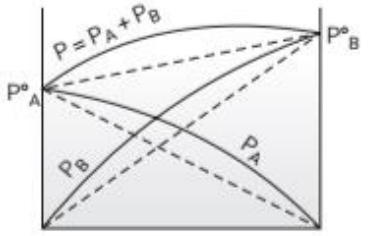
(a) Ethyl cyanide (b) Ethyl isocyanide
(c) Ethene (d) Ethanol 1

9. Which graph is true for ideal solution ?

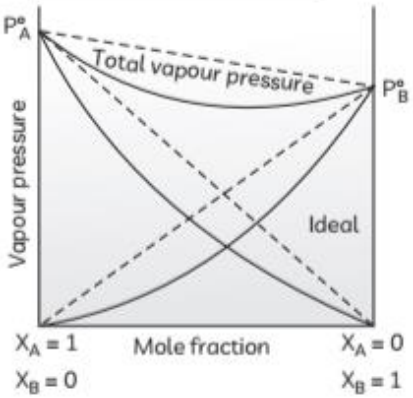
(a)



(b)



(c)



(d) None of these 1

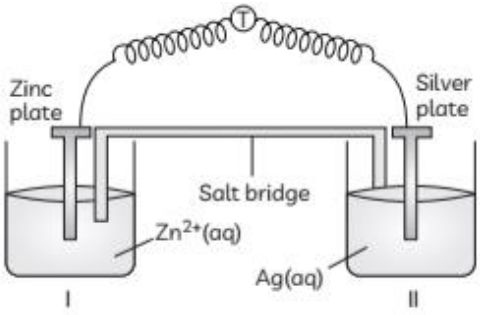
10. Alcohols are esterified in the following order:
(a) 3° > 1° > 2° (b) 2°> 3° > 1°
(c) 1 ° > 2° > 3° (d) None of these 1

11. Butanamide on reaction with bromine in aqueous NaOH gives:
(a) propanamine
(b) ethanamine
(c) n-Methyl ethanamine
(d) propanenitrile 1

12. IUPAC name of product formed by reaction of methyl amine with two moles of ethyl chloride:
(a) N, N-Dimethylethanamine
(b) N, N-Diethylmethanamine
(c) N-Methyl ethanamine
(d) N-Ethyl, N-methylethanamine 1

13. The weight of silver displaced by a quantity of electricity which displaces 5600ml of O_2 at STP will be:
(a) 5.4g (b) 10.8g
(c) 54.9g (d) 108.0g 1

14. Study the following electrochemical cell and answer the following question:



Which of the following is correct cell representation for the given electrochemical cell ?
(a) $Zn(s) \mid Zn^{+2} \parallel Ag^+ \mid Ag(s)$
(b) $Zn^{2+} \mid Zn(s) \parallel Ag(s) \mid Ag^+$
(c) $Zn(s) \mid Zn^+ \parallel Ag^{2+} \mid Ag$
(d) $Zn^{2+}(s) \mid Zn \parallel Ag^+(s) \mid Ag$ 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: The order of reactivity of different alkyl halides towards β elimination reactions is $3^0 > 2^0 > 1^0$.
Reason: 3^0 alkyl halides produce more substituted alkenes, which are being more stable and formed at faster rate. 1

16. Assertion: Effective Atomic Number (EAN) of Fe in its complexes is always 36.
Reason: Oxidation number of Fe in $Fe(CO)_5$ is zero. 1

17. Assertion: Osmotic pressure is inversely proportional to its concentration and temperature remains constant.
Reason: It is a colligative property and it depends on no. of moles of solute dissolved in volume of the solution. 1

18. Assertion: Enzymes are proteins.
Reason: Enzymes are highly specific in nature. 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. A reaction is of second order with respect to a reactant. How is the rate of the reaction affected if the concentration of the reactant is reduced to half? What is the unit of rate constant for such a reaction?

OR

Explain the following terms:

(A) Rate determining step of a reaction.

(B) Molecularity of a reaction. 2

20. (A) Identify the following as primary, secondary and tertiary alcohols.

(i) $CH_3—\underset{\displaystyle OH}{\underset{|}{CH}}—CH_3$

(ii) $CH_3CH_2—OH$

(iii) $CH_3—\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}—OH$

(iv) $CH_3—\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}—CH_2OH$

(B) Write the IUPAC name of neo-pentyl alcohol. 2

21. Identify the pH of the following half cell solutions(at 25°C):

(A) $Pt,H_2(1\ atm)\ |\ H_2SO_4$; $E_{H/H^+} = 0.25V$

(B) $Pt,H_2(1\ atm)\ |\ HCl$; $E_{H/H^+} = 0.4V$

OR

What will be the nature of cell reaction when:

(A) E_{cell} is positive

(B) E_{cell} is zero 2

22. (A) Write down the relation between molar and equivalent conductivity.

(B) Write the equation of degree of dissociation of a weak electrolyte by Kohlrausch's law. 2

23. Complete and balance the following equations:

(A) $Cl_2 + OH^- \longrightarrow$

(B) $3CuO + 2NH_3 + Heat \longrightarrow$ 2

24. Convert the following chemical reactions:

(A) Toluene to benzaldehyde.

(B) Propanone to propene. 2

25. (A) Define ppm.

(B) Find out the relation between mole fraction and molality. 2

SECTION - C

15 Marks

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

26. (A) Arrange the following complexes in decreasing order of stability.

Cu^{2+}, Mn^{2+}, Cd^{2+}, Co^{2+}, Co^{2+}

(B) State the colour shown by the following compounds.

(i) $[Co(NH_3)_6]^{3+}$,

(ii) $[Ti(H_2O)_6]^{3+}$

(C) State any two limitations of crystal field theory. 3

27. (A) Out of $CH_3—NH_2$ and $(CH_3)_3N$, which one has higher boiling point?

(B) Arrange the following in the increasing order of their boiling point:

$C_2H_5NH_2$, C_2H_5OH, $(CH_3)_3\ N$

(C) Give a simple chemical test to distinguish between the following pair of compounds:

$(CH_3)_2NH$ and $(CH_3)_3\ N$

OR

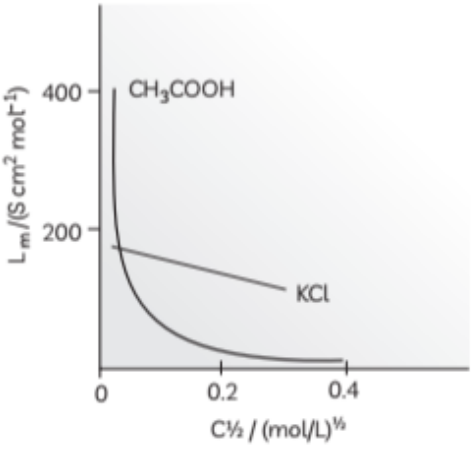
Write the chemical equations involved when aniline is treated with the following reagents:

(A) Br_2 water

(B) HCl

(C) Pyridine 3

28. Analyse the graph given below and answer the following question.



(A) What can be predicted from the given graph about the molar conductivity of the strong and weak electrolytes?

(B) Define limiting molar conductivity. 3

29. (A) Give any two differences between double salts and complexes.

(B) Explain how $[FeF_6]^{3-}$ is paramagnetic outer orbital complex. 3

30. (A) Concentrated nitric acid used in the laboratory work is 68%. Nitric acid by mass in aqueous solution. What should be the molarity of such a sample of the acid, if the density of solution is 1.504 g ml^{-1}.

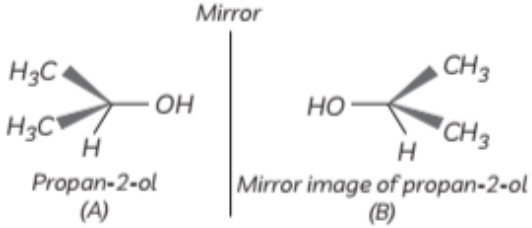
(B) State the Raoult's Law. 3

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. *The mirror image of the molecule is not overlaid on the molecule if all of the substituents connected to that carbon are unique. Asymmetric carbon or stereocenter are two names for such a carbon. Chiral objects are those that cannot be superimposed on their mirror images, whereas achiral objects can not be superimposed on their mirror images. The enantiomers, which are not superimposable mirror images of the steroisomers, are connected to one another. Here, the enantiomers A and B exist.*



Propan-2-ol (A) | *Mirror image of propan-2-ol (B)*

A mixture containing two enantiomers in equal proportions is called racemic mixture.

(A) What are diasteromers? 1

(B) Comment on the reactivity of arly halides towards neucleophilic substitution. 1

(C) Write down the major product of the following reaction:

(i) $CH_3CH(Br)CH_2CH_3 + NaOH \xrightarrow{Water}$

(ii) $(CH_3)_2CH\text{-}CH(Br)CH_2CH_3 \xrightarrow[Ethanol/Heat]{C_2H_5ONa}$

OR

Elaborate the formation of product in the following reaction:

$CH_3CH = CHCH_2Cl + H_2O \rightarrow$

$CH_3CH = CHCH_2OH + CH_3CH(OH)CH = CH_2$ 2

32. *D-Glucose, the most abundant carbohydrate and the most abundant organic compound (if all its combined forms are considered), belongs to the class of carbohydrates called monosaccharides. Monosaccharides are carbohydrate molecules that cannot be broken down to simpler carbohydrate molecules by hydrolysis, so they are sometimes referred to as simple sugars. They can be joined together to form larger structures, namely, oligosaccharides and polysaccharides, that can be converted into monosaccharides by hydrolysis.*

Glucose, also called dextrose, belongs to a group of carbohydrates known as simple sugars (monosaccharides). Glucose has the molecular formula $C_6H_{12}O_6$. It is found in fruits and honey and is the major free sugar circulating in the blood of higher animals. It is the source of energy in cell function, and the regulation of its metabolism is of great importance (gluconeogenesis). Molecules of starch, the major energy-reserve carbohydrate of plants, consist of thousands of glucose units, as do those of cellulose. Also composition of glucose is glycogen, the reserve carbohydate in most vertebrate and invertebrate animal cells, as well as those of numerous fungi and protozoans.

(A) What is the product formed on oxidation of glucose with bromine? 1

(B) Why glucose is refered to as aldohexose. 1

(C) (i) Why polysaccharides are also called carbohydrates?

(ii) Define glycosidic linkage.

OR

(i) How many amino acids are required to make a proten?

(ii) What product is formed on reduction of alcohol with sodium amalgum ? 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) Give 2 examples of zero and first order reaction each.**

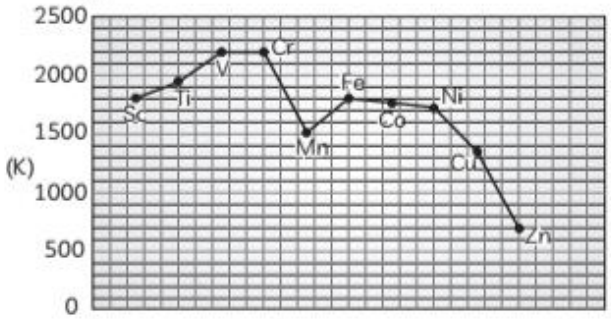
(B) Write any three differences between reaction rate and specific reaction rate. 5

34. **(A) What is lanthanoid contraction?**

(B) Calculate the magnetic moment of Ce^{3+} (Z = 58) using spin only formula.

(C) Mn^{2+} compounds are more stable than Fe^{2+} towards oxidation to their +3 state. Explain.

(D)



What can be predicted from the graph about the variation of melting point for 3*d* series?

OR

The elements of 3d transition series are given as:

Sc, Ti ,V ,Cr, Mn, Fe, Co, Ni, Cu, Zn

Answer the following questions:

(A) Write the element which shows maximum number of oxidation states. Give reasons.

(B) Which element has the highest melting point?

(C) Which element shows only +3 oxidation state?

(D) Which element is a strong oxidising agent in +3 oxidation state and why?

(E) Which element will have zero enthalphy of atomization? 5

35. **(A) How will you convert the following:**

(i) Propene to propan-1-ol

(ii) Ethanol to but-1-yne

(iii) 2-Chlorobutane to 3,4-dimethylhexane

(B) Account for the following:

(i) Why formaldehyde cannot be prepared by Rosenmund's reduction?

(ii) Benzaldehyde is less reactive towards nucleophilic addition reaction than acetaldehyde. Why?

OR

(A) Carry out the following conversions :

(i) p-Nitrotoluene to 2-bromobenzoic acid

(ii) Propanoic acid to acetic acid

(B) An alkene with molecular formula C_5H_{10} on ozonolysis gives a mixture of two compounds, B and C. Compound B gives positive fehling's test and also reacts with iodine and NaOH solution. Compound C does not give fehling's solution test but forms iodoform. Identify the compounds A, B and C. 5

SOLUTION

SECTION - A

1. *(a) A-T, G-C*

Explanation: Adenine pairs with thymine with 2 hydrogen bonds. Guanine pairs with cytosine with 3 hydrogen bonds. Guanine and cytosine bonded base pairs are stronger than thymine and adenine bonded base pairs in DNA.

Related Theory

DNA contains the deoxyribose sugar whereas RNA contains the ribose sugar. All the purine bases adenine and guanine are same in both DNA and RNA while the pyrimidine base cytosine and thymine are present in DNA and uracil is present in RNA instead of the thymine as a pyrimidine base.

2. *(a) Thymine*

Explanation: There are two types of bases namely purines and pyrimidines. Adenine and guanine are purine bases present in DNA but the pyrimidine base uracil is present in RNA whereas the base thymine is present in DNA.

3. *(a) 2- Methyl 1, 3- butadiene*

Related Theory

The International Union of Pure and Applied Chemistry (IUPAC) have given certain rules to name the organic compounds known as the

nomenclature system. It is a set of logical rules devised to circumvent problems caused by arbitrary nomenclature.

4. *(a) 2-Bromo-2-methylpropan-1-ol.*

Related Theory

Following Nomenclature rules are used for naming the alcohols as per the IUPAC.

(1) Find the longest chain containing the hydroxy group (OH). If there is a chain with more carbons than the one containing the OH group it will be named as a substituent.

(2) Place the OH on the lowest possible number for the chain. With the exception of carbonyl groups such as ketones and aldehydes, the alcohol or hydroxy groups have first priority for naming.

(3) When naming a cyclic structure, the —OH is assumed to be on the first carbon unless the carbonyl group is present, in which case the later will get priority at the first carbon.

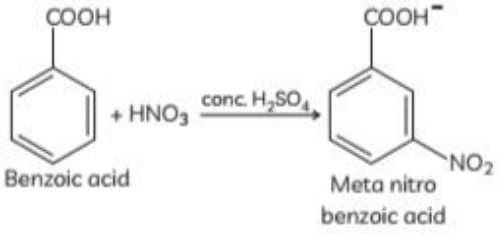
(4) When multiple —OH groups are on the cyclic structure, number the carbons on which the —OH groups reside.

(5) Remove the final e from the parent alkane chain and add -ol. When multiple alcohols are present use di, tri, etc. before the ol, after the parent name. ex. 2, 3-hexandiol.

(6) If a carbonyl group is present, the —OH group is named with the prefix "hydroxy," with the carbonyl group attached to the parent chain name so that it ends with -al or -one.

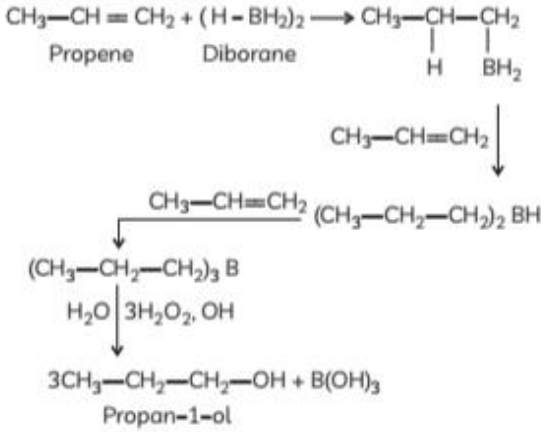
5. *(b) m-nitrobenzoic acid*

Explanation: The reaction of benzoic acid with a mixture of concentrated sulphuric acid and nitric acid is shown below:



6. *(c) Propanol*

Explanation: The hydroboration oxidation reaction is shown:



7. *(b) P_2O_5*

Explanation: Alkyl cyanides are prepared by the dehydration of suitable acid amides in the presence of phosphorus pentaoxide or thionyl chloride.

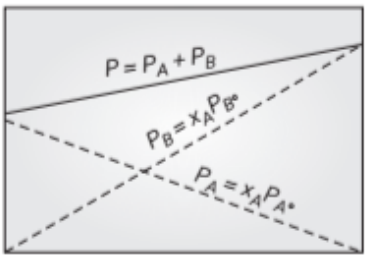
8. *(b) Ethyl isocyanide*

Explanation: $C_2H_5Br + KCN \rightarrow C_2H_5CN + KBr$

This above reaction takes place with KCN which is ionic in nature whereas when the similar reaction takes place with AgBr, ethyl isocyanide is formed:

$$C_2H_5Br + AgCN \rightarrow C_2H_5NC + AgBr$$

9. *(a)*



10. *(c) 1° > 2° > 3°*

Explanation: The relative order of esterification of alcohols is 1° > 2° > 3°. Thus as the steric hinderance (or bulkiness) increases from primary to secondary to tertiary alcohol, the order of esterification decreases.

11. *(a) propanamine*

Explanation: This reaction is called Hoffmann – Bromamide reaction.

$$\underset{\text{Butanamide}}{CH_3CH_2CH_2CONH_2} \xrightarrow{Br_2/NaOH} \underset{\text{Propanamine}}{CH_3CH_2CH_2NH_2}$$

12. *(d) N-Ethyl, N-methylethanamine*

Explanation:

$$\underset{\text{Methyl amine}}{CH_3NH_2} + \underset{\text{Ethyl chloride}}{C_2H_5Cl} \rightarrow \underset{\text{N-ethyl, N-methyl-ethanamine}}{CH_3NHC_2H_5} + HCl$$

13. *(d) 108.0 g*

Explanation: Since 22400 ml is occupied by 1 mole of O_2 at STP.

Hence, the number of moles of oxygen corresponding to 5600 ml is:

$$n_{O_2} = \frac{5600}{22400} = \frac{1}{4} = \frac{W_{O_2}}{M_{O_2}}$$

1 mole of oxygen produces 4 moles of electrons and 1 mole of silver requires 1 mole of electrons.

$$\frac{W_{Ag}}{M_{Ag}} \times 1 = \frac{W_{O_2}}{M_{O_2}}$$

$$\frac{W_{Ag}}{108} = \frac{1}{4} \times 4$$

$$W_{Ag} = 108 \text{ g.}$$

14. *(a) $Zn(s) \mid Zn^{+2} \parallel Ag^{+} \mid Ag(s)$*

Explanation: The cell is:

$$Zn(s) \mid Zn^{+2} \parallel Ag^{+} \mid Ag$$

Anode(oxidation) is represented on the LHS while cathode (reduction) on the RHS separated by a salt bridge

Caution

In the salt bridge both the cations on LHS and RHS come in the centre across the salt bridge .

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

Explanation: S_N1 mechanism proceeds through carbocation formation, as stability of carbocation increases, reaction favours the S_N1 mechanism. Therefore, 3° carbocations are more stable than others or stability order of carbocations is 3° > 2° > 1°, so, order of alkyl halides towards β elimination reaction is 3° > 2° > 1°

Related Theory

There are two types of ions formed during a chemical reaction the carbocation and the carbanion. A carbocation is a molecule in which a carbon atom has a positive charge and three bonds whereas a carbanion is an anion in which carbon has an unshared pair of electrons and bears a negative charge usually with three substituents for a total of eight valence electrons.

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

Explanation: EAN = Atomic Number – Oxidation number + 2 x Number of ligands

For $Fe(CO)_5$, Oxidation number of Fe = 0

EAN of Fe = $[(26 - 0) + (2 \times 5)]$

EAN of Fe = 26 + 10

EAN of Fe = 36

Related Theory

Effective atomic number (EAN), is the number that represents the total number of electrons surrounding the nucleus of a metal atom in a metal complex. It is composed of the metal atom's electrons and the bonding electrons from the surrounding electron-donating atoms and molecules.

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

Explanation: According to Boyle's law, Osmotic pressure is directly proportional to its concentration and temperature remains constant.

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

Explanation: Enzymes are biologically important group of globular proteins which acts as biological catalysts. Enzymes are highly specific in their action. Each enzyme can catalyse only specific types of reaction. The deficiency of enzymes in living system can cause many diseases.

Related Theory

A substance that enhances the action of an enzyme is known as co-enzymes they are organic non-protein molecules that bind with the protein molecule (apoenzyme) to form the active enzyme (holoenzyme).

SECTION - B

19. Since the order of the reaction is second with respect to the reactant, thus the rate law will be:

$$\text{Rate} = k[A]^2 \quad \text{...(i)}$$

Thus it is evident from the equation (i) that the rate of the reaction will become 4 times if the concentration of the reactant is reduced to half. The unit of the rate constant for such a reaction will be $mol^{-3} L^3 s^{-1}$.

OR

(A) The step which determines the kinetics of the reaction is known as the rate determining step of the reaction and is usually determined by the slowest step of the reaction.

(B) Molecularity of the reaction is the number of molecules that come together to react in an elementary (single-step) reaction and is equal to the sum of stoichiometric coefficients of reactants in this elementary reaction.

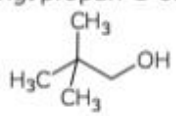
20. (A) (i) Secondary alcohol

(ii) Primary alcohol

(iii) Tertiary alcohol

(iv) Primary alcohol

(B) The IUPAC name of the neo-pentyl alcohol is 2,2-dimethyl propan-1-ol.



Explanation:

(1) Primary alcohols are those alcohols where the carbon atom of the hydroxyl group (OH) is attached to only one single alkyl group.

(2) Secondary alcohols are those where the carbon atom of the hydroxyl group is attached to two alkyl groups on either side.

(3) Tertiary alcohols are those which feature hydroxyl group attached to the carbon atom which is connected to 3- alkyl groups.

Related Theory

The International Union of Pure and Applied Chemistry (IUPAC) have given certain rules to name the organic compounds known as the nomenclature system. It is a set of logical rules devised to circumvent problems caused by arbitrary nomenclature.

21. (A) The electrode reaction is

$$H^+(aq) + e^- \rightarrow \frac{1}{2} H_2(g)$$

$$E_{H^+/\frac{1}{2}H_2} = -E_{\frac{1}{2}H_2/H^+}$$

$$= -0.3V, n = 1$$

Proceeding as above, we have

$$-0.3 = 0.00 - 0.059\ pH$$

$$pH = \frac{0.25}{0.059} = 4.23$$

(B) (i) The electrode reaction is

$$H^+(aq) + e^- \rightarrow \frac{1}{2} H_2(g)$$

According to the Nernest equation, at 25°C

$$E_{H^+/\frac{1}{2}H_2} = E_{\frac{1}{2}H_2/H^+}$$

$$= \frac{0.059}{n} \log_{10} \frac{1}{[H^+(aq)]}$$

For the given reaction, $n = 1$,

$$E_{H^+/\frac{1}{2}H_2} = E_{\frac{1}{2}H_2/H^+}$$

$$= -0.25V \text{ and } E^\circ_{H^+/\frac{1}{2}H_2} = 0.00$$

Substituting these values, we have

$$-0.25 - 0.00 - \frac{0.059}{1} \log_{10} \frac{1}{[H^+(aq)]}$$

or $-0.25 = 0.00 - 0.059\ pH$

$(\because pH = -\log_{10}[H^+](aq))$

$$\therefore \quad pH = \frac{0.4}{0.059} = 6.77$$

OR

(A) The cell reaction is feasible

(B) The cell reaction is in equilibrium

22. (A) $\wedge_m$ = (molar mass / equivalent mass) × $\wedge_{eq}$

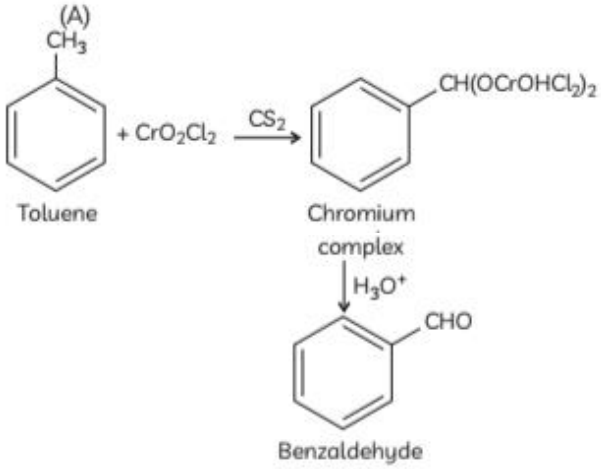
(B) $\alpha = \Lambda^\circ_m / \wedge_m$

23. (A) $2Cl_2 + 4OH^- \longrightarrow 2Cl^- + 2ClO^- + 2H_2O$

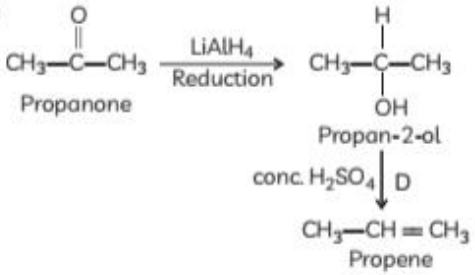
(B) $3CuO + 2NH_3 + Heat \longrightarrow N_2 + Cu + 3H_2O$

Explanation: The balancing of the equation is essential it gives an idea about the exact number of atoms required to form the desired product during the laboratory synthesis also depicts the exact amount and number of compounds reacting to give the exact number of the products obtained during the reaction.

24.



(B)



This is called Etard reaction.

25. (A) It is simple to represent the concentration in parts per million when the solute is present in trace amounts (ppm). The definition of it is the amount of solute (in grams) in 10^6 grams of solution.

(B) $X_B = \frac{n}{N+n}$ and $X_A = \frac{N}{N+n}$

$$\frac{X_B}{X_A} = \frac{n}{N} = \frac{\text{Moles of solute}}{\text{Moles of solvent}}$$

$$= \frac{W_B \times M_A}{M_B \times W_A}$$

$$\frac{X_B \times 100}{X_A \times M_A} = \frac{W_B \times 1000}{M_B \times W_A} = \text{molality}(m)$$

Or $$\frac{X_B \times 1000}{(1 - X_B) M_A} = m$$

SECTION - C

15 Marks

26. (A) $Cu^{2+} > Co^{2+} > Mn^{2+} > Cd^{2+}$

(B) (i) Yellow–orange

(ii) Purple

(C) Two limitation of crystal field theory are:

(i) This assumes that metal-ligand interaction is purely electrostatic.

(ii) This theory rules out the possibility of any bonding in complexes.

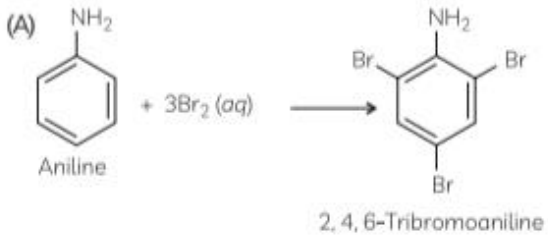
27. (A) $CH_3—NH_2$ has higher boiling point than $(CH_3)_3$ N due to extensive hydrogen bonding in primary methyl amine with 2 hydrogen atoms.

(B) $(CH_3)_5 N < C_2H_5NH_2 < C_2H_5OH$

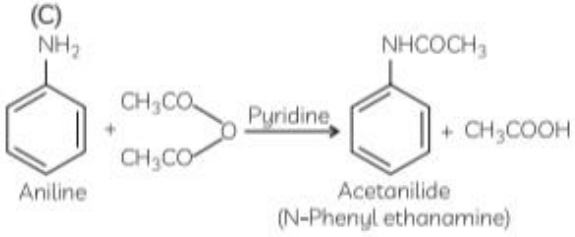
(C) Add NHO_2. $(CH_3)_2NH$ will from yellow oily compound, whereas $(CH_3)_5N$ will form a salt soluble in water.

Alternatively, add Hinsberg reagent $(C_6H_5SO_2Cl)$. $(CH_3)_2NH$ will form compound soluble in KOH, whereas $(CH_3)_5$ N will not react.

OR

(A) 

(B) 

(C) 

28. (A) Molar conductivity increases with decrease in concentration. This is because the total volume, (V), of solution containing one mole of electrolyte also increases. The molar conductivity is the conductance of all the ions produced by one mole of the electrolyte. For the strong electrolyte, the molar conductivity increases sharply with increasing concentration.

(B) When concentration approaches zero, the molar conductivity is known as limiting molar conductivity and is represented by the symbol Λ°_m.

29. (A) The difference between double salt and complex compound are:

S. No.	Double Salt	Complex Compound
1.	These exist only in solid state and dissociate into constituent species in their solution.	They retain their identity in solid as well as in solution state.
2.	They lose their identity in dissolved state.	They do not lose their identity in dissolved state.

(B) In $[FeF_6]^{3-}$ complex

Oxidation number of Fe = +3

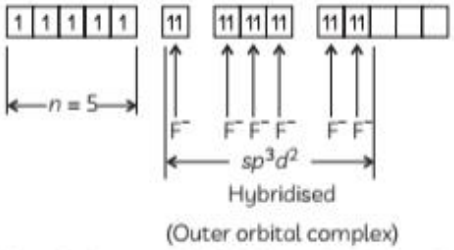
Coordination Number Fe = 6

Coordination orbitals = 6

$Fe \longrightarrow Fe^{3+} + 3e^-$

$Fe^{3+} \longrightarrow (26-3) - [Ar]_{18}$

$[FeF_2]^{3-}$ – (Strongly Paramagnetic)



(Outer orbital complex)

Here F^- is a weak field ligand and it obeys Hund's rule of leaving maximum number of unpaired electrons (n = 5) and it uses one 4s, three 4p and two 4d orbitals which are $sp^3 d^2$ hybridised. So, it is an outer orbital complex.

30. (A) To calculate molarity when density and mass percentage are given:

$$\text{Molarity} = \frac{\%\text{mass} \times \text{density} \times 10}{98}$$

$$= \frac{68 \times 1.504 \times 10}{98}$$

[Molarity mass % H_2SO_4 = 98 g]

= 16.23 M

(B) Raoult's Law states that "for a solution of volatile liquids the partial vapour pressure of each component in the solution is directly proportional to its mole fraction".

SECTION - D

8 Marks

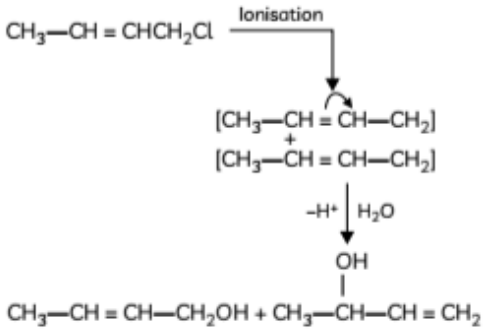
31. (A) Two possible stereo-structures of $CH_3CHOH.COOH$, which are optically active, are called. diastereomers.

(B) Aryl halides are less reactive towards nucleophilic substitution reactions as C—X bond acquired a partial double bond character due to resonance. Also halogen atom is attached to sp^2 hybridised carbon atom.

(C) (i) $CH_3CH(OH)CH_2CH_3$

(ii) $(CH_3)_2 C = CHCH_2CH_3$

OR



32. (A) Oxidation of glucose by bromine gives gluconic acid. Bromine oxidises only —CHO group in the structure of glucose.

(B) 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.

(C) (i) Polysaccharides are also called carbohydrates because they are large non- polar molecules, and they are not hydrophilic while the polysaccharides do not yield a small number of monosaccharide units on hydrolysis.

(ii) The new linkage formed between the two monosaccharide units is called glycosidic linkage.

OR

(i) The polypeptides are the chain of many amino acids and thus proteins are the macromolecules made up of amino acid molecules and thus a polypeptide with more than 100 amino acid residues is usually called protein.

(ii) D-sorbitol

SECTION - E

33. (A) (i) Zero order reaction:

(1) Photochemical oxidation of H_2 and Cl_2 over the surface of water.

(2) Decomposition of NH_3 at the surface of metals like platinum and gold.

(ii) First order reaction

(1) Decomposition of hydrogen peroxide.

(2) Decomposition of ethyl chloride.

(B)

S. No.	Reaction rate (rate of reaction)	Specific reaction rate (rate constant)
1.	It is the rate of change of concentration of a reactant or a product with respect to time.	It is a constant of proportionality and is equal to the rate of reaction when the molar concentration of each of the reactants is unity.
2.	The reaction rate at a particular instant depends upon the concentration of reactants at that instant.	The specific reaction rate remains constant for a particular reaction at a particular temperature and does not depend upon the concentration of reactants.
3.	Its units are fixed and are mol $L^{-1} s^{-1}$,	Its units depend upon the order of reaction. For a reaction of order *n*, the units of specific reaction rate are $mol^{1-n}L^{n-1}s^{-1}$.

34. (A) The steady decrease of atomic and ionic radii from Lanthanum (La = 57) to Lutetium (Lu = 71) is called lanthanide contraction.

(B) Ce(58) : $(Xe)_{54}\ 4s^1\ 5d^1\ 6s^2$

Ce^{+3} (58-3) : $[Xe]\ 4s^1\ 5d^0\ 6s^0$

Magnetic moment (m) = $\sqrt{n(n+2)}$ BM

(Bohr Magneton)

= $\sqrt{1(1+2=\sqrt{3})}$ = 1.732 BM

(C) Mn(25) : $[Ar]_{18}\ 3d^{5+}\ 5s^2$

Mn^{2+} (25 – 2) : $[Ar]_{18}\ 3d^5\ 4s^0$

Half filled orbital

(More stable)

Fe(26) : $[Ar]_{18}\ 3d^6\ 4s^2$

Fe^{2+} (26 – 2) : $[Ar]_{18}\ 3d^6\ 4s^2$

(Incomplete filled orbital)

(Less stable)

$Fe^{2+} \longrightarrow Fe^{3+} + 1e^-$

$Mn^{2+} \longrightarrow Mn^{3+} + 1e^-$

$(3d^5)$ $(3d^4)$

(More stable due to half-filled orbital) (Less stable due to incompletely filled d- orbital)

$Fe^{2+} \longrightarrow Fe^{3+} + 1e^-$

$(3d^6)$ $(3d^5)$

(Less stable due to incompletely filled orbital) (More stable due half-filled d- orbital)

(D) As we move from left to right along the transition metal series, melting point first increases as the number of unpaired d electrons available for metallic bonding increases, reach a maximum value and then decreases, as the d-electrons pair up and become less available for bonding.

OR

(A) Since the elements Cr and Mn have the maximum number of the unpaired electrons thus they will have the maximum oxidation state as well.

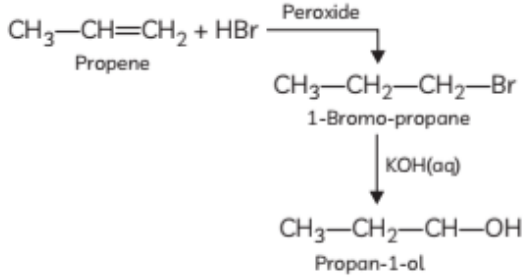
(B) Chromium has the highest melting point as it has maximum number of unpaired electrons and form stronger metallic bonds.

(C) The element which shows only +3 oxidation state is Scandium.

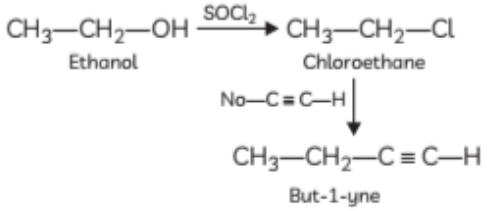
(D) Iron (Fe) is the strong oxidising agent in +3 oxidation state since in this it can accept 3 more electrons in order to make its oxidation state zero.

(E) Zn with electronic configuration $3d^{10}4s^2$ has fully filled configuration which is highly stable.

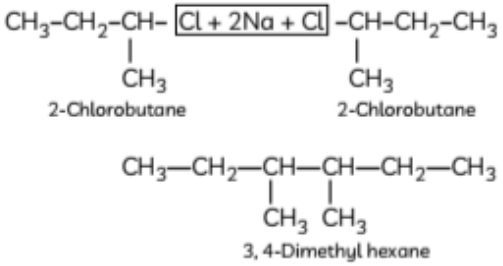
35. (i) Propene to propan-1-ol



(ii) Ethanol to but-1-yne



(iii)

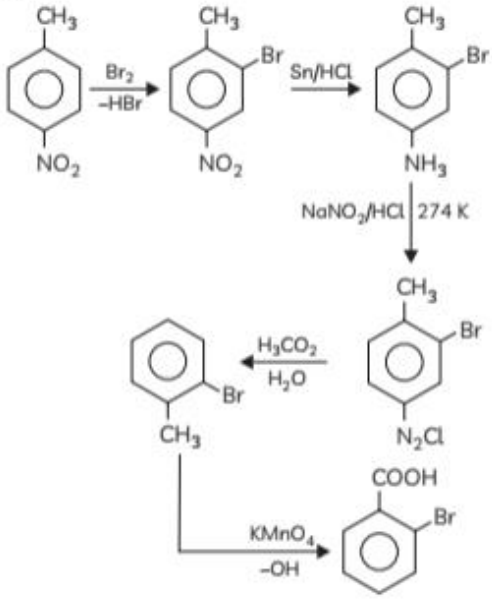


(B) (i) For Rosenmund's reaction, the acyl chloride required for the preparation of formaldehyde will be COCl, formyl chloride which is in itself an unstable compound. Hence, the reaction is not very feasible.

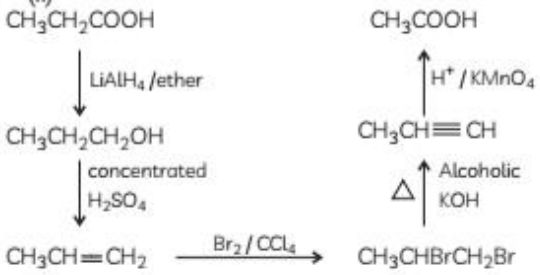
(ii) In benzaldehyde the phenyl group provides greater steric hindrance than methyl group (– CH_3) of acetaldehyde to the attacking nucleophile.

OR

(A) (i)



(ii)



(B) An alkene with molecular formula C_5H_{10} on ozonolysis gives a mixture of two compounds, B and C and the Compound B gives positive Fehling's test. It shows that it is an aldehyde and gives Iodoform test which shows it has $COCH_3$ group. Compounds C does not gives the Fehling's test thus it is a ketone but it gives the Iodoform test thus it has $COCH_3$ group as well. The sequence of the reaction can be shown as follows:

Hence, compound A is