Code No. **043**

Roll No. ☐☐☐☐☐☐☐

- Please check that this question paper contains **5** printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains **33** questions.
- **Please write down the Serial Number of the question before attempting it.**
- 15 minutes time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

CHEMISTRY–XII

Sample Paper (Solved)

Time allowed: 3 hours *Maximum Marks: 70*

General Instructions:

SECTION A (Objective Type)

1. **Read the passage given below and answer the following questions:** **(1×4=4)**

The lyophilic colloids differ in their protective power. The protective power is measured in terms of Gold number. This number was introduced by Zsigmondy and is defined as the number of milligrams of a lyophilic colloid that will just prevent the precipitation of 10 mL of a gold sol on the addition of 1 mL of 10% NaCl solution. The gold numbers of some of the common protective colloids are listed below:

S. No.	*Protective Colloid*	*Gold Number*
(*i*)	Gelatin	0.005 – 0.01
(*ii*)	Haemoglobin	0.03
(*iii*)	Gum Arabic	0.15
(*iv*)	Potato starch	25
(*v*)	Starch	25 – 50

Higher is the gold number lower will be the protective power.

(*i*) Which statements are true:

S_1 : lyophilic sols are more stable than lyophobic.
S_2 : lyophilic colloids can function as protective colloids for lyophobic colloids.
S_3 : gold number of gelatin is more than Gum Arabic.

(*a*) S_1, S_2 and S_3 (*b*) S_3 only (*c*) S_1, S_2 only (*d*) S_2, S_3 only

(*ii*) What is the gold number of haemoglobin if we use it as protective lyophilic colloid that will just prevent the precipitation of 10 mL of a gold sol on the addition of 1 mL of 20% NaCl solution, on the place of 10% NaCl solution?

(*a*) Half of initial (*b*) Remain same
(*c*) Double of initial (*d*) Four times of initial

Or

The protective power of lyophilic colloidal solution is expression in term of:

(*a*) coagulation value **(*b*)** gold number
(*c*) CMC (Critical Micelle Concentation) **(*d*)** Oxidation number

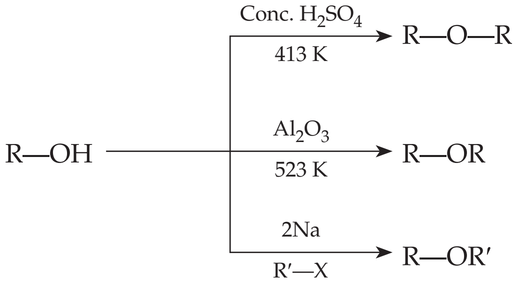
(*iii*) Arrange the following in increasing order of their protective nature.
Gelatin, Gum Arabic, potato starch

(*a*) I > III > II **(*b*)** I > II > III **(*c*)** I < II < III **(*d*)** III < I < II

(*iv*) Which substance is added in ice-cream as a protective agent?

(*a*) Gelatin **(*b*)** Starch **(*c*)** Potato starch **(*d*)** Both (*a*) & (*b*)

2. Read the passage given below and answer the following questions. **(1×4=4)**

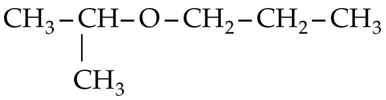


When an excess of alcohol is heated at 413 K in presence of protic acids (H_2SO_4, H_3PO_4) two molecules of alcohol eliminate one molecule of water to form symmetrical ether. The intermolecular dehydration of primary alcohol is affected by passing the vapours of an alcohol over aluminium at 523 K under pressure. Williamson ether synthesis produces both symmetrical and unsymmetrical ether through S_N2 mechanism. The tertiary alkoxide gives ether but if tertiary alkyl halide is used then elimination takes places and forms alkenes.

In these questions a statement followed by a statement of reason is given. Choose the correct answer out of the following choices.

(*a*) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(*b*) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(*c*) Assertion is correct statement but reason is wrong statement.
(*d*) Assertion is wrong statement but reason is correct statement.

(*i*) ***Assertion:*** IUPAC name of the compound



$CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-O-CH_2-CH_2-CH_3$ is 2-ethoxy-2-methylethane.

Reason: In IUPAC nomenclature, ether is regarded as hydrocarbon derivative in which a hydrogen atom is replaced by –OR or –OAr group [where R = alkyl group and Ar = aryl group].

(*ii*) ***Assertion:*** Bond angle in ethers is slightly less than the tetrahedral angle.
Reason: There is a repulsion between the two bulky (–R) groups.

(*iii*) ***Assertion:*** Ethers behave as bases in the presence of mineral acids.
Reason: Due to presence of lone pairs of electrons on oxygen.

(*iv*) ***Assertion:*** tert-Butyl methyl ether is not prepared by the reaction of ter-butyl bromide with sodium methoxide.
Reason: Sodium methoxide is a strong nucleophile.

Or

Assertion: An ether is more volatile than an alcohol having same molecular formula.
Reason: Alcohols have inter-molecular hydrogen bonding.

Following questions (No. 3-11) are Multiple Choice Questions carrying 1 mark each.

3. The difference between the electrode potentials of two electrodes when no current is drawn through the cell is called:

(*a*) cell potential **(*b*)** cell emf **(*c*)** potential difference **(*d*)** cell voltage

4. Which of the following polymer is stored in the liver of animals?

(*a*) Amylose **(*b*)** Cellulose **(*c*)** Amylopectin **(*d*)** Glycogen

Or

Which of the following statements in not true about glucose?

(*a*) It is an aldohexose. **(*b*)** On heating with HI it forms n-hexane.
(*c*) It is present in furanose form. **(*d*)** It does not give 2, 4-DNP test.

5. Colligative properties depend on :

(*a*) the nature of the solute particles dissolved in solution.
(*b*) the number of solute particles in solution.
(*c*) the physical properties of the solute particles dissolved in solution.
(*d*) the nature of solvent particles.

6. The magnetic nature of elements depends on the presence of unpaired electrons. Identify the configuration of transition element, which shows highest magnetic moment.

(*a*) $3d^7$ (*b*) $3d^5$ (*c*) $3d^8$ (*d*) $3d^2$

7. The source of nitrogen in Gabriel synthesis of amines is :

(*a*) sodium azide, NaN_3
(*b*) sodium nitrite, $NaNO_2$
(*c*) potassium cyanide, KCN
(*d*) potassium phthalimide, $C_6H_4\,(CO)_2\,N^-\,K^+$

Or

Hofmann bromamide degradation reaction is shown by:

(*a*) $ArNH_2$ (*b*) $ArCONH_2$ (*c*) $ArCH_2\,NH_2$ (*d*) $ArNO_2$

8. When 0.1 mole $CoCl_3\,(NH_3)_5$ is treated with excess of $AgNO_3$, 0.2 mole of AgCl are obtained. The conductivity of solution will correspond to :

(*a*) 1 : 3 electrolyte (*b*) 1 : 2 electrolyte (*c*) 1 : 1 electrolyte (*d*) 3 : 1 electrolyte

Or

When 1 mole $CrCl_3 \cdot 6\,H_2O$ is treated with excess of $AgNO_3$, 3 mole of AgCl are obtained. The formula of the complex is:

(*a*) $[CrCl_3\,(H_2O)_3] \cdot 3\,H_2O$
(*b*) $[CrCl_2\,(H_2O)_4]Cl \cdot 2\,H_2O$
(*c*) $[CrCl\,(H_2O)_5]\,Cl_2 \cdot H_2O$
(*d*) $[Cr\,(H_2O)_6]\,Cl_3$

9. Highest oxidation state of manganese in fluorides is +4 (MnF_4) but highest oxidation state in oxides is +7 (Mn_2O_7) because __________ .

(*a*) fluorine is more electronegative than oxygen.
(*b*) fluorine does not possess *d*-orbitals.
(*c*) fluorine stabilises lower oxidation state.
(*d*) in covalent compounds, fluorine can form single bond only while oxygen forms double bond.

10. Which reagent will you use for the following reaction?

$$CH_3\,CH_2\,CH_2\,CH_3 \longrightarrow CH_3\,CH_2\,CH_2\,CH_2\,Cl + CH_3\,CH_2\,CHCl$$

(*a*) Cl_2 / UV light
(*b*) Cl_2 gas in the presence of iron in dark.
(*c*) Cl_2 gas in dark
(*d*) $NaCl + H_2SO_4$

11. Cations are present in the interstitial sites in:

(*a*) Frenkel defect
(*b*) Schottky defect
(*c*) Vacancy defect
(*d*) Metal deficiency defect

Or

In zinc blende structure:

(*a*) zinc ions occupy half of the tetrahedral sites.
(*b*) each Zn^{2+} ion is surrounded by 6 S^{2-} ions.
(*c*) each S^{2-} ion is surrounded by 6 Zn^{2+} ions.
(*d*) it has fcc structure.

In the following question (Q. No. 12-16) a statement assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(*a*) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(*b*) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(*c*) Assertion is correct statement but reason is wrong statement.
(*d*) Assertion is wrong statement but reason is correct statement.

12. ***Assertion:*** β-glycosidic linkage is present in maltose.
Reason: Maltose is composed of two glucose units in which C-1 of one glucose unit is linked to C-4 of another glucose unit.

13. ***Assertion:*** Both rhombic and monoclinic sulphur exist as S_8 but oxygen exists as O_2.
Reason: Oxygen forms pπ-pπ multiple bond due to small size and small bond length but pπ-pπ bonding is not possible in sulphur.

14. ***Assertion:*** When methyl alcohol is added to water, boiling point of water decreases.
Reason: When a volatile solute is added to volatile solvent, elevation in boiling point is observed.

Or

Assertion: When NaCl is added to water a depression in freezing point is observed.
Reason: The lowering of vapour pressure of a solution causes depression in freezing point.

15. ***Assertion:*** Primary alcohols can be easily oxidised to aldehydes.
Reason: Aldehydes are prone to further oxidation to carboxylic acid.

16. ***Assertion:*** Equimolar mixture of conc. HCl and $ZnCl_2$ in known as Lucas reagent.
Reason: Lucas reagent can be used to distinguish between methanol and ethanol.

SECTION B

The following questions, Q. No. 17-25 are Short Answer Type I and carry 2 marks each.

17. Explain why the dipole moment of chlorobenzene is lower than that of cyclohexyl chloride.

Or

An optically active compound having molecular formula $C_7H_{15}Br$ reacts with aqueous KOH to give a racemic mixture of products. Write the mechanism involved in this reaction.

18. Derive the relationship between relative lowering of vapour pressure and mole fraction of the volatile liquid.

19. Give the electronic configuration of d-orbitals of $K_3[Fe(CN_6)]$ and $K_3[FeF_6]$ and explain why these complexes give different colour with same solution. (At. No. of Fe = 26u)

Or

(*a*) How many ions are produced from the complex, $[Co(NH_3)_6]\,Cl_2$ in solution?
(*b*) Given an example of coordination isomerism.

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

Or

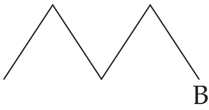
A reaction is first order in A and second order in B.
(*i*) How is the rate affected if the concentration of B is tripled?
(*ii*) How is the rate affected when the concentrations of both A and B are doubled?

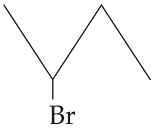
21. The rate constant for a reaction of zero order in A is 0.0030 mol L^{-1} s^{-1}. How long will it take for the initial concentration of A to fall from 0.10 M to 0.075 M?

22. **(*a*)** Why does *p*-dichlorobenzene have a higher m.p. than its o- and m-isomers?
(*b*) Why is (±)-Butan-2-ol optically inactive?

23. **Account for the following:**
(*i*) XeF_2 is a linear molecule without a bend.
(*ii*) The electron gain enthalpy with negative sign for fluorine is less than that of chlorine, still fluorine is a stronger oxidizing agent than chlorine.

24. **(*i*)** Which alkyl halide from the following pair is chiral and undergoes faster S_N2 reaction?

(*a*) 

(*b*) 

(*ii*) **Out of S_N1 and S_N2, which reaction occurs with**
(*a*) Inversion of configuration **(*b*)** Racemisation

25. The unit cell of an element of atomic mass 108 u and density 10.5 g cm^{-3} is a cube with edge length, 409 pm. Find the type of unit cell of the crystal.
[**Given:** Avogadro's constant = 6.023×10^{23} mol^{-1}]

SECTION C

Q. No. 26-30 are Short Answer Type II carrying 3 marks each.

26. **(*a*)** **Account for the following:**
(*i*) Transition elements show highest oxidation state in their oxides than fluorides.
(*ii*) Cu has positive electrode potential in the first transition series.
(*b*) **Compare non-transition and transition elements on the basis of their**
(*i*) Variability of oxidation states **(*ii*)** Stability of oxidation states

Or

Explain the following observations given an appropriate reason for each.
(*i*) The enthalpies of atomization of transition elements are quite high.

(*ii*) There occurs much more frequent metal–metal bonding in compounds of heavy transition metals (*i.e.* 3rd series).

(*iii*) Mn^{2+} is much more resistant than Fe^{2+} towards oxidation.

27. In the following cases rearrange the compounds as directed:

(*i*) **In an increasing order of basic strength:** $C_6H_5NH_2$, $C_6H_5\ N(CH_3)_2$, $(C_2H_5)_2NH$ and CH_3NH_2

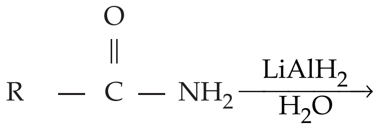
(*ii*) **In a decreasing order of basic strength:** Aniline, p-nitroaniline and p-toluidine

(*iii*) **In an increasing order of pK_b values:** $C_2H_5NH_2$, $C_6H_5\ NHCH_3$, $(C_2H_5)_2NH$ and $C_6H_5NH_2$

Or

Complete the following reaction equations:

(*i*)



$$R - \overset{\overset{\displaystyle O}{\|}}{C} - NH_2 \xrightarrow[H_2O]{LiAlH_2}$$

(*ii*) $C_2H_5NH_2 + C_6H_5SO_2Cl \longrightarrow$ (*iii*) $C_2H_5NH_2 + HNO_2 \longrightarrow$

28. Calculate packing efficiency in ccp structure.

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

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

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

30. Write balanced chemical equations for the following reactions:

(*a*) Hypophosphorous acid is added to $AgNO_3$ solution.

(*b*) Chlorine gas is passed through hot and concentrated solution of sodium hydroxide.

(*c*) XeF_2 undergoes hydrolysis.

SECTION D

Q. No. 31 to 33 are Long Answer Type carrying 5 marks each.

31. (*a*) **Draw the structure of:** (*i*) BrF_3; (*ii*) $XeOF_4$

(*b*) **Explain giving reason in each case:**

(*i*) Why H_2Te is more acidic than H_2S? (*ii*) Why are halogens strong oxidising agents?

(*iii*) Why does nitrogen show catenation tendency less than phosphorus?

Or

(*a*) **Account for the following:**

(*i*) Acidic character increases from HF to HI.

(*ii*) There is large difference between the melting and boiling points of oxygen and sulphur.

(*iii*) Nitrogen does not form pentahalide.

(*b*) **Draw the structures of the following:** (*i*) CIF_3 (*ii*) XeF_4

32. (*a*) **Write chemical reactions to affect the following transformations:**

(*i*) Propane to Propene (*ii*) Benzyl chloride to Phenylethanoic acid

(*iii*) Ethanol to 3-Hydroxybutanal

(*b*) **Draw structures of the following:**

(*i*) The semicarbazone of cyclopentanone (*ii*) *p*-Nitropropiophenone

33. (*a*) State the relationship amongst cell constant of a cell, resistance of the solution in the cell and conductivity of the solution. How is molar conductivity of a solute related to conductivity of its solution?

(*b*) **A voltaic cell is set up at 25°C with the following half-cells :**

$Al\ |\ Al^{3+}$ (0.001 M) and $Ni\ |\ Ni^{2+}$ (0.50 M)

Calculate the cell voltage

$[E^\circ_{Ni^{2+}/Ni} = -0.25\ V, E^\circ_{Ni^{2+}/Ni} = -1.66\ V]$

Or

(*a*) Define molar conductivity of a solution and explain how molar conductivity changes with change in concentration of solution for a weak and a strong electrolyte.

(*b*) The resistance of a conductivity cell containing 0.001 M KCl solution at 298 K is 1500 Ω. What is the cell constant if the conductivity of 0.001 M KCl solution at 298 K is $0.146 \times 10^{-3}\ S\ cm^{-1}$?

Answer Sheet

SAMPLE PAPER

Code No. 043

Roll No.

CHEMISTRY

SECTION A

1. *(i)* (*c*) S_1, S_2 only *(ii)* (*c*) Double of initial *Or* (*b*) gold number

(iii) (*b*) I > II > III *(iv)* (*a*) Gelatin

2. *(i)* (*d*) Assertion is wrong statement but reason is correct statement.

(ii) (*d*) Assertion is wrong statement but reason is correct statement.

(iii) (*a*) Assertion and reason both are correct statements and reason is correct explanation for assertion.

(iv) (*b*) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Or

(*a*) Assertion and reason both are correct statements and reason is correct explanation for assertion.

3. (*b*) cell emf

4. (*d*) Glycogen

Or

(*c*) It is present in furanose form.

5. (*b*) the number of solute particle in solution.

6. (*b*) $3d^5$

7. (*d*) potassium phthalimide, $C_6H_4(CO)_2N^-K^+$

Or

(*b*) $ArCONH_2$

8. (*b*) 1 : 2 electrolyte

Or

(*d*) $[Cr(H_2O)_6]Cl_3$

9. (*d*) in covalent compounds, fluorine can form single bond only while oxygen forms double bond.

10. (*a*) Cl_2 / UV light

11. (*a*) Frenkel defect

Or

(*c*) each S^{2-} ion is surrounded by 6 Zn^{2+} ions.

12. (*d*) Assertion is wrong statement but reason is correct statement.

13. (*a*) Assertion and reason both are correct statements and reason is correct explanation for assertion.

14. (*c*) Assertion is correct statement but reason is wrong statement.

Or

(*a*) Assertion and reason both are correct statements and reason is correct explanation for assertion.

15. (*d*) Assertion is wrong statement but reason is correct statement.

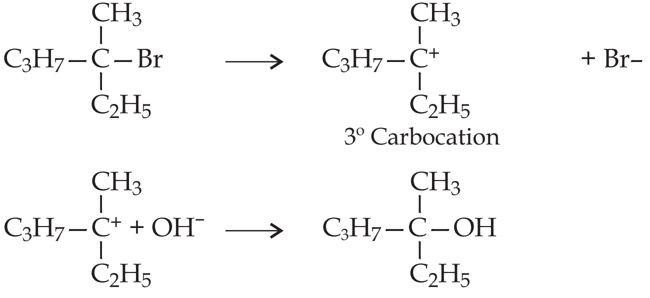
16. (*c*) Assertion is correct statement but reason is wrong statement.

SECTION B

17. Due to greater s-character, a sp^2 hybridized carbon is more electronegative than a sp^3 hybridized carbon. Therefore, the sp^2 hybridized carbon of C-Cl bond in chlorobenzene has less tendency to release electrons to Cl than a sp^3 hybridized carbon of cyclohexyl chloride.

Or

Since the alkyl halide reacts with KOH to form a racemic mixture, it must be a 3° alkyl halide and the reaction will follow S_N1 mechanism.



$$C_3H_7-\overset{\displaystyle CH_3}{\underset{\displaystyle C_2H_5}{C}}-Br \longrightarrow C_3H_7-\overset{\displaystyle CH_3}{\underset{\displaystyle C_2H_5}{C^+}} + Br^-$$

3° Carbocation

$$C_3H_7-\overset{\displaystyle CH_3}{\underset{\displaystyle C_2H_5}{C^+}} + OH^- \longrightarrow C_3H_7-\overset{\displaystyle CH_3}{\underset{\displaystyle C_2H_5}{C}}-OH$$

(Racemic mixture)

18. Let us assume a binary solution in which the mole fraction of the solvent be x_1 and that of the solute be x_2, p_1 be the vapour pressure of the solvent and $p_1°$ be the vapour pressure of the solvent in pure state.

According to Raoult's Law, $p_1 = x_1 p_1°$ ...(*i*)

The decrease in vapour pressure of the solvent (Δp_1) is given by:

$\Rightarrow \quad \Delta p_1 = p_1° - p_1 \qquad \Rightarrow \quad \Delta p_1 = p_1° - p_1° x_1$ ...[Using equation (*i*)

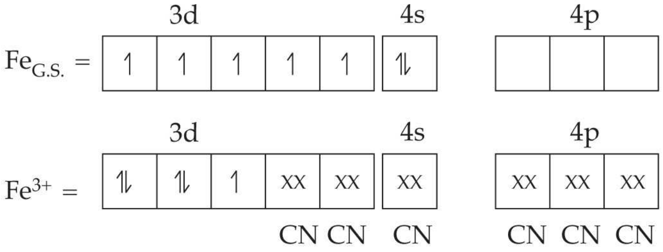
$\Rightarrow \quad \Delta p_1 = p_1° (1 - x_1)$

Since we have assumed the solution to be binary solution $x_2 = 1 - x_1$

$\Rightarrow \quad \Delta p_1 = p_1° x_2 \qquad \Rightarrow \quad \mathbf{x_2 = \Delta p_1 / p_1°}$

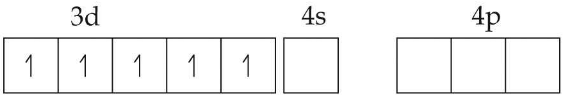
19. Oxidation state of Fe in $K_3[Fe(CN)_6]$ is **+3**

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



It has 5 unpaired electrons in 3d orbital which get paired leaving behind one unpaired electron only in the presence of strong ligand CN.

In $K_3[FeF_6]$ oxidation state of Fe is +3 and 5 unpaired electrons are there in 3d orbitals which cannot be paired due to weak ligand F.



Because of the presence of different number of unpaired electrons these impart different colour of same solution.

Or

(*a*) Three ions $[Co(NH_3)_6]^{2+}$, $2Cl^-$.

(*b*) ***Example :*** $[Co(NH_3)_6]\,[Cr(CN)_6]$ and $[Cr(NH_3)_6]\,[Co(CN)_6]$

20. **Given:** $a = 1$, $K = 2.54 \times 10^{-3}\ \text{sec}^{-1}$, $x = 3/4$

$$K = \frac{2.303}{t}\log\frac{a}{a-x} \qquad \Rightarrow \quad t = \frac{2.303}{K}\log\frac{a}{a-x}$$

$$\Rightarrow \quad t_{3/4} = \frac{2.303}{2.54\times10^{-3}}\log\frac{1}{1-\frac{3}{4}}$$

$$\Rightarrow \quad t_{3/4} = 0.9066 \times 10^3 \times 0.6021 \qquad \therefore \quad t_{3/4} = \mathbf{5.46 \times 10^2\ sec}$$

Or

As we know, rate, $r = K[A]^1\,[B]^2$

(*i*) $r_0 = K[A]^1\,[B]^2$

$r_1 = K[A]^1\,[3B]^2$

$r_1 = K[A]^1\,9[B]^2 = 9 \times r$

$\therefore$ **Rate becomes 9 times the initial rate**

(*ii*) $r_0 = K[A]^1\,[B]^2$

$r_2 = K[2A]^1\,[2B]^2$

$r_2 = 2K[A]^1\,4[B]^2$

$r_2 = 8K[A]^1\,[B]^2 = 8 \times r$

$\therefore$ **Rate becomes 8 times the initial rate.**

21. For a zero order reaction,

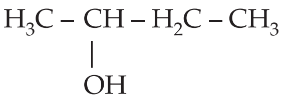
$$\text{Time, } t = \frac{1}{K}[(A)_0 - (A)]$$

$$\text{or} \quad t = \frac{1}{0.003}(0.10 - 0.075)$$

$$\therefore \quad \textbf{Time, } t = \frac{1}{0.003}\times\frac{0.025}{1} = \frac{25}{3} = \mathbf{8.3\ seconds}$$

22. (*a*) p-isomers are comparetively more symmetrical and fit closely in the crystal lattice, thus require more heat to break these strong forces of attraction. Therefore, higher melting point than o- and m-isomers.

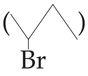
(*b*) (±)-Butan-2-ol is optically inactive because in racemic mix one type of rotation is cancelled by other.



$$H_3C-\underset{\displaystyle OH}{\underset{|}{CH}}-H_2C-CH_3$$

23. (*i*) The electron arrangement in XeF_2 is trigonal bipyramidal with sp^3d hybridisation. The shape is linear because the lone pairs prefer the equatorial positions to reduce repulsion. XeF_2 has 3 bond pairs and one lone pair.

(*ii*) Due to low bond dissociation enthalpy and high hydration enthalpy of fluorine.

24. (*i*) 2-bromobutane () is a chiral compound

and 1 Bromo Butane undergoes S_N2 reaction faster.

(*ii*) (*a*) Inversion of configuration occurs with S_N2 reaction.
(*b*) Racemisation occurs with S_N1 reaction.

25. We know that, $Z = \dfrac{a^3\rho \times N_A}{M}$

$$\therefore \quad Z = \frac{(409 \times 10^{-10})^3 \times 10.5 \times 6.023 \times 10^{23}}{108}$$

$$= \frac{409 \times 409 \times 409 \times 10^{-30} \times 10.5 \times 6.023 \times 10^{23}}{108}$$

$$= \frac{423.68}{108} = \mathbf{4}$$

So it forms cubic- closed packed (ccp) lattice or fcc structure.

SECTION C

26. **(*a*)** (*i*) Because oxygen forms multiple bonds with transition metals but fluorine does not form multiple bonds.

(*ii*) Cu has lower hydration enthalpy which is unable to compensate for its first and second ionisation enthalpy.

(*b*) (*i*) Oxidation states of transition elements differ from each other by unity. In non-transition elements oxidation states normally differ by a unit of two.

(*ii*) In transition elements higher oxidation states are favoured by heavier elements whereas in non-transition elements lower oxidation state is favoured.

Or

(*i*) In transition elements, there are large number of unpaired electrons in their atoms, thus they have a stronger inter atomic interaction and thereby stronger bonding between the atoms. Due to this they have high enthalpies of atomisation.

(*ii*) Because of high enthalpy of atomisation of 3rd series, there occurs much more frequent metal-metal bonding in compounds of heavy transition metals.

(*iii*) The 3d orbital in Mn^{2+} is half-filled and is more stable compared to Fe^{2+} and Fe has 6 electrons in the 3d orbital. Mn^{2+} prefer to lose an electron or get oxidised whereas Fe^{2+} will readily loose one electron or get oxidised. Therefore, Mn^{2+} is much more resistant than Fe^{2+} towards oxidation.

27. **(*i*) Order of basic strength :**

$$C_6H_5NH_2 < C_6H_5N(CH_3)_2 < CH_3NH_2 < \underset{\text{More +I effect}}{(C_2H_5)_2NH}$$

(*ii*) The decreasing order of basic strength :

$$\underset{\text{(+I effect)}}{\text{p-toluidine}} > \text{aniline} > \underset{\text{(NO}_2\text{ is electron withdrawing group)}}{\text{p-nitroaniline}}$$

(*iii*) Increasing order of pK_b values :

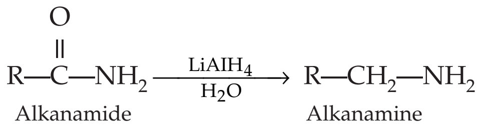
$$(C_2H_5)_2NH < C_2H_5NH_2 < C_6H_5NHCH_3 < C_6H_5NH_2$$

Since a stronger base has a lower pK_b value therefore basic strength order.

$$(C_2H_5)_2NH > C_2H_5NH_2 > C_6H_5NHCH_3 > C_6H_5NH_2$$

Or

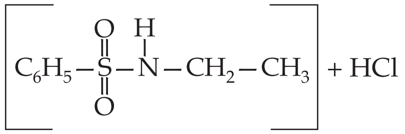
(*i*) Reduction reaction



$$\underset{\text{Alkanamide}}{R{-}\overset{\overset{\displaystyle O}{\|}}{C}{-}NH_2} \xrightarrow[H_2O]{LiAlH_4} \underset{\text{Alkanamine}}{R{-}CH_2{-}NH_2}$$

(ii) $C_2H_5NH_2$ + $C_6H_5SO_2Cl$ $\longrightarrow$

Ethylamine; Benzene sulphonyl Chloride (Hinsberg reagent)



$$\left[C_6H_5-\overset{\overset{\large O}{\|}}{\underset{\underset{\large O}{\|}}{S}}-\overset{\overset{\large H}{|}}{N}-CH_2-CH_3\right] + HCl$$

N-Ethylbenzene sulphonamide

(iii) $\underset{\text{Ethanamine}}{C_2H_5NH_2} + \underset{\text{Nitrous acid}}{HNO_2} \xrightarrow{273-278\text{ K}} \underset{\text{Ethanol}}{C_2H_5OH} + N_2 + H_2O$

28. For ccp structure, $a = \frac{4r}{\sqrt{2}} = 2\sqrt{2}r$ or $r = \frac{a}{2\sqrt{2}}$

Packing efficiency $= \frac{\text{Volume occupied by four spheres in the unit cell} \times 100}{\text{Total volume of the unit cell}}\,\%$

$$= \frac{4 \times \frac{4}{3}\pi r^3 \times 100}{\left(2\sqrt{2}r\right)^3}\,\%$$

$$= \frac{\frac{16}{3}\pi r^3 \times 100}{16\sqrt{2}r^3}\,\% = \frac{\frac{16}{3} \times \frac{22}{7} r^3 \times 100}{16 \times 1.414 r^3} = \frac{16.76 \times 100}{22.624} = \mathbf{74\%}$$

29. ***(i)*** Amylose is a long straight unbranched chain polymer α-D(+) glucose.
Amylopectin is a branched chain polymer of α-D glucose.

(ii) **Globular protein;** Its shape is spherical.

(iii) Liver and adipose tissue.

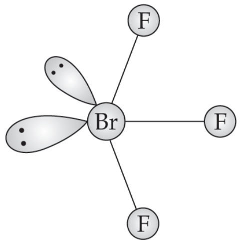
30. ***(a)*** $H_3PO_2 + 2AgNO_3 + H_2O \longrightarrow 2Ag + 2HNO_3 + H_3PO_3$

(b) $3Cl_2 + 6NaOH\ (\text{conc.}) \longrightarrow 5NaCl + NaClO_3 + 3H_2O$

(c) $2XeF_2 + 2H_2O \longrightarrow 2Xe + O_2 + 4H^+ + 4F^-$

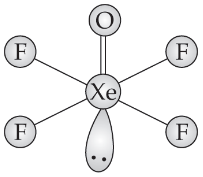
SECTION D

31. ***(a)*** (*i*)



T-shaped

(*ii*)



Square pyramidal

(b) (*i*) Because of low bond dissociation enthalpy of H-Te bond as Te has larger size than S.

(*ii*) Because of their strong electron affinity they have seven valence electrons.

(*iii*) Because N-N single bond is weaker than P-P single bond.

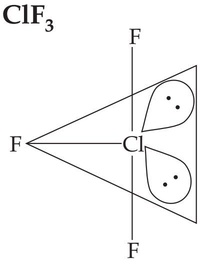
Or

(a) (*i*) Acidic character increases from HF to HI because bond dissociation enthalpy decreases from HF to HI.

(*ii*) Oxygen exists as diatomic O_2 molecule while sulphur exists as polyatomic S_8 molecule which has very high molecular mass therefore sulphur has much high melting and boiling points.

(*iii*) Nitrogen does not contain 'd' orbitals.

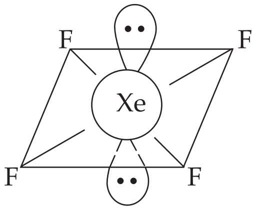
(b) (*i*) **ClF_3**



Shape : Bent T-shaped

Angle : The angle F–Cl–F is lesser than 90°

(*ii*) **XeF_4**



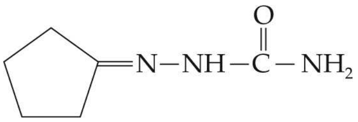
Shape : Square planar

32. **(*a*)** **(*i*)** $\underset{\text{Propane}}{CH_3CH_2CH_3} \xrightarrow[-HCl]{Cl_2/hv} \underset{\text{1-Chloropropane}}{CH_3CH_2CH_2Cl} \xrightarrow[\Delta]{\text{Alc. KOH}} \underset{\text{Propene}}{CH_3CH = CH_2}$

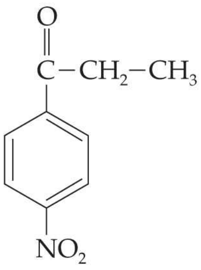
(*ii*) $\underset{\text{Benzyl chloride}}{C_6H_5CH_2Cl} \xrightarrow{KCN} \underset{\text{Benzyl cyanide}}{C_6H_5CH_2CN} \xrightarrow{H_3O + \Delta} \underset{\text{Phenyl ethanoic acid}}{C_6H_5CH_2COOH}$

(*iii*) $\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow{Cu\text{–}573\text{ K}} \underset{\text{Ethanal}}{CH_3CHO} \xrightarrow{\text{di.NaOH}} \underset{\text{3-Hydroxybutanal}}{CH_3CH(OH)CH_2CHO}$

(*b*) **(*i*)**

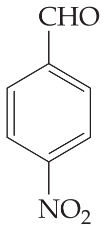


(*ii*)



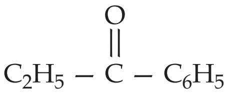
Or

(*i*)



p-Nitrobenzaldehyde

(*ii*)



$$C_2H_5 - \overset{\overset{\displaystyle O}{\|}}{C} - C_6H_5$$

Propiophenone

(*iii*) $CH_3 — CH(OH) — CH_2COOC_2H_5$ (Ethyl-3-hydroxybutanoate)

33. **(*a*)** The relationship between the cell constant of a cell (G*), resistance of the solution in the cell (R) and conductivity (K) is given by

$$K = \frac{\text{Cell constant}}{R} = \frac{G^*}{R} \qquad \text{...where } [G^* = l/a$$

The relationship between molar conductivity (Λ_m) and conductivity of the solution (K) is given by

$$\Lambda_m = \frac{K}{C} \times 1000$$

(*b*) The cell may be represented as

$\text{Al} \mid \text{Al}^{3+} \parallel \text{Ni}^{2+} \mid \text{Ni}$

$E^0_{\text{cell}} = E^0_{\text{R}} - E^0_{\text{L}}$

$E^0_{\text{cell}} = (-0.25) - (-1.66)$

$\therefore \quad \boldsymbol{E^0_{\text{cell}}} = -0.25 + 1.66 = \mathbf{1.41\ V}$

Or

(*a*) **Molar conductivity :** Conductivity of 1 M electrolytic solution placed between two electrodes 1 cm apart and have enough area of cross-section to hold the entire volume is known as molar conductivity or conductivity observed for one molar solution of electrolyte. Molar condctivity increases with decrease in concentration of solute for both weak and strong electrolytes.

(*b*) $\text{R} = \rho(l/a)$

$$\therefore \quad \text{Cell constant } \frac{l}{a} = \frac{\text{R}}{\rho} = \text{R}_{\text{K}}$$

$$= (1500\ \Omega) \times 0.146 \times 10^{-3}\ \text{S cm}^{-1}$$

$$= \mathbf{0.219\ cm^{-1}}$$

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