Marking Scheme links are on each paper

Pre-Board Sample Papers

CBSE EXAM 2024 20 Sets

Class : 12th

Sub : Chemistry

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Sample Paper 1

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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. For the reaction, $2X + Y \longrightarrow X_2Y$
What will be the expression for instantaneous rate of the reaction?

(a) $+\frac{1}{2}\frac{d(Y)}{dt}$ (b) $-\frac{1}{2}\frac{d(X_2Y)}{dt}$

(c) $\frac{-d(X)}{2dt}$ (d) None of these

2. Out of the following, the strongest base in aqueous solution is:

(a) dimethylamine (b) aniline

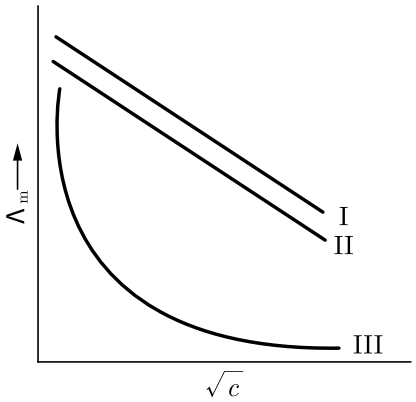
(c) methylamine (d) trimethylamine

3. Which of the following compound will not undergo azo coupling reaction with benzene diazonium chloride?

(a) Phenol (b) Aniline

(c) Nitrobenzene (d) Anisole

4. A graph was plotted between molar conductivity of various electrolytes (NaCl, HCl and NH_4OH) and $\sqrt{c}$ (in mol L^{-1}). Which of the following is the correct set?



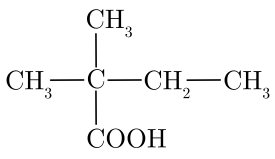
(a) I (NH_4OH), II (HCl), III (NaCl)
(b) I (NaCl), II (HCl), (III) (NH_4OH)
(c) I (HCl), II (NaCl), III (NH_4OH)
(d) I (NH_4OH), II (NaCl), III (HCl)

5. The role of a catalyst is to change :
(a) enthalpy of reaction
(b) Gibbs' energy of reaction
(c) equilibrium constant
(d) activation energy of reaction

6. Out of the following transition elements, the maximum number of oxidation states are shown by:
(a) Cr ($Z = 24$)
(b) Sc ($Z = 21$)
(c) Fe ($Z = 26$)
(d) Mn ($Z = 25$)

7. The value of K_H for Ar(g), CO_2(g), HCHO(g) and CH_4(g) are 40.39, 1.67, 1.83×10^{-5} and 0.413 respectively. Arrange these gases in increasing order of solubility.
(a) Ar $<$ CO_2 $<$ CH_4 $<$ HCHO
(b) Ar $<$ CH_4 $<$ CO_2 $<$ HCHO
(c) HCHO $<$ CH_4 $<$ CO_2 $<$ Ar
(d) HCHO $<$ CO_2 $<$ CH_4 $<$ Ar

8. What is the correct IUPAC name of the given compound?



(a) 2-carboxyl-2-methylpropanoic acid
(b) 2-ethyl-2-methylpropanoic acid
(c) 3-methylabutance carboxylic acid
(d) 2, 2-dimethylbutanoic acid

9. The boiling points of alcohols are higher than those of hydrocarbons of comparable masses due to:

(a) ion-dipole interaction (b) dipole -dipole interaction

(c) hydrogen bonding (d) vander Waals forces

10. For the reaction $2H_2O_2 \longrightarrow 2H_2O + O_2$, $r = k[H_2O_2]$. The reaction is of :

(a) first order (b) second order

(c) third order (d) zero order

11. The compound obtained by the reaction of nitrous acid on aliphatic primary amine is:

(a) alkyl nitrite (b) alcohol

(c) nitroalkane (d) secondary amine

12. A graph was plotted between the molar conductivity Using valence bond theory, the complex $[Cr(NH_3)_6]^{3+}$ can be described as :

(a) d^2sp^3, inner orbital complex, paramagnetic

(b) d^2sp^3, outer orbital complex, diamagnetic

(c) sp^3d^2, outer orbital complex, paramagnetic

(d) dsp^2, inner orbital complex, diamagnetic

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Vanadium had the ability to exhibit a wide range of oxidation states.
Reason : The standard potentials Vanadium are rather small, making a switch between oxidation states relatively easy.

(a) Both Assertion and Reason are true but Reason is not a correct explanation of Assertion.

(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(c) Assertion is fake but Reason is true.

(d) Assertion is true but Reason is fake.

14. **Assertion :** DNA has a double strand helix structure.
Reason : The two strands in a DNA molecule are exactly similar.

(a) Both Assertion and Reason are true but Reason is not a correct explanation of Assertion.

(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(c) Assertion is fake but Reason is true.

(d) Assertion is true but Reason is fake.

15. **Assertion :** Tertiary butylamine can be prepared by the action of NH_3 on tert-butylbromide.
Reason : Tertiary butyl bromide being 3° alkyl halide prefers to undergo elimination on the treatment with a base.

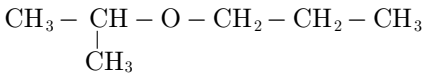
(a) Both Assertion and Reason are true but Reason is not a correct explanation of Assertion.

(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(c) Assertion is fake but Reason is true.

(d) Assertion is true but Reason is fake.

16. **Assertion :** IUPAC name of the compound



is 2-Ethoxy-2-methylethane.
Reason : In IUPAC nomenclature, ether is regarded as hydrocarbon derivative in which a hydrogen atom replaced by —OR or —OAr group
[where R = alkyl group and Ar = aryl group]

(a) Both Assertion and Reason are true but Reason is not a correct explanation of Assertion.

(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(c) Assertion is fake but Reason is true.

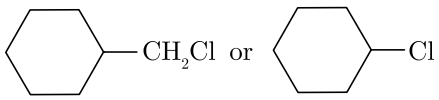
(d) Assertion is true but Reason is fake.

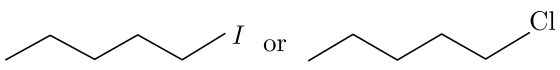
SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Time required to decompose SO_2Cl_2 to half of its initial amount is 60 minutes. If the decomposition is a first order reaction, calculate the rate constant of the reaction.

18. Which one of the following pairs of substances undergoes S_N2 substitution reaction faster and why?

(i) 

(ii) 

19. A cell is constructed between copper and silver

$$Cu(s) \mid Cu^{2+}(aq) \parallel Aq^{+}(aq) \mid Aq(s)$$

If the two half-cells are working under standard condition, then calculate the emf of the cell.

$E^\circ_{Cu^{2+}/Cu} = +0.34\ V$, $E^\circ_{Ag^{+}/Ag} = +0.80\ V$

20. Identify compounds (A) and (B) in the following reactions and write the related balanced chemical equation :

$$CH_3CONH_2 \xrightarrow[\Delta]{P_2O_5} (A) \xrightarrow[Sn+HCl]{4[H]} (B)$$

or

Complete and name the following reaction:

(i) $RNH_2 + CHCl_3 + 3KOH \longrightarrow$

(ii) $RCONH_2 + Br_2 + 4NaOH \longrightarrow$

21. (i) Sketch the zwitter ionic form of α-amino acetic acid.

(ii) What type of linkage holds together the monomers in DNA?

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. A zinc rod is dipped in 0.1 M solution of $ZnSO_4$. The salt is 95% dissociated at this dilution at 298K. Calculate the electrode potential.

$[E^\circ_{(Zn^{2+}/Zn)} = -0.76\ V]$

23. (i) Give the electronic configuration of the d-orbitals of Ti in $[Ti(H_2O)_6]^{3+}$ ion and explain why this complex is coloured ? [At. No. of Ti = 22]

(ii) Write IUPAC name of $[Cr(NH_3)_3\ (H_2O)_3]Cl_3$.

24. (i) Draw the structural formulas and write IUPAC names of all the isomeric alcohols with the molecular formula $C_5H_{12}O$.

(ii) Classify the isomers of alcohols given in part (a) as primary, secondary and tertiary alcohols.

25. Answer the following questions :(Any three)

(i) What do you mean by depression in freezing point?

(ii) How can the molecular weight of a non-volatile substance be calculated by freezing point depression method? Only give the formula.

(iii) Measurement of osmotic pressure method is preferred for the determination of molar mass of macromolecules such as proteins and polymers.

(iv) Elevation of boiling point of 1M KCl solution is nearly double than that of 1 M sugar solution.

26. (i) Write the IUPAC name of the following complex :
$[Co(NH_3)_4(H_2O)Cl]C1_2$

(ii) What is the difference between an Ambidentate ligand and a Bidentate ligand?

(iii) Out of $[Fe(NH_3)_6]^{3+}$ and $[Fe(C_2O_4)_3]^{3-}$, which complex is more stable and why ?

27. What happens when :
(i) N-ethylethanamine reacts with benzenesulphonyl chloride.
(ii) Benzylchloride is treated with ammonia followed by the reaction with Chloromethane.
(iii) Aniline reacts with chloroform in the presence of alcoholic potassium hydroxide.

28. How will you convert ethanal to the following compounds?
(i) Butane-1, 3-diol
(ii) But-2-enal
(iii) But-2-enoic acid

SECTION-D

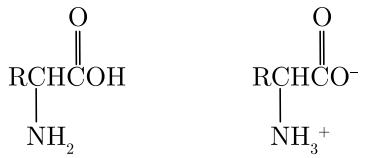
Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. The rate law for a chemical reaction relates the reaction rate with the concentrations or partial pressures of the reactants. For a general reaction $aA + bB \longrightarrow C$ with no intermediate steps in its reaction mechanism, meaning that it is an elementary reaction, the rate law is given by $r = k[A]^x[B]^y$, where [A] and [B] express the concentrations of A and B in moles per litre. Exponents x and y vary for each reaction and are determined experimentally. The value of k varies with conditions that affect reaction rate, such as temperature, pressure, surface area, etc. The sum of these exponents is known as overall reaction order. A zero order reaction has a constant rate that is independent of the concentration of the reactants. A first order reaction depends on the concentration of only one reactant. A reaction is said to be second order when the overall order is two. Once we have determined the order of the reaction, we can go back and plug in one set of our initial values and solve for k.
In the context of the given passage, answer the following questions :
(i) Calculate the overall order of a reaction which has the following rate expression :
Rate $= k[A]^{1/2}[B]^{3/2}$
(ii) What is the effect of temperature on rate of reaction?
(iii) A first order reaction takes 77.78 minutes for 50% completion. Calculate the time required for 30% completion of this reaction log 10 = 1, log 7 = 0.8450.

or

(iv) A first order reaction has a rate constant 1×10^{-3} per sec. How long will 5g of this reactant take to reduce to 3 g?
(log 3 = 0.4771; log 5 = 0.6990)

30. An amino acid is a compound that contains both carboxyl group and an amino group. Although, many types of amino acids are known, the α-amino acids are the most significant in the biological world because they are the monomers from which proteins are constructed. A general structural formula of an α-amino acid is shown in figure below.



(a) Unionised form (b) Internal salt (Zwitter ion) form

An α- amino acid

Although, figure (a) is a common way of writing structural formulas for amino acids, it is not accurate because it shows an acid (—COOH) and a base ($—NH_2$) within the same molecule. These acidic and basic groups react with each other to form a dipolar ion or internal salt (figure (b). The internal salt of an amino acid is given the special name Zwitter ion. Note that a Zwitter ion has no net charge, it contains one positive charge and one negative charge.

Because they exist as Zwitter ions, amino acids have many of the properties associated with salts. They are crystalline solids with high melting points and are fairly soluble in water but insoluble in non-polar organic solvents such as ether and hydrocarbon solvents.

According to the above passage, answer the following questions :

(i) Amino acids are usually colourless, crystalline solids. They behave like salts rather than simple amines or carboxylic acids. Why amino acids show such a behaviour?

(ii) Amino acids are essential and non-essential depending upon their need. One of the essential amino acid is lysine. Can you say why lysine is considered an essential amino acid?

(iii) Here are given some amino acids—lysine, Tyrosine, Glycine, Alamine. One of these amino acids is not optically active. Which one is that amino acid? Also, provide the reason.

or

(iv) The pk_{a_1}, and pk_{a_2}, of an amino acid are 2.3 and 9.7 respectively. What would be the isoelectric point of the amino acid? Calculate by defining it.

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. (i) The cell in which the following reaction occurs:

$2Fe^{3+}(aq) + 2I^{-}(aq) \longrightarrow 2Fe^{2+}(aq) + I_2(s)$

has $E^{\circ}_{Cell} = 0.236$ Volt at 298K. Calculate the standard Gibbs energy of the cell reaction. (Given : 1F = 96,500 C mol^{-1})

(ii) How many electrons flow through a metallic wire if a current of 0.5 A is passed for 2 hours? (Given : 1F = 96,500 C mol^{-1})

(iii) Explain the following with reason :

(a) Chlorine can displace iodine from KI solution but iodine can not displace bromine from KBr solution.

(b) Following reaction is possible or not.

$Hg + H_2SO_4 \longrightarrow HgSO_4 + H_2$

32. (i) Account for the following :

(a) Transition metals from large number of complex compounds.

(b) The lowest oxide of transition metal is basic whereas the highest oxide is amphoteric or acidic.

(c) E° value for the Mn^{3+}/Mn^{2+} couple is highly positive (+1.57 V) as compare to Cr^{3+}/Cr^{2+}.

(ii) Write one similarity and one difference between the chemistry of lanthanoid and actinoid elements.

or

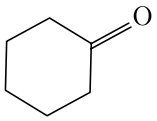
(i) (a) How is the variability in oxidation states of transition metals different from that of the p-block elements ?

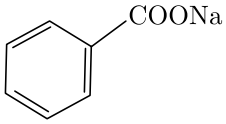
(b) Out of Cu^+ and Cu^{2+}, which ion is unstable in aqueous solution and why ?

(c) Orange colour of $Cr_2O_7^{2-}$ ion changes to yellow colour when treated with an alkali. Why ?

(ii) Chemistry of actinoids is complicated as compared to lanthanoids. Give two reasons.

33. (i) Write the product (s) in the following reactions:

(a)  + HCN ⟶ ?

(b)  + NaOH $\xrightarrow[\Delta]{CaO}$

(c) $CH_3 - CH = CH - CN \xrightarrow[(b)\,H_2O]{(a)\,DIBAL-H}$?

(ii) Give simple chemical test to distinguish between the following pairs of compounds :

(a) Butanal and Butan-2-one.

(b) Benzoic acid and Phenol.

or

(i) An organic compound (A) with molecular formula C_3H_7NO on heating with Br_2 and KOH forms a compound (B), compound (B), on heating with $CHCl_3$ and alcoholic KOH produces a foul smelling compound (C) and on reacting with $C_6H_5SO_2Cl$ forms a compound (D) which is soluble in alkali. Write the structures of (A), (B), (C) and (D).

(ii) Give reasons to support the answer :

(a) Presence of alpha hydrogen in aldehydes and ketones is essential for aldol condensations.

(b) 3-Hydroxy pentan-2-one shows positive result to Tollen's test.

□□□□□□□

Sample Paper 2

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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. Acetic acid reacts with hydrazoic acid at 0° in the presence of conc. H_2SO_4 to give:

(a) methyl amine (b) methyl cyanide

(c) ethylamine (d) methane

2. Osmotic pressure of a solution is 0.0821 atm at a temperature of 300 K. The Concentration in moles/lit. will be:

(a) 0.3×10^{-2} (b) 3

(c) 0.33 (d) 0.666

3. When nitrobenzene is reduced in neutral medium, the product is:

(a) C_6H_5NHOH (b) C_6H_5NH2

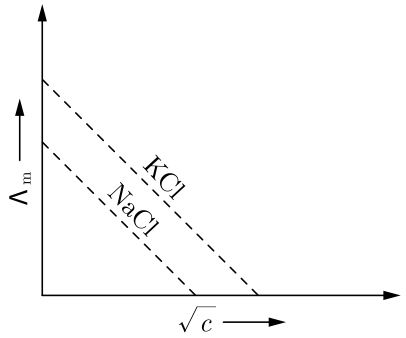
(c) *p*-aminophenol (d) azobenzene

4. The rate constant for the reaction, $A + 2B \longrightarrow$ product is expressed by $R = [A][8]$ The order of reaction will be:

(a) 6 (b) 5

(c) 2 (d) 3

5. Consider the following graph between molar conductivity (Λ_m) and $\sqrt{c}$



What do you infer about NaCl and KCl from the graph?

(a) NaCI and KCl are strong electrolytes

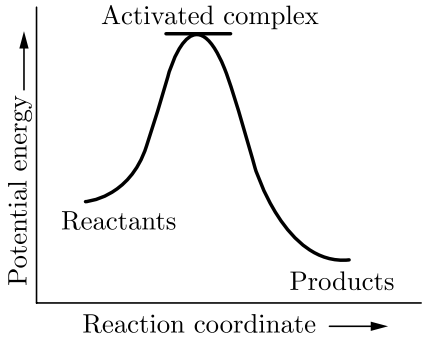
(b) Na^+ (aq.) has less conductance than $K^+(aq)$ due to less hydration

(c) NaCl and KCl are weak electrolytes

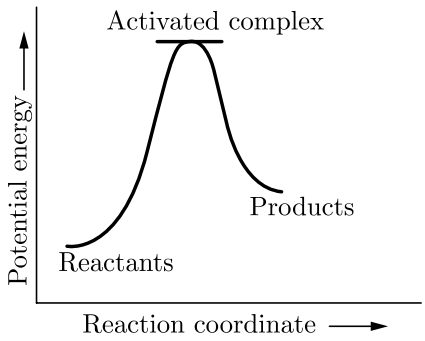
(d) Na^+ (aq.) has more conductance than $K^+(aq)$

6. Which of the following graphs represents exothermic reaction?

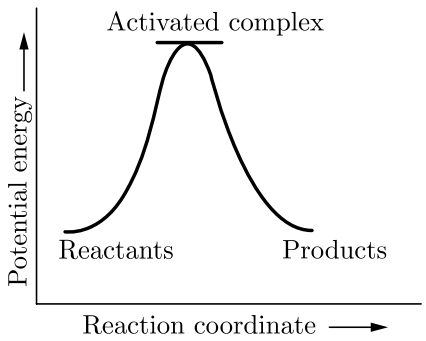
(i)



(ii)



(iii)



(a) (ii) only

(b) (i) only

(c) (iii) only

(d) (i) and (ii)

7. In which of the following ions, number of unpaired electron is zero?

(a) $Fe^{++}(Z = 26)$

(b) $Cr^{++}(Z = 24)$

(c) $Zn^{++}(Z = 30)$

(d) $Cu^{++}(Z = 29)$

8. Phenol does not undergo nucleophilic substitution reaction easily due to:
(a) instability of phenoxide ion
(b) acidic nature of phenol
(c) partial double bond character of C—OH bond
(d) partial double bond character of C—C bond

9. The time required for the half-completion ($t_{1/2}$) of a first order reaction is:
(a) independent of its initial concentration
(b) dependent on square root of its initial concentration
(c) dependent on its initial concentration
(d) inversely proportional to its initial concentration

10. Which of the following isomer has the highest melting point?
(a) 1, 4-dichlorobenzene
(b) 1, 2-dichlorobenzene
(c) 1, 3-dichlorobenzene
(d) All isomers have same melting points

11. Why is $[Ni(CN)_4]^{2-}$ diamagnetic while $[NiCl_4]^{2-}$ is paramagnetic in nature:
(a) In $[Ni(CN)_4]^{2-}$, no unpaired electrons are present while in $[NiCl_4]^{2-}$ two unpaired electrons are present.
(b) $[NiCl_4]^{2-}$ shows sp^2 hybridisation, hence it is paramagnetic.
(c) $[Ni(CN_4)]^{2-}$ shows sp^3 hybridisation, hence it is diamagnetic.
(d) In $[NiCl_4]^{2-}$, no unpaired electrons are present while in $[Ni(CN)_4]^2$ two unpaired electrons are present.

12. Which one of the following is formed by Gabriel phthalimide reaction?
(a) Tertiary amine
(b) Primary aromatic amine
(c) Primary aliphatic amine
(d) Secondary amine

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Separation of Zr and Hf is difficult.
Reason : Because Zr and Hf lie in the same group of the periodic table.
(a) Both Assertion and Reason are true but Reason not the correct explanation of Assertion.
(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(c) Assertion is false but Reason is true.
(d) Assertion is true but Reason is false.

14. **Assertion :** All naturally occurring α-amino acids except glycine are optically active.
Reason : Most naturally occurring amino acids have L-configuration.

(a) Both Assertion and Reason are true but Reason not the correct explanation of Assertion.

(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(c) Assertion is false but Reason is true.

(d) Assertion is true but Reason is false.

15. **Assertion :** N, N-Diethylbenzene sulphonamide is insoluble in alkali.
Reason: Sulphonyl group attached to nitrogen atom is strong electron withdrawing group.

(a) Both Assertion and Reason are true but Reason not the correct explanation of Assertion.

(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(c) Assertion is false but Reason is true.

(d) Assertion is true but Reason is false.

16. **Assertion :** Alcohols have higher boiling Points than ethers of comparable molecular masses
Reason: Alcohols and ethers are isomeric in nature

(a) Both Assertion and Reason are true but Reason not the correct explanation of Assertion.

(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(c) Assertion is false but Reason is true.

(d) Assertion is true but Reason is false.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Define molar conductivity for the solution of an electrolyte. How does it vary with concentration?

18. Consider the decomposition of hydrogen peroxide in alkaline medium which is catalysed by iodide ions.

$$2H_2O_2 \xrightarrow{OH^-} 2H_2O + O_2$$

This reaction takes place in two steps as given below :

Step-I : $H_2O_2 + I^- \longrightarrow H_2O + IO^-$ (Show)

Step-II : $H_2O_2 + IO^- \longrightarrow H_2O + I^- + O_2$ (fast)

(i) Write the rate law expression and determine the order of reaction w.r.t. H_2O_2

(ii) What is the molecularity of each individual step?

19. Glucose and sucrose are soluble in water but cyclohexane and benzene (simple six membered ring compounds) are insoluble in water. Explain.

or

What type of bonding helps in stabilising the α-helix structure of proteins? Explain

20. CH_3CHO is more reactive than CH_3COCH_3 towards reaction with HCN. Why?

21. Write the IUPAC name and geometrical isomer of $[Pt(NH_3)_2Cl_2]$.

SECTION-C

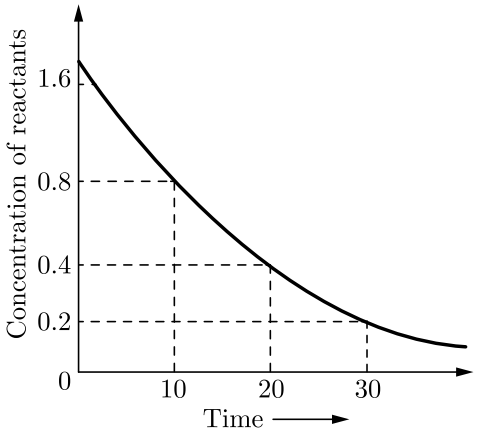
Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. Arrange each set of compounds in order of increasing boiling points:

(i) Bromomethane, bromoform, chloromethane, dibromomethane

(ii) 1-Chloropropane, isopropylchloride, 1-chlorobutane.

23. Analyse the given graph, drawn between concentration of reactant *vs* time.



(i) Predict the order of reaction.

(ii) Theoretically, can the concentration of the reactant reduce to zero after infinite time? Explain.

24. Answer the following questions:(Any three)

(i) Why is the vapour pressure of an aqueous solution of glucose lower than that of water?

(ii) What is semi-permeable membrane?

(iii) Why do gases always tend to be less soluble in liquids as the temperature is raised?

(iv) How does sprinkling of salt help in clearing the snow covered roads in hilly areas? Explain the phenomenon involved in the process.

25. (i) What is diazonium salt?
(ii) Write the chemical reaction of preparation of chlorobenzene from benzene diazonium chloride.

26. Determine the structure and magnetic behaviour of $[Fe(CN)_6]^{4-}$ ion on the basis of valence bond theory.

27. Write structure of compounds *A*, *B* and *C* in each of the following reactions:

(i) $C_6H_5Br \xrightarrow{Mg/\text{dry ether}} A \xrightarrow[(b)\,H_3O^+]{(a)\,CO_2(g)} B \xrightarrow{PCl_5} C$

(ii) $CH_3CN \xrightarrow[(b)\,H_3O^+]{(a)\,SnCl_2/HCl} A \xrightarrow{\text{dil. NaOH}} B \xrightarrow{\Delta} C$

28. (i) Define the following terms:
(a) Enantiomers
(b) Racemic mixture
(ii) Why is chlorobenzene resistant to nucleophilic substitution reaction?

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. The four colligative properties of the dilute solutions help in calculating the molecular mass of the solute which is often called observed molecular mass. It may be same as the theoretical molecular mass (calculated from the molecular formula) if the solute behaves normally in solution. In case, it undergoes association or dissociation, the observed molar mass gives different results. The nature of the solute in solution is expressed in terms of van't Hoff factor (i) which may be 1 (if the solute behaves normally), less than 1 (if the solute associates) and more than 1 (if the solute dissociates). The extent of association or dissociation is represented by cc which is:

$a = \dfrac{i-1}{(1/n-1)}$ or $\dfrac{i-1}{n-1}$ (for dissociation)

(for association)

Based on the above passage, answer the following questions :
(i) What is common in all the four colligative properties?
(ii) What is the expected value of van't Hoff factor for $K_4[Fe(CN)_6]$ when it completely dissociates in water?
(iii) What is the value of van't Hoff factor fora dilute solution of K_2SO_4 in water?

or

(iv) In the determination of molar mass of A^+B using colligative property, what will be the van't Hoff factor if the solute is 40% dissociated?

30. Polysaccharides may be very large molecules. Starch, glycogen, cellulose, and chitin are examples of polysaccharides.

Starch is the stored form of sugars in plants and is made up of amylose and amylopectin (both polymers of glucose). Amylose is soluble in water and can be hydrolyzed into glucose units breaking glycosidic bonds, by the enzymes α-amylase and β-amylase. It is straight chain polymer. β-mylopectin is a branched chain polymer of several D-glucose molecules. 80% of amylopectin is present in starch. Plants are able to synthesize glucose, and the excess glucose is stored as starch in different plant parts, including roots and seeds. The starch that is consumed by animals is broken down into smaller molecules, such as glucose.

The cells can then absorb the glucose. Glycogen is the storage form of glucose in humans and other vertebrates, and is made up of monomers of glucose. It is structurally quite similar to amylopectin. Glycogen is the animal equivalent of starch. It is stored in liver and skeletal muscles.

Cellulose is one of the most abundant natural biopolymers. The cell walls of plants are mostly made of cellulose, which provides structural support to the cell. Wood and paper are mostly cellulosic in nature.

Like amylose, cellulose is a linear polymer of glucose. Cellulose is made up of glucose monomers that are linked by bonds between particular carbon atoms in the glucose molecule. Every other glucose monomer in cellulose is flipped over and packed tightly as extended long chains. This gives cellulose its rigidity and high tensile strength—which is so important to plant cells. Cellulose passing through our digestive system is called dietary fiber.

Based on the above passage, answer the following questions:

(i) Glycogen is a kind of polysaccharide and is the storage form of glucose present in humans and other vertebrates. It is the animal equivalent of starch but can you say where is it stored in animals?

(ii) What can you infer about the characteristic of amylose from the passage?

(iii) Whenever glucose levels drop in our body, a bipolymer breaks down to release glucose. Name this bipolymer and it is structurally similar to which polymer?

or

(iv) Which polymer is important to plant cells? How?

Section-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. (i) Write down complete equation for the following reactions:

(a) Oxidation of Fee' by 0.203- in acidic medium.

(b) Oxidation of 5203- by $KMnO_4$ (aq) neutral.

(c) Decomposition of oxalate in the presence of $KMnO_4$ in acidic medium.

(ii) Compare the chemistry of actinoids with that of the lanthanoids with special reference to :

(a) Electronic configuration. (b) Atomic and ionic sizes.

(c) Oxidation state. (d) Chemical reactivity.

32. (i) Give the mechanism for the formation of ethanol from ethene.

(ii) Predict the reagent for carrying out the following conversions:

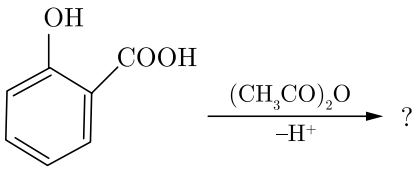
(a) Phenol to benzoquinone.

(b) Anisole to p-bromoanisole.

(c) Phenol to 2, 4, 6-tribromophenol.

or

(i) Write the product(s) in the following reactions:

(a) 

(b) $H_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-O-CH_2-CH_3 \xrightarrow{HI} ? + ?$

(c) $CH_3-CH=CH-CH_2-OH \xrightarrow{PCC} ?$

(ii) Give simple chemical tests to distinguish between the following pairs of compounds:

(a) Ethanol and Phenol.

(b) Propanol and 2-methylpropan-2-ol.

33. (i) For the reaction:

$2AgCl(s) + H_2(g)\,(1\,atm) \longrightarrow 2Ag(s) + 2H^+$

$(0.1M) + 2C1^-(0.1M),\ \Delta G^\circ = -43600\ J$ at $25^\circ C$.

Calculate the emf of the cell. $[Log10^{-n} = -n]$

(ii) Define fuel cell and write its two advantages.

or

(i) Out of the following pairs, predict with reason which pair will allow greater conduction of electricity:

(a) Silver wire at 30°C or silver wire at 60°C.

(b) 0.1 M CH_3COOH solution or 1 M CH_3COOH solution.

(c) KG solution at 20°C or KCl solution at 50°C.

(ii) Give two points of differences between electrochemical and electrolytic cells.

□□□□□□□

Sample Paper 3

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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. Electrolytic reduction of nitrobenzene in strongly acidic medium gives the final product:

(a) *p*-aminophenol (b) azobenzene

(c) aniline (d) phenyl hydroxyl amine

2. The value of rate constant for a first order reaction is $2.303 \times 10^{-2}\,s^{-1}$. What will be the time required to reduce the concentration to 1/10th of its initial concentration ?

(a) 10 s (b) 2303 s

(c) 23.03 s (d) 100 s

3. Long time nitration of phenol with mixture of conc. HNO_3 and concentrated H_2SO_4 gives:

(a) picric acid (b) *o*-nitrophenol

(c) nitrobenzene (d) *p*-nitrophenol

4. The reaction between $RNH_2 + CHCl_3 + KOH$ (alc.) is known as:

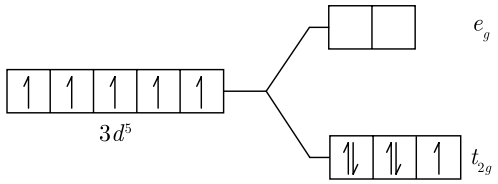
(a) Coupling reaction

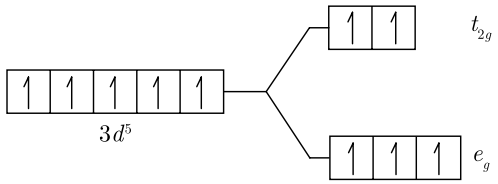
(b) Carbylamine reaction

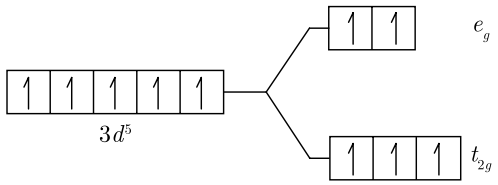
(c) Hoffmann bromamide reaction

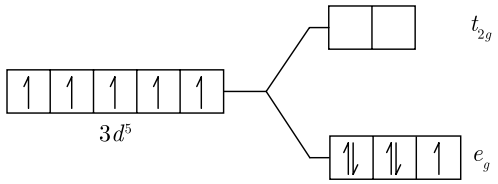
(d) Schmidt reaction

5. Which of the following energy level diagram for $[FeF_6]^{3-}$ is correct on the basis of crystal field theory?

(a)


(b)


(c)


(d)


6. Metallic radii of some transition elements are given below:

Element	Fe	Co	Ni	Cu
Metallic radii/pm	126	125	125	128

Which of these elements will have highest density ?

(a) Cu (b) Fe

(c) Ni (d) Co

7. Which of the following does not reduce Fehling's solution?

(a) CH_3CHO (b) HCHO

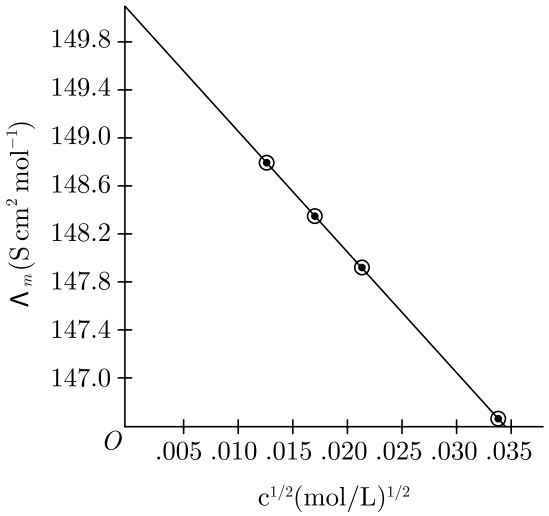
(c) CH_3COOH (d) HCOOH

8. How much ethyl alcohol must be added to 1L of water so that the solution will freeze at –14°C ? (K_f for water = 1.86°C/mol)

(a) 10.5 mol (b) 9.5 mol

(c) 7.5 mol (d) 8.5 mol

9. The molar conductivity of KCl solutions at different concentrations at 298 K is shown in the graph:



Determine the value of $\wedge^\circ_m$ for KCl using the graph.

(a) 151.2 S cm^2 mol^{-1} (b) 149.9 S cm^2 moL^{-1}

(c) 150.0 S cm^2 mol^{-1} (d) 152.0 S cm^2 mol^{-1}

10. Consider the following reaction:

$$CH_3 - CH = CH_2 \xrightarrow[2.\,aq.\,KOH]{1.\,HBr}$$

The major end product is :

(a) $CH_3 - \underset{\displaystyle Br}{\underset{|}{CH}} - CH_3$ (b) $CH_3 - \underset{\displaystyle OH}{\underset{|}{CH}} - CH_3$

(c) $CH_3 - CH_2 - CH_2 - Br$ (d) $CH_3 - CH_2 - CH_2 - OH$

11. Williamson's synthesis of preparing dimethyl ether is an :

(a) S_N2 reaction

(b) S_N1 reaction

(c) Elimination reaction

(d) Nucleophilic addition reaction

12. In reaction $A \longrightarrow B$, the rate of reaction is doubled on increasing the concentration of the reactants four times. The order of the reaction is :

(a) $\frac{1}{2}$ (b) 2

(c) 4 (d) Zero

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** $(CH_3)_3COH$ when heated with conc. H_2SO_4 gives iso-butylene as the main product and not di-tertiary butyl ether.
Reason : All alcohols readily dehydrates with conc. H_2SO_4.

(a) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(c) Assertion is false but Reason is true.

(d) Assertion is true but Reason is false.

14. **Assertion :** In presence of enzyme, substrate molecule can be attacked by the reagent effectively.
Reason : Active sites of enzymes hold the substrate molecule in a suitable position.

(a) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(c) Assertion is false but Reason is true.

(d) Assertion is true but Reason is false.

15. **Assertion :** Cu cannot liberate hydrogen from acids.
Reason : Cu has positive electrode potential.

(a) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(c) Assertion is false but Reason is true.

(d) Assertion is true but Reason is false.

16. **Assertion :** Hoffmann's bromamide reaction is given by primary amines.
Reason : Primary amines are more basic than secondary amines.

(a) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(c) Assertion is false but Reason is true.

(d) Assertion is true but Reason is false.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. $[Fe(CN)_6]^{4-}$ and $[Fe(H_2O)_6]^{2+}$ are of different colours in dilute solutions. Why?

18. What is the effect of denaturation on the structure of proteins?

19. HgO decomposes on heating but MgO does not. Explain with reason.

20. For the reaction $2N_2O_5(g) \longrightarrow 4NO_2(g) + O_2(g)$, the rate of formation of $NO_2(g)$ is $2.8 \times 10^{-3}\,M\,s^{-1}$. Calculate the rate of disappearance of $N_2O_5(g)$.

or

What do you mean by rate of a reaction? For the reaction $NO_2(g) + CO(g) \longrightarrow CO_2(g) + NO(g)$, the proposed mechanism is as follows :

(i) $NO_2 + NO_2 \longrightarrow NO + NO_3$ (slow)

(ii) $NO_3 + CO \longrightarrow CO_2 + NO_2$ (fast)

What is the velocity (rate) of reaction?

21. Write the structures of A, B, C and D in the following reactions :

$$\underset{\text{Benzoyl chloride}}{C_6H_5COCl} \xrightarrow{H_2/Pd-BaSO_4} [A] \xrightarrow{NaOH\,(conc.)} B + C \xrightarrow{CH_3MgBr/H_3O^+} [D]$$

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. In a reaction $2N_2O_5(g) \longrightarrow 4NO_2(g) + O_2(g)$, the concentration of N_2O_5 decreases from 0.5 mol L^{-1} to 0.4 mol L^{-1} in 10 minutes, Calculate the average rate of this reaction and rate of production of NO_2 during this period.

23. Propose the mechanism of the reaction taking place when :

(i) (–)-2-Bromooctane reacts with sodium hydroxide to form (+)-Octane-2-ol.

(ii) 2-Bromopentane is heated with KOH(alc.) to form alkene.

24. The following compounds are given to you :

2-Bromopentane, 2-Bromo-2-methylbutane, 1- Bromopentane

(i) Write the compound which is most reactive towards S_N2 reaction.

(ii) Write the compound which is optically active.

(iii) Write the compound which is most reactive towards β elimination reaction.

25. What happens when: (Any three)

(i) formic acid reacts with conc. H_2SO_4.

(ii) acetic acid reacts with Cl_2 in the presence of red P?

(iii) calcium acetate is heated?

(iv) $CH_3 - O - CH_3$ is heated with HI.

26. (i) At low pressure and high temperature, water evaporates rapidly, why?

(ii) Calculate the molality of a solution when 20 g NaOH is dissolved in 440 g of solvent.

27. A solution of $[Ni(H_2O)_6]^{2-}$ is green but a solution of $[Ni(CN)_4]^{2-}$ is colourless. Explain.

28. How will you convert (Give only chemical equation):

(i) Propanamide to ethylamine

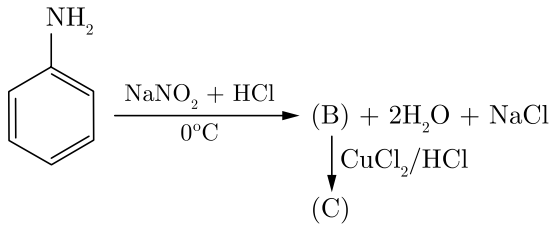
(ii) Ethyl amine to methane

(iii) Aniline to acetanilide.

or

Identify A, B and C in the following equations :

(i) $C_6H_5NO_2 \xrightarrow[6[H]]{Sn/HCl} (A) + H_2O$

(ii) 

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. Molar conductivity of a solution is the conductance of solution containing one mole of electrolyte, kept between two electrodes having unit length between them and large cross-sectional area, so as to contain the electrolyte. In other words, molar conductivity is the conductance of the electrolytic solution kept between the electrodes of a conductivity cell at unit distance but having area of cross-section large enough to accommodate sufficient volume of solution that contains one mole of the electrolyte.

It is denoted by Λ_m.

The molar conductivity is related to conductivity as:

$$\Lambda_m = k \times V = \frac{1000}{C} \times k = k \times \frac{1000}{\text{Molarity}}$$

Unity of Λ_m (molar conductivity) shall be ohm^{-1} cm^{-1} mol^{-1} or S cm^2 mol^{-1}.

Thus, knowing molar concentration (C) and conductivity (k), Λ_m can be calculated. Λ°_m is called molar conductivity at infinite dilution. The molar conductivity of strong electrolytes is found to vary with concentration according to the equation,

$$\Lambda_m^C = \Lambda^\circ_m - A\sqrt{C}$$

This equation is called Debye-Huckel Onsager equation.

Here, A is constant depending upon the type of electrolyte taken and nature of solvent and temperature.

In the context of given passage, answer the following questions:

(i) The molar conductivity of HCl increases with dilution. Can you suggest what may be the reason for this?

(ii) Here are given the different molarities of NaCl. Which of them will exhibit the highest molar conductivity?

0.005 M NaCl, 0.1 M NaCl, 0.5 M NaCl, 0.01 M NaCl.

(iii) Molar conductivity of a solution is $1.26 \times 10^2\ \Omega^{-1}\,cm^2\,mol^{-1}$. Its molarity is 0.01. What will be its specific conductivity?

or

(iv) The conductivity of 0.00241 M acetic acid is $7.896 \times 10^{-5}\ S\,cm^{-1}$. What shall be the molar conductivity of the solution in S cm^{-1} mol^{-1} ?

30. Amines constitute an important class of organic compounds derived by replacing one or more hydrogen atoms of ammonia molecule by alkyl/ aryl groups. Amines are usually formed from nitro compounds, halides, amides, etc. They exhibit hydrogen bonding which influences their physical properties. Alkyl amines are found to be stronger bases than ammonia. In aromatic amines, electron releasing and withdrawing groups, respectively increase and decrease their basic character. Reactions of amines are governed by availability of the unshared pair or electrons on nitrogen. Influence of the number of hydrogen atoms at nitrogen atom on the type of reactions and nature of products is responsible for identification and distinction between primary, secondary and tertiary amines. Reactivity of aromatic amines can be controlled by acylation process.

In the context of given passage, answer the following questions :

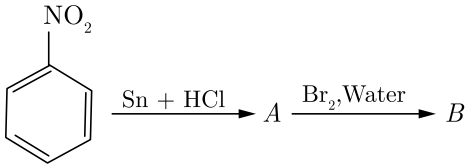
(i) Why does aniline not give Friedel-Crafts reaction?

(ii) Arrange the following in the increasing order of their pK_b values :
$C_6H_5NH_2$, NH_3, $C_2H_5NH_2$, $(CH_3)_3N$

(iii) How can you distinguish between $CH_3CH_2NH_2$ and $(CH_3CH_2)_2$ NH by Hinsberg test?

or

(iv) Write the structures of A and B in the following reactions:

(a) 

(b) $CH_3CH_2CONH_2 \xrightarrow{Br_2/alc.\,KOH} A \xrightarrow[Pyridine]{CH_3COCl} B$

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. (i) Calculate the mass of Ag deposited at cathode when a current of 2 amperes was passed through a solution of $AgNO_3$ for 15 minutes.
(Given : Molar mass of Ag $= 108\ g\,mol^{-1}$, $1F = 96500\ C\,mol^{-1}$)

(ii) What do you mean by fuel cell?

(iii) Write Cu, Na, Mg and Ag in the decreasing order of electrochemical series with the help of the following reactions :

$Cu + 2Ag^{+} \longrightarrow Cu^{2+} + 2Ag$

$2Na + Mg^{2+} \longrightarrow 2Na^{+} + Mg$

$Mg + Cu^{2+} \longrightarrow Mg^{2+} + Cu$

32. (i) Write the reaction involved in the following :
(a) Etard reaction
(b) Stephan reduction

(ii) How will you convert the following in not more than two steps :
(a) Benzoic acid to Benzaldehyde
(b) Acetophenone to Benzoic acid
(c) Ethanoic acid to 2-hydroxyethanoic acid.

or

(i) An organic compound [A] with molecular formula $C_8H_{16}O_2$ was hydrolysed with dilute sulphuric acid to give a carboxylic acid [B] and an alcohol [C]. Oxidation of [C] with chromic acid produced [B]. The alcohol [C] on dehydration gave but-1-ene. Write equations for the reactions involved.

(ii) How many asymmetric carbon atoms are created during the complete reduction of benzil (PhCOCOPh) with $LiAlH_4$? Also write the number of possible stereoisomers formed as the product.

33. (i) Account for the following :
(a) Copper (I) compounds are white whereas Copper (II) compounds are coloured.
(b) Chromates change their colour when kept in an acidic solution.
(c) Zn, Cd, Hg are considered as d-block elements, but not as transition elements.

(ii) Calculate the spin-only moment of Co^{2+} $(Z = 27)$ by writing the electronic configuration of Co and Co^{2+}.

or

(i) Following are the transition metal ions of $3d$ series :

$$Ti^{4+}, V^{2+}, Mn^{3+}, Cr^{3+}$$

(Atomic numbers :

$$Ti = 22, V = 23, Mn = 25, Cr = 24)$$

Answer the following :
(a) Which ion is most stable in an aqueous solution and why?
(b) Which ion is a strong oxidising agent and why?
(c) Which ion is colourless and why?

(ii) Complete the following equations :
(a) $2MnO_4^{-} + 16H^{+} + 5S^{2-} \longrightarrow$
(b) $KMnO_4 \xrightarrow{\text{heat}}$

□□□□□□□

Sample Paper 4

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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. The half-life for a first order reaction is 4 minutes. The time after which 99.9% reaction gets completed is:

(a) 32 minutes (b) 40 minutes

(c) 16 minutes (d) 8 minutes

2. In the following reaction:

$CH_3 - CH = CH - CH_2OH \xrightarrow{PCC}$ .....

The product formed is:

(a) $CH_3 - CH = CH - CHO$ (b) $CH_3 - CH_2 - CH_2 - CHO$

(c) CH_3– CHO and CH_3CH_2OH (d) $CH_3 - CH = CH - COOH$

3. In the nitration of benzene using a mixture of conc. H_2SO_4 and conc. HNO_3, the species which initiate the reaction is _____.

(a) NO^+ (b) NO_2

(c) NO_2^- (d) NO_2^+

4. The reagent with which acetaldehyde and acetone both react easily is:

(a) Grignard reagent (b) Schiff's reagent

(c) Tollen's reagent (d) Fehling solution

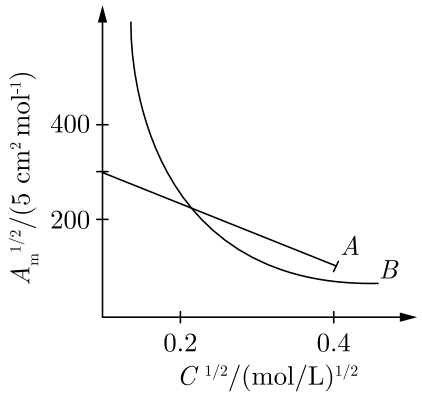
5. o-hydroxy benzyl alcohol when reacted with PCl_3 gives the product as (IUPAC name):

(a) o- hydroxy-benzyl chloride
(b) o-chloromethylchlorobenzene
(c) 4-hydroxymethylphenol
(d) 2- chloromethylphenol

6. The relationship between rate constant and half-life period for a first order reaction is:

(a) $t_{1/2} = 0.693k$
(b) $t_{1/2} = k/0.693$
(c) $t_{1/2} = \frac{0.693}{k}$
(d) $k = \frac{t_{1/2}}{0.693}$

7. The following curve is obtained when molar conductivity λ_m (y-axis) is plotted against the square root of concentration $C^{1/2}$ (x-axis) for two electrolytes A and B.



What can you infer about the nature of the two electrolytes A and B?

(a) A is weak electrolyte and B is strong electrolyte
(b) A is strong electrolyte and B is weak electrolyte
(c) A and B both are strong electrolytes
(d) A and B both are weak electrolytes

8. $KMnO_4$ acts as an oxidising agent in alkaline medium. When alkaline $KMnO_4$ is treated with KI, iodide ion is oxidised to:

(a) IO^-
(b) I_2
(c) IO_4^-
(d) IO_3^-

9. The magnitude of CFSE (crystal field splitting energy, Δ_0) can be related to the configuration of d-orbital in a coordination entity as:

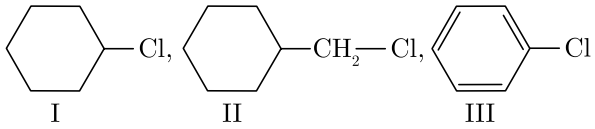
(a) if $\Delta_0 < P$, the configuration is $t_{2g}^3 e_g^1$ = week field ligand and high spin complex
(b) if $\Delta_0 > P$, the configuration is $t_{2g}^4 e_g^0$ = strong field ligand and high spin complex
(c) if $\Delta_0 > P$, the configuration is $t_{2g}^3 e_g^1$ = strong field ligand and low spin complex
(d) if $\Delta_0 = P$, the configuration is $t_{2g}^4 e_g^1$ = strong field ligand and high spin complex

10. Benzene diazonium chloride reacts with phenol in weakly alkaline medium to give:

(a) *p*-hydroxyphenol (b) Chlorobenzene

(c) Biphenyl ether (d) Benzene

11. Consider the following given compounds :

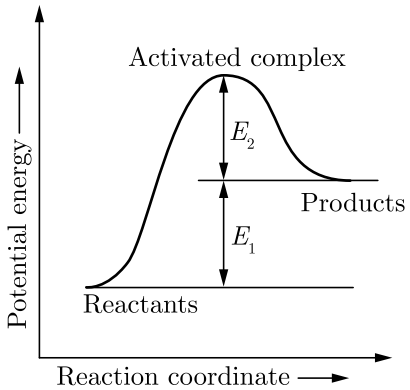


Which of the following is the correct order of reactivity towards S_N2 reaction?

(a) I > III > II (b) II > I > III

(c) II > III > I (d) III > I > II

12. Consider the given figure and mark the correct option.



(a) Activation energy of both forward and backward reaction is $E_1 + E_2$ and reactant is more stable than product.

(b) Activation energy of forward reaction is $E_1 + E_2$ and product is less stable than reactant.

(c) Activation energy of forward reaction is $E_1 + E_2$ and product is more stable than reactant.

(d) Activation energy of backward reaction is E_1 and product is more stable than reactant.

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Aliphatic amines are weaker bases than ammonia and aromatic amines are stronger bases than ammonia.
Reason : +/− effect of alkyl groups on aliphatic amines increase the electron density on nitrogen atom. Aromatic amines are weaker due to electron withdrawing nature of the aryl group.

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) Assertion is false but Reason is true.

(d) Assertion is true but Reason is false.

14. **Assertion :** Only α-amino acids are obtained on hydrolysis of proteins.
Reason : In zwitter ionic form, amino acids show amphoteric behaviour.

(a) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

15. **Assertion :** Actinoids form relatively less stable complexes as compared to lanthanides.
Reason : Actinoids can utilise their $5f$ orbitals along with $6d$ orbitals in bonding, but lanthanoids do not use their $4f$ orbital for bonding.

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) Assertion is false but Reason is true.

(d) Assertion is true but Reason is false.

16. **Assertion :** Ethers have specific dipole moment values.
Reason : The $C-O$ bond is polar in nature.

(a) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Is the following reaction possible? Explain with reason.
$Fe(s) + H_2SO_4(aq) \longrightarrow FeSO_4 + H_2\uparrow$

18. A compound (A) on oxidation gives B $(C_2H_4O_2)$, (A) reacts with dil. NaOH and on subsequent heating forms (C). The compound (C) on catalytic hydrogenation gives (D). Identify A, B, C, D and write down the reaction involved.

19. Write the order of following reactions with reason:

(i) $N_2 + 3H_2 \underset{Mo}{\overset{Fe}{\rightleftharpoons}} 2NH_3^-$

(ii) $CH_3COOC_2H_5 + NaOH \rightleftharpoons CH_3COONa$

20. Give the plausible explanation for the following:
(i) Glucose doesn't 2, 4-DNP test.
(ii) The two strands in DNA are not identical but are complementary.

or

What happens when D-glucose is treated with the following? Give equation to support your answer.
(i) HI (ii) HNO_3

21. Write all the geometrical isomers of $[Pt(NH_3)(Br)(Cl)(Py)]$ and how many of these will exhibit optical isomers?

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. How will you distinguish between the following pairs of compounds ?
(i) Chloroform and carbon tetrachloride
(ii) Benzyl chloride and chlorobenzene.

23. Show that for a first order reaction, time required for completion of 99% of reaction is twice the time required for completion of 90% of reaction.

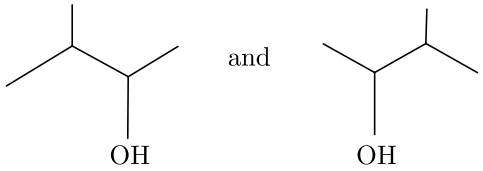
24. Give reasons for the following: (Any three)
(i) Aniline cannot be prepared by the ammonolysis of chlorobenzene under normal conditions.
(ii) N-ethylethanamine boils at 329.3K and butanamine boils at 350.8K. although both are isomeric in nature.
(iii) Acylation of aniline is carried out in the presence of pyridine.
(iv) Acetylation of aniline reduces its activation effect.

25. (i) Write the IUPAC name of the following complex : $K_2[PdCl_4]$
(ii) Using crystal field theory, write the electronic configuration of d^5 ion, if $\Delta_o > P$.
(iii) What are homoleptic complexes?

26. How are following conversions carried out?
(i) Ethyl cyanide to ethanoic acid
(ii) Butan-1-ol to butanoic acid
(iii) Benzoic acid to *m*-bromobenzoic acid.

27. The boiling point of solution obtained by dissolving 6 g urea (NH_2CONH_2) in 200 g water, is 100.28C. What will be the freezing point of this solution? For water molal elevation constant and molal depression constant are respectively 0.52°C $molal^{-1}$ and 1.86°C $molal^{-1}$.

28. (i) Identify the chiral molecule in the following pair:



(a) (b)

(ii) Write the structure of the product when chlorobenzene is treated with methyl chloride in the presence of sodium metal and dry ether.

(iii) Write the structure of the alkene formed by dehydrohalogenation of 1-bromo-1-methylcyclohexane with alcoholic KOH.

SECTION-D

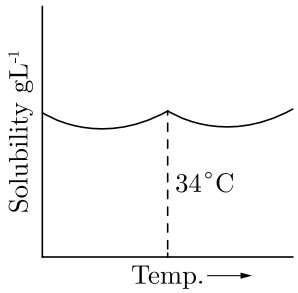
Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. Solubility in Binary Solutions

Binary solutions can be of nine different types depending upon the nature of the solute and solvent whether solid, liquid or gas. They may be further classified as solid, liquid and gaseous solutions based on the component which acts as the solvent. However, the liquid solutions are the most important. Both solids and gases dissolve in liquids resulting in homogeneous mixtures, i.e. solutions. The solubility is governed by number of factors such as nature of solute and solvent, temperature, pressure etc. The concentrations of the solutions can be expressed in different ways such as normality, molarity, molality, mole fraction etc. Out of these, molality and mole fraction are better as they do not change with the change in temperature.

Based on the above passage, answer the .following questions:

(i) Solubility curve of $Na_2SO_4 \cdot 10H_2O$ in water with temperature is given as:



What do you infer about the temperature variation of curve with solubility process?

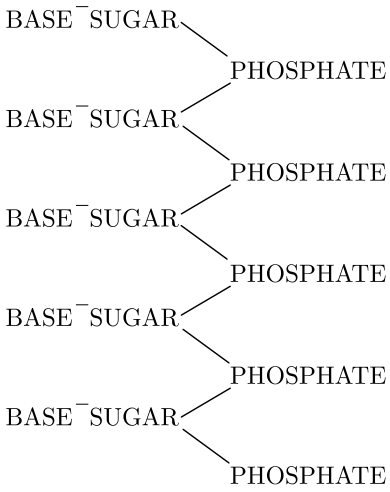
(ii) On what factor does the maximum amount of a solid solute that can be dissolved in a specified amount of a given liquid solvent not depend upon?

(iii) What is the molality of a sulphuric acid solution in which mole fraction of water is 0.85?

or

How much amount of salt is contained in 1000 g of a 4% solution of salt?

30. The basic chemical formula of DNA is now well established. As shown in figure, it consists of a very long chain, the backbone of which is made up of alternate sugar and phosphate groups, joined together in regular 3′5′ phosphate di-ester linkages. To each sugar is attached a nitrogenous base, only four different kinds of which are commonly found in DNA.



Two of these–adenine and guanine are purines, and the other two thymine and cytosine are pyrimidines. A fifth base, 5-methyl cytosine, occurs in smaller amounts in certain organisms, and a sixth, 5-hydroxy-methyl-cytosine, is found instead of cytosine in the T even phages. It should be noted that the chain is unbranched, a consequence of the regular intemucleotide linkage. On the other hand the sequence of the different nucleotides is, as far as can be ascertained, completely irregular. Thus, DNA has some features which are regular, and some which are irregular. A similar conception of the DNA molecule as a long thin fibre is obtained from physicochemical analysis involving sedimentation, diffusion, light scattering, and viscosity measurements. These techniques indicated that DNA is a very asymmetrical structure approximately 20. A wide and many thousands of angstorms long. Estimates of its molecular weight currently center between 5×10^6 and 10^7 (approximately 3×10^4 nucleotides). Surprisingly each of these measurements tend to suggest that the DNA is relatively rigid, a puzzling finding in view of the large number of single bonds (5 per nucleotide) in the phosphate-sugar back bone. Recently these indirect inferences have been confirmed by electron microscopy.

Based on the above passage answer the following questions:

(i) A nitorgenous based is attached to each sugar and only four of its kinds are commonly found in DNA. Name the purines present in DNA.

(ii) Which of the four kinds of nitrogenous bases commonly found in DNA has been replaced in some organisms?

(iii) As shown in figure, DNA has a long chain. What is the backbone of DNA made up of and how is it joined?

or

As given, DNA has some regular and some irregular features. Which features of DNA are regular and which are irregular? Which analysis provide the same concept of DNA?

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. Explain the following observations:
(i) d-block elements exhibit more oxidation states as compared to elements of f-block.
(ii) Cu^+ salts are colourless, whereas Cu^{2+} salts are coloured. (Atomic number of Cu = 29).
(iii) Mn^{2+} ion is more stable than Mn^{3+} ion.
(iv) Transition elements form several complex compounds.
(v) Zn^{2+} salts are white whereas Cu^{2+} salts are blue.

32. A, B and C are three non-cyclic functional isomers of a carbonyl compound with molecular formula C_4H_8O. Isomers A and C give positive Tollen's test whereas isomer B does not give Tollen's test but gives positive lodoform test. Isomers A and B on reduction with Zn (Hg)/ Conc. HCl give the same product D.
(i) Write the structure of A, B, C and D.
(ii) Out of A, B and C isomers, which one is least reactive towards addition of HCN?

or

An alkene 'A' (Mol. formula C_5H_{10}) on ozonolysis gives a mixture of two compounds 'B' and 'C'. Compound 'B' gives positive Fehling's test and also forms iodoform on treatment with I_2 and NaOH. Compound 'C' does not give Fehling's test but forms iodoform.
(i) Identify the compounds A, B and C.
(ii) Write the reaction for ozonolysis and formation of iodoform from B and C.

33. (i) Write the cell reaction and calculate the emf of the following cell at 298 K :

$$Sn(s) \mid Sn^{2+}(0.004\,M) \parallel H^+(0.020\,M) \mid H_2(g)(1\,bar) \mid Pt(s)$$

(Given: $E^\circ_{Sn^{2+}/Sn} = -0.14\,V$)
(ii) Give reasons :
(a) On the basis of E° values, O_2 gas should be liberated at anode but it is Cl_2 gas which is liberated in the electrolysis of aqueous NaCl.
(b) Conductivity of CH_3COOH decreases on dilution.

or

(i) Out of the following pairs, predict with reason which pair will allow greater conduction of electricity:
(a) Silver wire at 30°C or silver wire at 60°C.
(b) 0.1 M CH_3COOH solution or 1 M CH_3COOH solution.
(c) KCl solution at 20°C or KCl solution at 50°C.
(ii) Give two points of differences between electrochemical and electrolytic cells.

□□□□□□□

Sample Paper 5

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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. A Grignard reagent is prepared by the action of magnesium in dry ether on:

(a) C_2H_5OH (b) C_2H_6

(c) C_2H_5Cl (d) C_2H_5CN

2. Azeotropic mixture of HCl and H_2O has:

(a) 48% HCl (b) 22.2% HCl

(c) 36% HCl (d) 20.2% HCl

3. If the rate of a reaction is expressed by, Rate $= k|A|^2|B|$. Then the order of reaction will be

(a) 2 (b) 3

(c) 1 (d) 0

4. For a zero order reaction:

(a) $t_{1/2} \propto a$ (b) $t_{1/2} \propto \frac{1}{a}$

(c) $t_{1/2} \propto a^2$ (d) $t_{1/2} \propto \frac{1}{a^2}$

5. The cannizzaro's reaction is not given by –

(a) Formaldehyde (b) Acetaldehyde

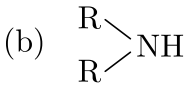
(c) Benzaldehyde (d) Furfural

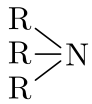
6. Copper sulphate solution on treatment excess of KI gives white precipitate. The precipitate is

(a) CuI_2 (b) Cu_2I_2

(c) Cu_2SO_4 (d) I_2

7. An organic compound reacts with benzene sulfonyl chloride and product dissolves in aqueous NaOH. The compound is –

(a) $R–NH_2$ (b) 

(c)  (d) All of these

8. Sweetest of all sugars is:

(a) Glucose (b) Lactose

(c) Sucrose (d) Fructose

9. The van't Hoff's factor of 0.1 M $Ba(NO_3)_2$ solution is 2.74. The degree of association is -

(a) 91.3% (b) 87%

(c) 100% (d) 74%

10. A dilute aqueous solution of sodium fluoride is electrolysed; the products at the anode and cathode are :

(a) F_2, Na (b) F_2, H_2

(c) O_2, Na (d) O_2, H_2

11. Which of the following compounds has tetrahedral geometry?

(a) $[Ni(CN)_4]^{2-}$ (b) $[Pd(CN)_4]^{2-}$

(c) $[PdCl_4]^{2-}$ (d) $[NiCl_4]^{2-}$

12. $R–OH + CH_2N_2 \longrightarrow$ Leaving group in this reaction is –

(a) CH_3 (b) R

(c) N_2 (d) CH_2

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** SN^2 reaction of an optically active aryl halide with an aqueous solution of KOH always gives an alcohol with opposite sign of rotation.
Reason : SN^2 reactions always proceed with retention of configuration.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** DNA as well as RNA molecules are found in the nucleus of a cell.
Reason : On heating, the enzymes do not lose their specific activity.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :** The rate of the reaction is the rate of change of concentration of a reactant or a product.
Reason : Rate of reaction remains constant during the course of reaction.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion :** Disruption of the natural structure of a protein is called denaturation.
Reason : The change in colour and appearance of egg during cooking is due to denaturation.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. State the main advantage of molality over molarity as the unit of concentration.

18. Why do transition metals show variable oxidation state?

19. If in a chemical reaction $A + B \longrightarrow$ product, rate law is given by $R = K[A]^{\frac{1}{2}}[B]^{\frac{3}{2}}$, find the order of reaction.

20. P-Nitrophenol is more acidic than P-methyl phenol. Why?

or

Write the structural formulae of the following :

1. 4, 4 dimethyl-2-pentanol
2. 2-butanol

21. What is chemical kinetics?

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. Account for the following:
The treatment of an alkyl chloride with aqueous KOH leads to the formation of alcoholic whereas in the presence of alcoholic KOH, alkene is the major product.

23. Differentiate between molarity and molality of a solution. How can we change molality value of a solution into molarity value?

24. Define standard electrode potential.

25. What are the characteristics of the transition elements and why are they called transition elements? Which of the d-block elements may not be regarded as the transition elements?

26. Give the structures and IUPAC names of products expected from the following reactions :

1. Catalytic reduction of butanal.
2. Hydration of propene in presence of concentrated sulphuric acid.
3. Reaction of propanone with methyl magnesium bromide followed by hydrolysis.

27. How will you distinguish between methanoic acid and ethanoic acid?

or

What are aldehydes, ketones, carboxylic acid?

28. Give the IUPAC names of the following:

(i) $Cl - CH_2C \equiv C - CH_2 - Br$

(ii) $CH_3CH_2CH(CH_3)CH(C_2H_5)Cl$

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. There are 13 vitamins known till today. Four of which are fat soluble (A, D, E, K) and rest of which are water soluble (B_1, B_2, B_3, B_5, B_6, B_7, B_9, B_{12}, C). Let's know the history how vitamins were discovered. By the end of mid-1800 scientists had discovered that pathogens caused various diseases. It was assumed that patchy skin, falling eye-sight etc. is also caused by germs instead of vitamin deficiency. Dutch Bio Scientist Dr. Christiaan Eijkman reported in 1895, that chickens that ate polished rice developed beri-beri. He was awarded Noble Prize in 1929 for his contribution in discovery of vitamins. 'Vita' (Latin—for important to life), amine (a specific group which Funk believed is present in all vitamins). In the beginning vitamin C was called Scurvy Vitamin, Vitamin-B was called Beri-Beri vitamin when rats were fed a diet heavy in lard and olive oil, they died but with the addition of tiny amount of butter fat they survived. McCollum called vitamin in butter fat. Fat soluble Vitamin A, Vitamin B_{12} and Vitamin D were discovered later. Now we also know vitamin E, K and H also.

Answer the following questions:

(a) Name four vitamins that are stored in liver and adipose (fat storing) tissues.

(b) Out of B, C and B_{12} which vitamin cannot be stored in our body and why?

(c) Name a vitamin which helps in blood clotting and name source of this vitamin.

or

(d) Name a vitamin which is fat soluble and anti-oxidant. What are sources of this vitamin and its deficiency disease?

30. Electrolytes dissociate into ions. In case of electrolytes if we determine their molar mass using colligative property, the value of molar mass is found to be abnormal because colligative property depends on number of ions. Greater the number of ions, more will be colligative property. van't Hoff factor(i) is ratio of normal molar mass to the abnormal molar mass. It is also equal to ratio of observed colligative property to the calculated colligative property.

A student determined value of i at various concentration of NaCl, KCl, $MgSO_4$ and K_2SO_4. The values are given in the following table.

Table: Values of van't Hoff factor, i, at Various Concentrations for NaCl, KCl, MgSO4 and K2SO4.

Salt	**Values of i**			**van't Hoff Factor i for complete dissociation of solute**
	0.1 m	**0.01 m**	**0.001 m**	
NaCl	1.87	1.94	1.97	2.00
KCl	1.85	1.94	1.98	2.00
$MgSO_4$	1.21	1.82	1.82	2.00
K_2SO_4	2.32	2.84	2.84	3.00

* represent i values for incomplete dissociation. Answer the following questions based on above table.

(a) How is van't Hoff factor related to molality and why?
(b) What is value of i in case of (i) electrolyte (ii) non-electrolyte?
(c) Determine the amount of $CaCl_2$ ($i = 2.47$) dissolved in 2.5 L of water such that its osmotic pressure is 0.75 atm at 27°C. [$R = 0.082$ L atm K^{-1} mol^{-1}] [Ca 40u, Cl = 35.5u]

or

(d) Determine the osmotic pressure of a solution prepared by dissolving 25 mg of K_2SO_4 in 2 L solution at 25°C
Assuming it is completely ionised.
[$R = 0.082$ L atm K^{-1}, $K = 39$u, $s = 32$u, $O = 16$u]

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. How would you determine the standard electrode potential of $Mg^{2+} \mid Mg$?

or

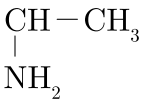
Explain Nernst equation.

32. (a) State Werner's coordination theory.
(b) What are ligands? Classify them with examples.

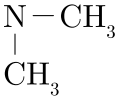
or

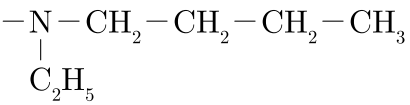
List various types of isomerism possible for coordination compounds give one example of each.

33. Write common name and IUPAC name of following amines.
(i) $CH_3CH_2 - NH$
(ii) $CH_3CH_2CH_2 - NH_2$

(iii) 

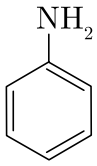
(iv) $CH_3 - NH - CH_2CH_3$

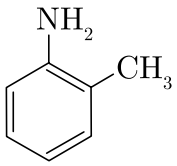
(v) 

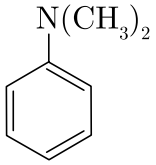
(vi) 

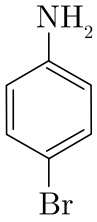
(vii) $NH_2 - CH_2 - CH = CH_2$

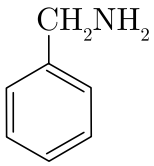
(viii) $NH_2 - (CH_2)_6 - NH_2$

(ix) 

(x) 

(xi) 

(xii) 

(xiii) 

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Sample Paper 6

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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. Enzyme is:

(a) Carbohydrate (b) Lipid

(c) Proteins (d) None of these

2. A compound on hydrolysis gives 1°-amine. The compound is

(a) anilide (b) amide

(c) cyanide (d) none of these

3. The oxidation state of nickel in $[Ni(CO)_4]$ is :

(a) 4 (b) 0

(c) 2 (d) 3

4. Formula of copper pyrite is :

(a) Cu_2S (b) CuFeS

(c) $CuFeS_2$ (d) $Cu_2Fe_2S_2$

5. Which one of the following will produce maximum depression of freezing point?

(a) K_2SO_4 (b) NaCl

(c) Urea (d) Glucose

6. Which of the following statement for order of reaction is not correct?

(a) Order can be determined experimentally

(b) Order of reaction is equal to sum of the powers of concentration terms in differential rate law

(c) It is not affected with the stoichiometric coefficient of the reactants

(d) Order cannot be fractional

7. Carbon atom in the carbonyl group is:

(a) *sp*-hybridised (b) sp^2-hybridised

(c) sp^3-hybridised (d) dsp^2-hybridised

8. Fused NaCl on electrolysis gives ..... on cathode.

(a) chlorine (b) sodium

(c) sodium amalgam (d) hydrogen

9. Which of the following aqueous solution should have the highest boiling point?

(a) 1.0 M NaOH (b) 1.0 M Na_2SO_4

(c) 1.0 M NH_4NO_3 (d) 1.0 M KNO_3

10. What are the products formed by the chlorination of methane in diffused sunlight?

(a) CCl_4 (b) CH_2Cl_2

(c) $CHCl_3$ (d) All of these

11. Which one of the following is diamagnetic ion?

(a) Co^{2+} (b) Ni^{2+}

(c) Cu^{2+} (d) Zn^{2+}

12. The rate of the reaction $2N_2O_5 \longrightarrow 4NO_2 + O_2$ can be written in three ways:

$$-\frac{d[N_2O_5]}{dt} = k[N_2O_5]$$

$$\frac{d[NO_2]}{dt} = k'[N_2O_5]$$

$$\frac{d[O_2]}{dt} = k''[N_2O_5]$$

The relationship between k and k' and between k and k'' are

(a) $k' = 2k; k' = k$ (b) $k' = 2k; k'' = \frac{k}{2}$

(c) $k' = 2k; k'' = 2k$ (d) $k' = k; k'' = k$

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Hydrolysis of sucrose is known as inversion of cane sugar.
Reason : Sucrose is a disaccharide.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** Glycosides are hydrolyzed in acidic conditions.
Reason : Glycosides are acetals.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :** According to transition state theory for the formation of an activated complex. one of the vibrational degree of freedom.
Reason : Energy of the activated complex is higher than the energy of reactant molecules.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion :** 4-Nitrochlorobenzene undergoes nucleophilic substitution more readily than chlorobenzene.
Reason : Chlorobenzene undergoes nucleophilic substitution by elimination-addition mechanism while 4-nitrochlorobenzene undergoes nucleophilic substitution by addition-elimination mechanism.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. What is meant by molality of the solution ?

18. Any transition series contains only ten elements. Why ?

19. What do you mean by half time of a reaction?

20. What are alcohols?

or

What do you mean by primary alcohols?

21. Give one example of each of the following reactions:
(i) Wurtz reaction
(ii) Wurtz-Fitting reaction.

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. (i) What happens when iodoform is heated with silver powder? Write the chemical equation.
(ii) Out of ethyl bromide and ethyl chloride which has higher boiling point and why?

23. How is standard Gibbs energy of a reaction is related to its equilibrium constant ?

24. Construct electric cells for the following reactions:
(i) $Fe + Cu^{2+} \longrightarrow Cu + Fe^{2+}$
(ii) $2Fe^{3+} + 2Cl^{-} \longrightarrow 2Fe^{2+} + Cl_2$

25. Write the electronic configuration of Cu^{+} and also draw the figure.

26. Write a note on rules for writing IUPAC names of alcohols.

27. How can one reduce carboxylic acid to alcohol?

or

Arrange the following compounds in the increasing order of their boiling points :
$CH_3CH_2CH_2CHO$, $CH_3CH_2CH_2CH_2OH$, $H_5C_2 - O - C_2H_5$, $CH_3CH_2\ CH_2CH_2CH_3$

28. Write main series of transition metals.

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. Oxidation of Aldehydes and Ketones (Popoff's Rule)Aldehydes differ from ketones in their oxidation reactions.

Aldehydes are easily oxidised to carboxylic acids on treatment with common oxidising agents like HNO_3, $KMnO_4$, $K_2Cr_2O_7$, etc. Even mild oxidising agents mainly Tollen's reagent, Fehling's solution, Benedict reagents, also oxidise aldehydes.

Ketones are difficult to oxidise. They are oxidised by strong oxidising agents at elevated temperature. Their oxidation involves C—C cleavage to form mixture of carboxylic acids. The oxidation of ketones is governed by Popoff's rule. 'In unsymmetrical ketones, on oxidation of ketones to carboxylic acids, $\diagup C{=}O$ group is retained by smaller alkyl group' is Popoff's rule.

$$R-\overset{1}{C}H_2-\underset{\underset{O}{\|}}{\overset{2}{C}}-\overset{3}{C}H_2-R' \xrightarrow[\Delta]{[O]\ K_2Cr_2O_7/H_2SO_4\ \text{conc.}}$$

$$\underset{\text{[By cleavage of } C_1-C_2 \text{ bond]}}{R-COOH} + RCH_2COOH + \underset{\text{[By cleavage of } C_2-C_3 \text{ bond]}}{RCH_2COOH} + R'-COOH$$

Ketones do not react with Tollen's reagent and Fehling's solutions. Methyl ketones give yellow precipitate of iodoform with I_2 and NaOH. Ketones can be oxidised by haloform reaction if they have one methyl group.

Answer the following questions:

(a) Why is it difficult to oxidise ketone as compared to aldehyde?

(b) What happens when 3-methyl-pentan-2-one reacts with sodium hypochlorite? Write chemical reaction involved?

(c) A compound A $C_5H_{10}O$ does not give silver mirror with Tollen's reagent, it gives iodoform test with I_2/NaOH. Write possible structures of compounds and write the chemical reactions involved.

or

(d) What happens when :

(i) Pentan-2-one is oxidised with $K_2Cr_2O_7/H_2SO_4$(conc.) on heating.

(ii) Acetophenone is oxidised on heating with $K_2Cr_2O_7/H_2SO_4$(conc).

30. Most distinctive properties of transition metal complexes is their wide range of colours. The colour of complex is complementary to that which is absorbed. The complementary colour is the colour generated from the wavelength left over. The following table gives the relationship of the different wavelength absorbed and the colour observed.

Table : Relationship between the Wavelength of Light absorbed and the Colour observed in some Coordination Entities Coordination entity

Coordination entity	Wavelength of light absorbed (nm)	Colour of light absorbed	Colour of coordination entity
$[CoCl(NH_3)_5]$	535	Yellow	Violet
$[Co(NH_3)_5(H_2O)]^{3+}$	500	Blue Green	Red
$[Co(NH_3)_6]^{3+}$	475	Blue	Yellow Orange
$[Co(CN)_6]^{3-}$	310	Ultraviolet	Pale Yellow
$[Cu(H_2O)_4]^{2+}$	600	Red	Blue
$[Ti(H_2O)_6]^{3+}$	489	Blue Green	Violet

(a) Why does $[Co(CN)_6]^{3-}$ absorb U.V. light and not from visible region?
(b) Why is $[Ti(H_2O)_6]^{3+}$ violet in colour where as $[Cu(H_2O)_4]^{2+}$ is blue?
(c) (i) If CFSE for $[Co(NH_3)_6]^{3+}$ is 27000 cm^{-1}, what is CFSE for $[Cu(H_2O)_4]^{2+}$?
(ii) Why is $[Ti(H_2O)_6]^{4+}$ colourless?

or

(d) What will be the correct order for the wavelength of absorption for the following complexes? Give reason.
$[Co(CN)_6]^{3-}$, $[Co(NH_3)_6]^{3+}$, $[Cu(H_2O)_6]^{2+}$

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. Give explanation for each of the following:
(i) Why are aliphatic amines stronger bases than ammonia?
(ii) Why are aliphatic amines stronger base than aromatic amines?

32. What is electrochemical series? Write its applications.

or

(a) What is the difference between ferromagnetism and paramagnetism?
(b) For the cell shown below :
$Zn(s) \mid ZnSO_4(aq) \mid\mid CuSO_4(aq) \mid Cu(s)$
Calculate standard cell potential if standard state reduction electrode potential for $Cu^{2+} \mid Cu$ and $Zn^{2+} \mid Zn$ are $+0.34$ Volt and -0.76 Volt respectively.

33. What are the shortcomings of valence bond theory for bonding in complexes? Briefly describe the crystal field theory.

or

Briefly describe the importance of coordination compounds in:
(i) Qualitative analysis, (ii) Extraction of metals, (iii) Biological systems

□□□□□□□

Sample Paper 7

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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. Adenosine is an example of

(a) Nucleotide (b) Pyrimidine base

(c) Nucleoside (d) Purine base

2. If 2 gm of NaOH is present in 200 ml of its solution, its molarity will be :

(a) 0.25 (b) 0.5

(c) 5 (d) 10

3. The hybridisation of Fe in $K_4[Fe(CN)_6]$ is :

(a) dsp^2 (b) sp^3

(c) d^2sp^3 (d) sp^3d^2

4. If 96500 coulomb of electricity is passed through $CuSO_4$ solution, it will liberate

(a) 63.5 g Cu (b) 31.76 g Cu

(c) 96500 g Cu (d) 100 g Cu

5. Which of the following alcohols gives 2-butene on dehydration by concentration H_2SO_4 ?

(a) 2-Methyl propene-2-ol (b) 2-Methyll 1-propanol

(c) Butane-2-ol (d) Butane-1-ol

6. The rate constant of a reaction depends on

(a) temperature (b) initial concentration of the reactants

(c) time of reaction (d) extent of reaction

7. Methylamine can be prepared by :

(a) Wurtz reaction (b) Hofmann's bromamide reaction

(c) Friedel-Crafts reaction (d) Kolbe reaction

8. The most common oxidation state shown by 1st row of transition elements is :

(a) (+II) (b) (+III)

(c) (+IV) (d) all of these

9. Avogardr's number (N) is equal to :

(a) 6.023×10^{24} (b) 6.023×10^{23}

(c) 6.023×10^{-23} (d) 11.2

10. What is the coordination number of Cr in $[K_3Cr(OX)_3]$

(a) 6 (b) 5

(c) 4 (d) 3

11. The reaction is called :

$RCOCl + H_2 \xrightarrow{Pd/BaSO_4} RCHO + HCL$

(a) Cannizzaro Reaction (b) Rosenmund's Reaction

(c) Haloform Reaction (d) Clemensen's Reaction

12. Alkyl halide is converted into an alcohol by :

(a) Addition reaction (b) Substitution reaction

(c) Elimination reaction (d) Dehydrogenation reaction

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Carboxypeptidase is an exopeptidase.
Reason : It cleaves the N-terminal bond.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** Reimer-Tiemann reaction of phenol with CCl_4 in NaOH at 340 K gives salicylic acid as the major product.
Reason : The reaction occurs through intermediate formation of di-chlorocarbene.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :** The order of a reaction can have fractional value.
Reason : The order of a reaction cannot be written from balanced equation of a reaction.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion :** Proteins on hydrolysis produce amino acids.
Reason : Amino acids contain-NH_2 and $-COOH$ group.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

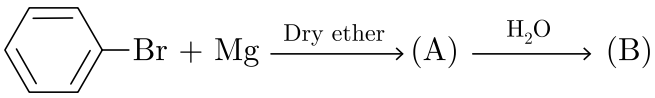
17. Explain why aquatic species are more comfortable in cold water rather than in warm water.

18. Why is Cr^{2+} reducing and Mn^{3+} oxidising when both have d^4 configuration?

Ans :

Cr^{2+} is reducing because after the loss of one electron its configuration changes from d^4 to d^3 , the latter having a half filled t_{2g} level (see next unit). Mn^{3+} is oxidising because after taking one electron its configuration changes form d^4 to d^5(Mn^{3+} to Mn^{2+}) configuration which has extra stabilitytransition elements.

19. Identify A and B in the following:



20. What are phenols?

or

What are ethers?

21. Write the general form of reactions:
(i) Wurtz reaction
(ii) Swarts reaction

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. Differentiate between average and instantaneous rate of reaction.

23. Why Zinc, Cadmium and Mercury are not regarded as transition elements?

24. Why does vapour pressure of a liquid decrease with addition of a non volatile solid solute?

25. What are the products obtained at the cathode and anode during the electrolysis of the following when platinum electrodes are used in the electrolysis
(a) Molten KCl
(b) Aq. $CuSO_4$ solution
(c) Aq. K_2SO_4 solution

26. Transition elements form coloured compound. Explain.

27. What happens when :
1. ethanol is oxidised with acidified $KMnO_3$ solution?
2. ethanol is treated with PCl_5?

28. Explain two important uses of formalin.

or

Give reasons for the following :
1. Ethyne is more acidic than ethane.
2. Lower members of aldehyde are more soluble in water.

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. In the 1880s, French chemist François-Marie Raoult discovered that when a substance is dissolved in a solution, the vapor pressure of the solution will generally decrease. This observation depends on two variables:

(i) the mole fraction of the amount of dissolved solute present and

(ii) the original vapor pressure (pure solvent).

At any given temperature for a particular solid or liquid, there is a pressure at which the vapor formed above the substance is in dynamic equilibrium with its liquid or solid form. This is the vapor pressure of the substance at that temperature. At equilibrium, the rate at which the solid or liquid evaporates is equal to the rate that the gas is condensing back to its original form. All solids and liquids have a vapor pressure, and this pressure is constant regardless of how much of the substance is present.

Answer the following questions :

(a) What is the value of ΔH_{mixing} and ΔV_{mixing} for an ideal solution?

(b) Do the intermolecular forces between A and B are weaker or stronger than that between $A - A$ and $B - B$ in an non-ideal solution with positive deviation ?

(c) Give an example of non-ideal solution with negative deviation. Give an example of ideal solution.

or

(d) Write the expression for the pressure of non ideal solution with positive and negative deviations.

30. The sequence of bases along the DNA and RNA chain establishes its primary structure which controls the specific properties of the nucleic acid. An RNA molecule is usually a single chain of ribose-containing nucleotide. On the basis of X-ray analysis of DNA, J.D., Watson and F.H.C. Crick (shared noble prize in 1962) proposed a three dimensional secondary structure for DNA. DNA molecule is a long and highly complex, spirally twisted, double helix, ladder like structure. The two polynucleotide chains or strands are linked up by hydrogen bonding between the nitrogeneous base molecules of their nucleotide monomers. Adenine (purine) always links with thymine (pyrimidine) with the help of two hydrogen bonds and guanine (purine) with cytosine (pyrimidine) with the help of three hydrogen bonds. Hence, the two strands extend in opposite directions, i.e., are antiparallel and complimentary.

Answer the following questions :

(a) What information is given by primary structure of DNA?

(b) Name the types of nitrogeneous bases present in nucleic acids.

(c) Write the structural and functional difference between DNA and RNA.

or

(d) Name the bases present in RNA. Which one of these is not present in DNA?

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. Write following methods of preparation of amines:
(i) Reduction of nitro compounds.
(ii) Ammonolysis
(iii) Reduction of nitriles
(iv) Reduction of amides
(v) Gabriel phthalimide synthesis
(vi) Hoffmann bromamide degradation reaction.
(vii) Schmidt reaction

32. Define the following :
1. Resistance
2. Conductance
3. Conductivity
4. Equivalent conductivity
5. Molar conductivity

or

1. How Molar conductivity of strong and weak electrolyte vary with concentration?
2. How conductivity of solution vary with concentration.

33. (i) Draw all the possible isomers having the formula $Cr[(NH_3)_4Cl_2]^+$.
(ii) Illustrate the following with an example:
(a) Linkage isomerism
(b) Coordination isomerism.
(iii) Why is $[NiCl_4]^{2-}$ is paramagnetic (Ni = 28)?

or

Explain bonding in coordination compounds with the help of crystal field theory.

□□□□□□□

Sample Paper 8

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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/are not affected by temperature?

(a) Molarity (b) Mole fraction

(c) Normality (d) All of these

2. The enzyme which can catalyse the conversion of glucose to ethanol is

(a) zymase (b) invertase

(c) maltase (d) diastase

3. When one Faraday of electric current is passed, the mass deposited, equal to

(a) One gram equivalent (b) One gram mole

(c) Electrochemical equivalent (d) Half gram equivalent

4. Which of the following is not a pyrimidine base ?

(a) Uracil (b) Cytosine

(c) Thymine (d) Guanine

5. If the rate of the reaction is equal to the rate constant, the order of the reaction is

(a) 3 (b) 0

(c) 1 (d) 2

6. Lucas reagent is

(a) Conc. HCl and anhydrous $ZnCl_2$ (b) Conc. HNO_3 and hydrous $ZnCl_2$

(c) Conc. HCl and hydrous $ZnCl_2$ (d) Conc. HNO_3 and anhydrous $ZnCl_2$

7. The transition metal which shows the highest oxidation state is :

(a) Mn (b) Pt

(c) Fe (d) Ni

8. Which of the following undergo aldol condensation?

(a) HCHO (b) CH_3CHO

(c) C_6H_5CHO (d) CH_3COCH_3

9. IUPAC name of $H_2[PtCl_6]$ is –

(a) Hydrogen hexachloro platinate (IV) (b) Hydrogen hexachloro platinate (II)

(c) Hydrogen hexa chlorido Pt (IV) (d) Hydrogen hexa chlorido Pt (II)

10. An isocyanide is prepared:

(a) Friedel-Crafts reaction (b) Perkin reaction

(c) Carbylamine reaction (d) Wurtz reaction

11. Chlorobenzene give DDT when it reacts with :

(a) charcoal (b) chloral

(c) naphthalene (d) benzenoid

12. Volume of one mole of any gas at NTP is :

(a) 11.2 litre (b) 22.4 litre

(c) 10.2 litre (d) 22.8 litre

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Sucrose undergoes mutarotation.
Reason : Sucrose is a disaccharide.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** $CHCl_3$ is stored in dark bottles.
Reason : $CHCl_3$ is oxidised in dark.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :** Sucrose is a non-reducing sugar.
Reason : It has glycosidic linkage.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion :** In rate law, unlike in the expression for equilibrium constants, the exponents for concentrations do not necessarily match the stoichiometric coefficients.
Reason : It is the mechanism and not the balanced chemical equation for the overall change that governs the reaction rate.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Explain the Henry's law about dissolution of a gas in a liquid.

18. Write general expression for the amount of the substance left after n half lives.

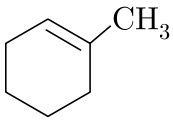
19. Write the IUPAC names of the following compounds :

1. $CH_3\,CHOH\,CH_2\,CHOH\,CH_3$
2. $C_6H_{50}OC_6H_5$

or

You are given benzene, conc. H_2SO_4 and NaOH. Write the equations for the preparation of phenol using these reagents.

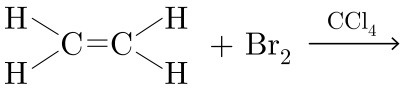
20. Complete the following reaction equations :

(i)  $+ HI \longrightarrow$

(ii) $CH_3CH_2CH = CH_2 + HBr \longrightarrow$

21. Complete the following reaction equations:

(i) $C_6H_5N_2Cl + KI \longrightarrow$

(ii) 

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. How molarity of a solution different from molality?

23. What is the effect of temperature on the rate constant of reaction? How can this temperature effect on the rate constant be represented quantitatively?

24. Define electrode and electrode potential.

25. How would you account for the irregular variation of ionization enthalpies (first and second) in the first series of the transition elements?

26. Account for the following :

1. The boiling point of ether is much lower than that of alcohol.
2. Phenol is more acidic than alcohol.

27. An organic compound (A) (molecular formula $C_8H_{16}O_2$) was hydrolysed with dilute sulphuric acid to give a carboxylic acid (B) and an alcohol (C). Oxidation of (C) with chromic acid produced (B). (C) on dehydration gives but-1-ene. Write equation for the reactions involved.

or

An organic compound with molecular formula $C_9H_{10}O$ forms, 2, 4-DNP derivatives, reduces Tollen's reagent and undergoes cannizzaro reaction. On vigorous oxidation, it gives 1,2-benzenedicarboxylic acid. Identify the compound.

28. Write down the electronic configuration of

1. Cr^{3+}
2. Cu^{+}
3. Co^{2+}
4. Mn^{2+}

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. The substitution reaction of alkyl halide mainly occurs by S_N1 or S_N2 mechanism. Whatever mechanism alkyl halides follow for the substitution reaction to occur, the polarity of the carbon halogen bond is responsible for these substitution reactions. The rate of S_N1 reactions are governed by the stability of carbocation whereas for S_N2 reactions steric factor is the deciding factor. If the starting material is a chiral compound, we may end up with an inverted product or racemic mixture depending upon the type of mechanism followed by alkyl halide. Cleavage of ethers with HI is also governed by steric factor and stability of carbocation, which indicates that in organic chemistry, these two major factors help us in deciding the kind of product formed.

Answer The following questions :

(a) Out of chlorobenzene and benzyl chloride, which one gets easily hydrolysed by aqueous NaOH and why?

(b) Predict the stereochemistry of the product formed if an optically active alkyl halide undergoes substitution reaction by S_N1 mechanism.

(c) Following compounds are given to you : 2-Bromopentane, 2-Bromo-2-methylbutane, 1-Bromopentane

(i) Write the compound which is most reactive towards S_N2 reaction.

(ii) Write the compound which is optically active.

or

(d) What are the points of similarities between S_N1 and S_N2 reactions?

30. For the first order decomposition reaction are as follows :

$(CH_3)_3COOC(CH_3)_3 \rightarrow 2CH_3COCH_3 + C_2H_6$

In the gaseous phase, the pressures of the system at $t = 0$ and $t = 15$ min were found to be 169.3 Torr and 256 Torr, respectively.

Answer the following questions according to the above given paragraph:

(a) What is the pressure of C_2H_6 at time t?

(b) Write integrated rate law expression for this reaction.

(c) Find out the value of rate constant k.?

or

(d) What is the total pressure of the system after 9 minutes?

$= 169.3 + 2 \times 27.38 = 224.06$

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. Predict giving reasons, the order of basicity of the following compounds is

(i) gaseous phase and

(ii) in aqueous solution $(CH_3)_3N, (CH_3)_2N, CH_3NH_2, NH_3$

32. State and explain Kohlrausch law

or

Predict the products of electrolysis of the following :

1. An aqueous solution of $AgNO_3$ with silver electrodes
2. An aqueous solution of $AgNO_3$ with platinum electrodes
3. An dilute aqueous solution of H_2SO_4 with platinum electrodes
4. An aqueous solution of $CuCl_2$ with platinum electrodes.

(Given $E^{o}_{Ag^+/Ag} = +0.80\,V$, $E^{o}_{Cu^{2+}/Cu} = +0.34\,V$)

33. How would you account for the fact that $[Fe(CN_6)]^{3-}$ is weakly paramagnetic while $[Fe(CN)_6]^{4-}$ is diamagnetic?

There is no unpaired electron therefore it is diamagnetic.

or

How does valence bond theory explain the bonding in the following complexes of nickel:

(i) $[NiCl_4]^{2-}$ is tetrahedral

(ii) $[Ni(CN)_4]^{2-}$ is square planar

(iii) $[Ni(CO)_4]$ is tetrahedral?

□□□□□□□

Sample Paper 9

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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 reactions is an example of nucleophilic substitution reaction ?

(a) $2RX + 2NA \rightarrow R - R + 2NaX$

(b) $RX + H_2 \rightarrow RH + HX$

(c) $RX + Mg \rightarrow RH + HX$

(d) $RX + KOH \rightarrow ROH + KX$

2. Which enzyme converts glucose and fructose both into ethanol ?

(a) Diastase (b) Invertase

(c) Zymase (d) Maltase

3. Faraday's law of electrolysis is related to :

(a) Atomic number of cation (b) Speed of cation

(c) Speed of anion (d) Equivalent weight of element

4. The green residue (B) has the formula :

(a) CrO_2 (b) Cr_2O_2

(c) Cr_2O_3 (d) CrO_5

5. The compound having tetrahedral geometry is –

(a) $[NiCl_4]^{2-}$

(b) $[Ni(CN)_4]^{2-}$

(c) $[PdCl_4]^{2-}$

(d) $[NiCl_4]^{2-}$ and $[PdCl_4]^{2-}$ both

6. In test for primary amines, the amine is treated with $CHCl_3$ and KOH and a bad smelling compound is formed. If the primary amine used is ethylamine, identify the bad smelling compound formed?

(a) CH_3CN

(b) CH_3CNO

(c) CH_3CH_2NC

(d) CH_3NCO

7. During osmosis, flow of water through a semi-permeable membrane is:

(a) from both sides of semi-permeable with equal flow rates

(b) from both sides of semi-permeable membrane with unequal flow rates

(c) from solution having lower concentration only

(d) from solution having higher concentration only

8. In a first-order reaction $A \longrightarrow B$, if k is the rate constant and initial concentration of the reactant A is 0.5 M, then the half-life is

(a) $\frac{\log 2}{k}$

(b) $\frac{\log 2}{k\sqrt{0.5}}$

(c) $\frac{\ln 2}{k}$

(d) $\frac{0.693}{0.5k}$

9. The number of chiral carbon is glucose is

(a) 4

(b) 5

(c) 3

(d) 1

10. In the Haber process for the manufacture of ammonia the following catalyst is used

(a) platinized asbestos

(b) iron with molybdenum as promoter

(c) copper oxide

(d) alumina

Directions (Q. No. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

11. **Assertion :** Cyanide (CN^-) is a strong nucleophile.
Reason : Benzonitrilie is prepared by the reaction of chlorobenzene with potassium cyanide.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

12. **Assertion :** Haemoglobin is an oxygen carrier.
Reason : Oxygen binds as O_2^- to Fe of haemoglobin.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

13. **Assertion :** If the activation energy of a reaction is zero, temperature will have no effect on the rate constant.
Reason : Lower the activation energy, faster is the reaction.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** Proteins are made up of α-amino acids.
Reason : During denaturation, secondary and tertiary structures of proteins are destroyed.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

15. What is the effect of temperature on solubility of a gas in a liquid?

16. In what way is the electronic configuration of transition metals different from non-transition metals?

17. The decomposition of dimethyl ether leads to formation of CH_4, H_2 and CO and the reaction rate is given by Rate $= K[P_{CH_3OCH_3}]^{3/2}$. If the pressure is measured in bar and time in minutes then what are the units of the rate and rate constants ?

18. What are secondary alcohols ?

or

What are tertiary alcohols?

19. Write the structure of diphenyl. How is it prepared from chlorobenzene?

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

20. Discuss Raoult's law of relative lowering of vapour pressure.

21. What is specific conductance and molar conductance?

22. Why is the E° value for the Mn^{3+}/Mn^{2+} couple much more positive than that of Cr^{3+}/Cr^{2+} or Fe^{3+}/Fe^{2+}? Explain.

23. Write the structural formulae of the following:

1. 4, 4 dimethyl-2-pentanol
2. 2-butanol

24. An organic compound (A) (molecular formula ($C_8H_{16}O_2$) was hydrolysed with dilute sulphuric acid to give a carboxylic acid (B) and an alcohol (C) Oxidation of (C) with chromic acid produced (B). (C) on dehydration gives but-2-ene as the major product. Write equation for the reaction involved.

or

Write difference between aldehyde and ketone.

25. What are aldehydes, ketones, carboxylic acid?

26. Define Collision frequency.

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

27. In a reaction, the rates of disappearance of different reactants or rates of formation of different products may not be equal but rate of reaction at any instant of time has the same value expressed in terms of any reactant or product. Further, the rate of reaction may not depend upon the stoichiometric coefficients of the balanced chemical equation. The exact powers of molar concentrations of reactants on which rate depends are found experimentally and expressed in terms of 'order of reaction: Each reaction has a characteristic rate constant depends upon temperature. The units of the rate constant depend upon the order of reaction.
Answer the following questions :

(a) The rate constant of a reaction is found to be $3 \times 10^{-3} \text{mol}^{-2}\text{L}^2\,\text{sec}^{-1}$. What is the order of the reaction?

(b) Rate of a reaction can be expressed by following rate expression, Rate $= k[A]^2[B]$, if concentration of A is increased by 3 times and concentration of B is increased by 2 times, how many times rate of reaction increases?

(c) The rate of a certain reaction is given by, rate $= k[\text{H}^+]''$. The rate increases 100 times when the pH changes from 3 to 1. What is the order (n) of the reaction ?

or

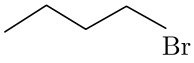
(d) In a chemical reaction $A + 2B \rightarrow$ products, when concentration of A is doubled, rate of the reaction increases 4 times and when concentration of B alone is doubled rate continues to be the same. What is the order of the reaction ?

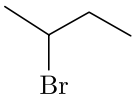
28. When haloalkanes with (β-hydrogen atom are boiled with alcoholic solution of KOH, they undergo elimination of hydrogen halide resulting in the formation of alkenes. These reactions are called (β-elimination reactions or dehydrohalogenation reactions. These reactions follow

Saytzeff's rule. Substitution and elimination reactions often compete with each other. Mostly bases behave as nucleophiles and therefore can engage in substitution or elimination reactions depending upon the alkyl halide and the reaction conditions.

Answer the following questions :

(a) Which alkyl halide from the following pair is chiral and undergoes faster S_N2 reaction ?

(i) 

(ii) 

(b) What happens when ethyl chloride is treated with aqueous KOH?

(c) Out of 2-bromopentane, 2-bromo-2-methylbutane, and 1-bromopentane, which compound is most reactive towards elimination reaction and why?

or

(d) Write the mechanism of the following S_N1 reaction.

$$(CH_3)_3C-Br \xrightarrow{\text{aq. NaOH}} C-OH + NaBr$$

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

29. Arrange the following :

(i) In decreasing order of pk_b values :

$C_2N_5NH_2, C_6H_5NHCH, (C_2H_5)_2NH$ and $C_6H_5NH_2$

(ii) In increasing order of basic strength (or basicity) :

$C_6H_5NH_2, C_6H_5N(CH_3)_2, (C_2H_5)_2NH$ and CH_3NH_2

(iii) increasing order of basic strength or (basicity) :

(a) Aniline, p-nitroaniline and p-toluidine

(b) $C_6H_5NH_2, C_6H_5NHCH_3, C_6H_5CH_2NH_2$

(c) $C_6H_5NH_2, C_6H_5NHCH_3, C_6H_5N(CH_3)_2$

(iv) Decreasing order of basic strength in the gas phase :

$C_2H_5NH_2, (C_2H_5)_2NH, (C_2H_5)_2N$ and NH_3.

(v) Decreasing order of basic strength :

$C_2H_5NH_2$, $C_2H_5NH_2$, $(C_2H_5)_2NH$, NH_3

30. Give the reactions occurring at two electrodes during electrolysis of aqueous sodium chloride solution.

or

What are fuel cells? Discuss $H_2 - O_2$ fuel cell. List some advantages of fuel cells over other cells?

31. Explain IUPAC system of Nomenclature of coordination compounds.

or

Explain bonding in co-ordination compounds with the help of valence bond theory.

□□□□□□□

Sample Paper 10

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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. Regarding criteria of catalysis which one of the following statements is not true?

(a) The catalyst is unchanged chemically at the end of the reaction

(b) A small quantity of catalyst is often sufficient to bring about a considerable amount of reaction

(c) In a reversible reaction the catalyst alters the equilibrium position

(d) The catalyst accelerates the reaction

2. By increasing the temperature, the vapour pressure of substance:

(a) always increases (b) does not depend on temperature

(c) always decreases (d) partially depends on temperature

3. Benzyl alcohol is obtained from benzaldehyde by

(a) Fitting's reaction (b) Cannizzaro's reaction

(c) Kolbe's reaction (d) Wurtz's reaction

4. The best way to prevent rusting of iron is

(a) Making it cathode (b) putting in saline water

(c) both of these (d) none of these

5. An example of double salt is

(a) Bleaching powder (b) $K_4[Fe(CN)_6]$

(c) Hypo (d) Potash alum

6. A zero order reaction is one whose rate is independent of

(a) the concentration of the reactants

(b) the temperature of reaction

(c) the concentration of the product

(d) the material of the vessel in which reaction is carried out

7. On hydrolysis of starch, we finally get

(a) Glucose (b) Fructose

(c) Both a and b (d) Sucrose

8. Of the following transition metals, the maximum numbers of oxidation states are exhibited by:

(a) Chromium (Z = 24) (b) Manganese (Z = 25)

(c) iron (Z = 26) (d) Titanium (Z = 22)

9. Which of the following undergoes Cannizzaro's reaction?

(a) CH_3CHO (b) CH_3CH_2CHO

(c) $(CH_3)_2CHCHO$ (d) HCHO

10. Which one is most reactive towards S_N1 reaction?

(a) $C_6H_5CH(C_6H_5)Br$ (b) $C_6H_5CH(CH_3)Br$

(c) $C_6H_5C(CH_3)(C_6H_5)Br$ (d) $C_6H_5CH_2Br$

11. The correct order of increasing basic nature for the bases NH_3, CH_3NH_2 and $(CH_3)_2NH$ is :

(a) $(CH_3)_2NH < NH_3 < CH_3NH_2$

(b) $NH_3 < CH_3NH_2 < (CH_3)NH$

(c) $CH_3NH_2 < (CH)_3NH < NH_3$

(d) $CH_3NH_2 < NH_3 < (CH_3)_2NH$

12. Which of the following concentration unit is independent of temperature?

(a) Normality

(b) Molarity

(c) Formality

(d) Molality

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Maltose is a reducing sugar which gives two moles of D-glucose on hydrolysis.
Reason : Maltose has 1, 4-β-glycosidic linkage.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** The kinetics of the reaction :
$mA + nB + pC \longrightarrow m'X + n'Y + p'Z$

Obey the rate expression as $\frac{dx}{dt} = k[A]^m[B]^n$.

Reason : The rate of the reaction does not depend upon the concentration of C.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :** SN^2 reactions always proceed with inversion of configuration.
Reason : SN^2 reaction of an optically active aryl halide with an aqueous solution of KOH always gives an alcohol with opposite sign of rotation.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion :** Vitamin D cannot be stored in our body.
Reason : Vitamin D is fat soluble vitamin and is excreted from the body in urine.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. What is the trend in melting point of transition metals when we move left to right in a series?

18. For what reason transition metals have high melting points?

19. What is rate law? Illustrate with an example.

20. Give one test from which methyl alcohol and ethyl alcohol are distinguished.

or

How are alcohols classified?

21. Give the reason of dipole in C – X bond.

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

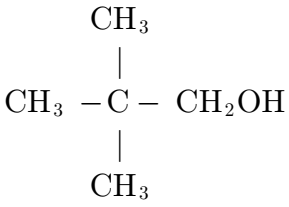
22. Explain Raoult's Law.

23. Mention a reaction for which the exponents of concentration terms are not the same as their stoichiometric coefficients in the rate equation.

24. Define specific conductance and equivalent conductance.

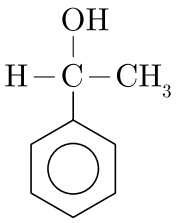
25. What may be the stable oxidation state of the transition element with the following d electrons configurations in the ground state of their atoms : $3d^3$, $3d^5$, $3d^8$ and $3d^4$?

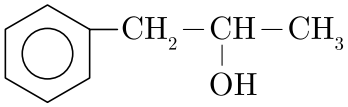
26. Classify the following as primary, secondary and tertiary alcohols :

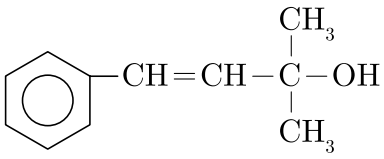
1. 

2. $H_2C = CH - CH_2OH$

3. $CH_3CH_2CH_2OH$

4. 

5. 

6. 

27. Discuss the structures of Carbonyl group.

or

Why aldehydes are generally more reactive than Ketones in nucleophilic addition reactions?

28. Why do the gases always tend to be less soluble in liquids as the temperature is raised?

SECTION-D

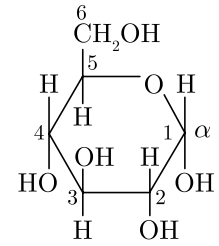
Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. Pentose and hexose undergo intramolecular hemiacetal or hemiketal formation due to combination of the –OH group with the carbonyl group. The actual structure is either of five or six membered ring containing an oxygen atom. In the free state all pentoses and hexoses exist in pyranose form (resembling pyran). However, in the combined state some of them exist as five membered cyclic structures, called furanose (resembling furan).

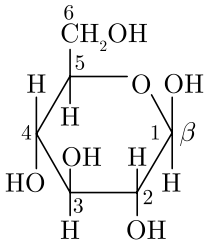

Pyran


Furan

The cyclic structure of glucose is represented by Haworth structure :



α-D-(+)-Glucopyranose



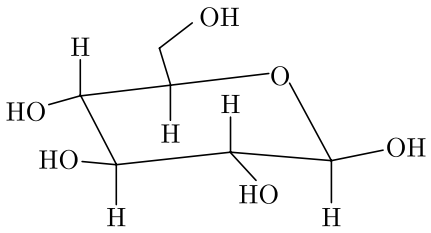
β-D-(+)-Glucopyranose

$\alpha-$ and $\beta-D$ glucose have different configuration at anomeric $(C-1)$ carbon atom, hence are called anomers and the $C-1$ carbon atom is called anomeric carbon (glycosidic carbon). The six membered cyclic structure of glucose is called pyranose structure.

Answer the following questions :

(a) Give the difference between $\alpha-D(+)$-glucose and $\beta-D(+)$ glucose ?

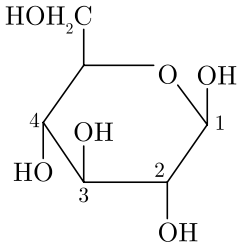
(b) The given carbohydrate is an α-furanose or a β-pyranose ?



(c) What is the structural difference between starch and cellulose?

or

(d) What is the anomers ? Find anomeric carbon in given structure.



30. Elevation in boiling point is the increase in boiling point when a non volatile solute is added to the solvent.

Addition of the solute lowers the vapour pressure of solvent, hence more heat is required to increase the vapour pressure upto the atmospheric pressure. The addition of 3 g of a substance to 100 g CCl_4 ($M = 154\,\text{g mol}^{-1}$) raises the boiling point of CCl_4 by 0.60°C. $K_b(CCl_4)$ is 5.03 K kg mol^{-1}.

Given : $K_f(CCl_4) = 31.8\,\text{K kg mol}^{-1}$ and ρ (solution) $= 1.64\,\text{g cm}^{-3}$.

Answer the following questions :

(a) Determine the relative lowering of vapour pressure of the solution.

(b) Determine the molar mass of the substance.

(c) What will be the freezing point depression of the solution ?

or

(d) Define molal elevation constant for a solvent. Why is elevation of boiling point a colligative property ?

or

(e) Molal elevation constant may be defined as the elevation in boiling point when the molality of the solution is unity (i.e., 1 mole of the solute is dissolved in 1 kg (1000 g) of the solvent). The units of K_b are therefore, degree/molality i.e., K/m or °C/m or K kg mol^{-1}. Elevation of boiling point is a colligative property because it depends on number of solute particles present in a solution.

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. Write the chemistry of recharging the lead storage battery, highlighting all the material that are involved during recharging.

or

What is the function of salt bridge in an electrochemical cell?

32. Discuss the nature of bonding in the following coordination entities on the basis of valence bond theory.

(i) $[Fe(CN)_6]^{4-}$

(ii) $[FeF_6]^{3-}$

(iii) $[Co(C_2O_4)_3]^{3-}$

(iv) $[CoF_6]^{3-}$

or

Explain $[Co(NH_3)_6]^{3+}$ is an inner orbital complex whereas $[Ni(NH_3)_6]^{2+}$ is an outer orbital complex.

33. Accounts of the following

(i) Methylamine in water reacts with ferric chloride to precipitate hydrated ferric oxide.

(ii) Aniline does not undergo Friedel-Crafts reaction.

(iii) Diazonium salts of aromatic amines are more stable than those of aliphatic amines.

□□□□□□□

Sample Paper 11

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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 colligative property can provide molar mass of proteins (or polymers or colloids) with greatest precision?

(a) Osmotic pressure (b) Elevation of boiling point

(c) depression of freezing point (d) Relative lowering of vapour pressure

2. Correct formula of potassium ferrocyanide is

(a) $K_3[Fe(CN)_6]$ (b) K4$[Fe(CN)_6]$

(c) $K_2[Fe(CN)_6]$ (d) $K[Fe(CN)_6]H_2O$

3. Williamson synthesis is used to prepare

(a) Acetone (b) Diethyl ether

(c) P.V.C. (d) Bakelite

4. Which of the following statement is incorrect?

(a) Silver glance mainly contains silver sulphide.

(b) Gold is found in native state.

(c) Zinc is blende mainly contains zinc chloride.

(d) Copper pyrites also contain Fe_2S_3

5. A 5% solution of cane sugar (Mol. Wt = 342) is isotonic with 1% solution of substance X. The molecular weight of X is –

(a) 68.4 (b) 34.2

(c) 171.2 (d) 136.2

6. Which of the following possesses highest melting point?

(a) Chlorobenzene (b) *m*-dichlorobenzene

(c) *o*-dichlorobenzene (d) *p*-dichlorobenzene

7. Which of the following statements about primary amines is 'False'?

(a) Alkyl amines are stronger bases than aryl amines.

(b) Alkyl amines react with nitrous acid to produce alcohols

(c) Aryl amines react with nitrous acid to produce phenols

(d) Alkyl amines are stronger bases than ammonia.

8. In DNA, thymien is held by two hydrogen bonds with the base

(a) Adenine (b) Cytosine

(c) Thymine (d) Guanine

9. The standard electrode potentials of four elements A, B, C and D are –3.05, –1.66, –0.40 and +0.80. The highest chemical reactivity will be exhibited by:

(a) A (b) B

(c) C (d) D

10. The cell used in Apollo mission was

(a) Leclanche cell (b) Daniell cell

(c) Voltaic cell (d) Bacon cell

11. A catalyst can affect reversible reaction by

(a) changing equilibrium constant

(b) slowing forward reaction

(c) attaining equilibrium in both directions

(d) none of the above

12. Which of the following the strongest acid is

(a) CH_3COOH (b) CH_2ClCH_2COOH

(c) $CH_2ClCOOH$ (d) CH_3CH_2COOH

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Alkyl isocyanides in acidified water give alkyl form-amides.
Reason : In isocyanides, carbon first acts as a nucleophile and then as an electrophile.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** DNA has a double helix structure.
Reason : The two strands in a DNA molecule are exactly similar.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :** Ethylenediaminetetraacetate ion forms an octahedral complex with the metal ion.
Reason : It has six donor atoms which coordinate simulatneously to the metal ion.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion :** Amines are basic in nature.
Reason : Presence of lone pair of electrons on nitrogen atom.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

Continue on next page.....

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. State and explain Faraday's second law of electrolysis.

18. Why do the transition elements exhibit higher enthalpies of atomisation ?

19. Give the similarities between $> C = O$ and $> C = C <$ bond.

20. Define molecularity of a reaction. Illustrate with an example.

or

Give the mechanism for the decomposition reaction of H_2O_2 in alkaline medium catalysed by

21. Alcohols are comparatively more soluble in water than hydrocarbons of comparable molecular masses. Explain this fact.

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. What are Faraday's laws of electrolysis? Explain.

23. Give the name and chemical composition of important ores of Aluminium and Copper.

24. The atomic sizes of Fe, Co, Ni are nearly same. Explain with reason.

25. How are IUPAC and common names given to phenols?

26. How will you convert the following :
(a) Ethyl alcohol from ethyl amine.
(b) Ethyl amine from ethyl alcohol.

27. Define the terms :
(i) Biomolecules.
(ii) Reducing Sugars.

or

What is essentially the difference between α-glucose? What is meant by pyranose structure of glucose?

28. How will you convert ethanal to the following compounds?
(i) Butane-1, 3-diol
(ii) But-2-enal (iii) But-2-enoic acid

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. The study of the conductivity of electrolyte solutions is important for the development of electrochemical devices, for the characterisation of the dissociation equilibrium of weak electrolytes and for the fundamental understanding of charge transport by ions. The conductivity of electrolyte is measured for electrolyte solution with concentrations in the range of 10^{-3} to $10^{-1}\,\text{mol}\,\text{L}^{-1}$ as solution in this range of concentrations can be easily prepared. The molar conductivity (A_m) of strong electrolyte solutions can be nicely fit by Kohlrausch equation.

$$A_m = \Delta\,^{\circ}_{m} - K\sqrt{C} \qquad ...(1)$$

Where, $\Delta\,3^{\circ}_{m}$ is the molar conductivity at infinite dilution and C is the concentration of the solution. K is an empirical proportionality constant to be obtained from the experiment. The molar conductivity of weak electrolytes, on the other hand, is dependent on the degree of dissociation of the electrolyte. At the limit of very dilute solution, the Ostwald dilution law is expected to be followed,

$$\frac{1}{\Delta\,^{\circ}_{m}} = \frac{1}{\Delta\,^{\circ}_{m}} + \frac{\Delta\,^{\circ}_{m}}{(\Delta\,^{\circ}_{m})^2}\frac{C_A}{K_d} \qquad ...(2)$$

Where, C_A is the analytical concentration of the electrolyte and K_d is dissociation constant. The molar conductivity at infinite dilution can be decomposed into the contributions of each ion.

$$\Delta\,^{\circ}_{m} = V_+\lambda^{\circ}_{+} + V_-\lambda^{\circ}_{-} \qquad ...(3)$$

Where, λ_+ and λ_- are the ionic conductivities of positive and negative ions, respectively and V_+ and λ_- are their stoichiometric coefficients in the salt molecular formula.

Answer the following questions :

(a) Give reason why conductivity of CH_3COOH decreases on dilution.

(b) The value of $\Delta\,^{\circ}_{m}$ of $Al_2(SO_4)_3$ is $858\,\text{S}\,\text{cm}^2\,\text{mol}^{-1}$, while $\lambda^{\circ}SO_4^{2-}$ is $160\,\text{S}\,\text{cm}^2\,\text{mol}^{-1}$ calculate the limiting ionic conductivity of Al^{3+}.

(c) Calculate $\Delta\,^{\circ}_{m}$ for acetic acid.

Given that :

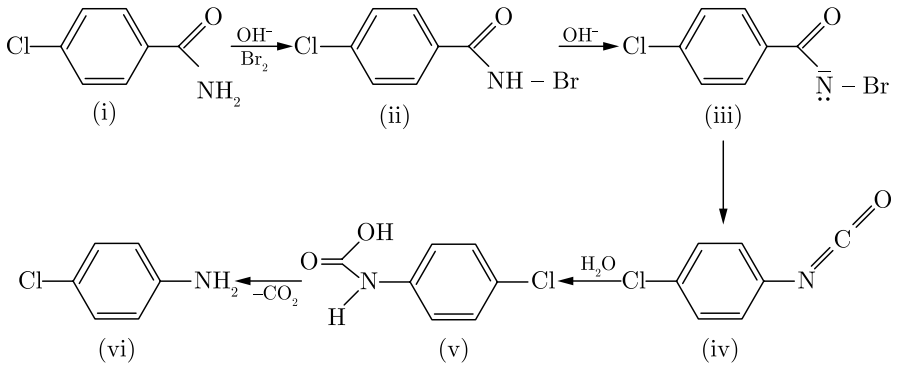
$$\Delta\,^{\circ}_{m}(\text{HCl}) = 426\,\text{S}\,\text{cm}^2\,\text{mol}^{-1}$$
$$\Delta\,^{\circ}_{m}(\text{NaCl}) = 126\,\text{S}\,\text{cm}^2\,\text{mol}^{-1}$$
$$\Delta\,^{\circ}_{m}(\text{CH}_3\text{COONa}) = 91\,\text{S}\,\text{cm}^2\,\text{mol}^{-1}$$

or

(d) Calculate the degree of dissociation of acetic acid at 298 K, given that :

$$\Delta_m(\text{CH}_3\text{COOH}) = 11.7\,\text{S}\,\text{cm}^2\text{mol}^{-1}$$
$$\Delta_m(\text{CH}_3\text{COO}^-) = 49.9\,\text{S}\,\text{cm}^2\text{mol}^{-1}$$
$$\Delta\,^{\circ}_{m}(\text{H}^+) = 349.1\,\text{S}\,\text{cm}^2\text{mol}^{-1}$$

30. $R\text{CONH}_2$ is converted into $R\text{NH}_2$ by means of Hoffmann bromamide degradation. During the reaction amide is treated with Br_2 and alkali to get amine. This reaction is used to descend the series in which carbon atom is removed as carbonate ion (CO_3^{2-}). Hoffmann bromide degradation reaction can be written as :



Answer the following questions :

(a) Why cannot primary aromatic amines be prepared by Gabriel phthalimide synthesis?

(b) Write the chemical equation involved in the following reaction : Hofmann bromamide degradation reaction

(c) Write the structures of A, B and C in the following :

(i) $C_6H_5 - CONH_2 \xrightarrow{Br_2/\text{aq. KOH}} A \xrightarrow[0-5^\circ C]{NaNO_2+HCl} B \xrightarrow{KI} C$

or

(d) An aromatic compound 'A' on treatment with aqueous ammonia and heating forms compound 'B' which on heating with Br_2 and KOH forms a compound 'C' of molecular formula C_6H_7N. Write the structures and IUPAC names of compounds A, B and C.

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. Write various methods of preparation of alcohol.

32. (a) What do you mean by the term 'Depression of freezing point'?

(b) State Raoult's Law of depression of freezing point. How is it useful in determining the molecular weight of non-volatile and non-electrolyte solute?

or

(a) What do you mean by relative lowering of vapour pressure?

(b) The relative lowering of vapour pressure of 1% solution of Aniline in Ether was 0.007. Calculate the molecular weight of Aniline.

33. What are haloalkanes and haloarenes ? Give their classification.

□□□□□□□

Sample Paper 12

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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. Order of reaction can be

(a) zero (b) fraction

(c) whole number (d) integer, fraction, zero

2. For an electrolyte, elevation of B.P. is directly proportional to:

(a) molarity (b) molality

(c) mole fraction (d) all of these

3. The complexes $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$ are the examples of which type of isomerism ?

(a) Linkage isomerism (b) Ionisation isomerism

(c) Coordination isomerism (d) Geometrical isomerism

4. Colligative properties of the solution depend on:

(a) Nature of solute (b) Nature of solvent

(c) Number of particles present in the solution (d) Number of moles of solvent only

5. The fuel used in the cell used in Apollo mission was

(a) H_2 (b) $H_2 - O_2$

(c) CH_4 (d) O_2

6. The rate of a chemical reaction

(a) increases as the reaction proceeds

(b) decreases as the reaction proceeds

(c) may increase or decrease during the reaction

(d) remains constant as the reaction proceeds

7. An example of a compound with functional group $-O-$ is :

(a) Acetic acid (b) Methyl alcohol

(c) Diethyl ether (d) Acetone

8. Acetamide is treated with the following reagents separately. Which one of these would yield methylamine?

(a) $NaOH - Br_2$ (b) Sodalime

(c) Hot con. H_2SO_4 (d) PCl_5

9. In a hydrogen-oxygen fuel cell, combustion of hydrogen occurs to

(a) produce high purity water

(b) create potential difference between two electrodes

(c) generate heat

(d) remove absorbed oxygen from electrode surfaces

10. Which of the following is a disaccharide?

(a) Lactose (b) Starch

(c) Cellulose (d) Fructose

11. Which reagent cannot be used to prepare an alkyl halide from an alcohol ?

(a) $HCl + ZnCl_2$ (b) NaCl

(c) PCl_5 (d) $SOCl_2$

12. Which of the following represents the correct order of the acidity in the given compounds?

(a) $FCH_2COOH > CH_3COOH > BrCH_2COOH > ClCH_2COOH$

(b) $BrCH_2COOH > ClCH_2COOH > FCH_2COOH > CH_3COOH$

(c) $FCH_2COOH > ClCH_2COOH > BrCH_2COOH > CH_2COOH$

(d) $CH_3COOH > BrCH_2COOH > ClCH_2COOH > FCH_2COOH$

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Benzene diazonium salt on boiling with water forms phenol.
Reason : C-N bond is polar.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** In acidic medium, $K_2Cr_2O_7$ exists as $Cr_2O_7^{2-}$ (orange) while in basic medium it is converted to CrO_4^{2-} (yellow).
Assertion : $K_2Cr_2O_7$ is hygroscopic in nature and changes colour on reaction with water.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :** $[Co(NO_2)_3\ (NH_3)_3]$ does not show optical isomerism.
Reason : It has a plane of symmetry.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion :** Benzene diazonium chloride does not give test for nitrogen.
Reason : Loss of N_2 gas takes place during heating.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

Continue on next page.....

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. What is salt bridge? What are its uses?

18. Why the properties of third transition series are very similar to second transition series?

19. How will you convert Phenol to benzene?

20. Define Order of a reaction. Illustrate your answer with an example.

or

What are complex reactions? Name one complex reaction.

21. What are reducing and non reducing sugars?

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. Derive the structure of cyclohex-3-en-1-ol.

23. State colligative properties of dilute solution. Write down the different types of colligative properties.

24. Explain magnetic behaviour of transition metals.

25. Draw the structure of all isomeric alcohols of molecular formula $C_4H_{10}O$ and give their IUPAC names.

26. What are the common types of secondary (2°) structure of proteins?

27. Write the following reactions of Benzene diazonium chloride.

(i) Sandmeyer reaction

(ii) Gatterman reaction

or

What do you mean by invert sugar?

28. (i) Define the following terms:
(a) Enantiomers
(b) Racemic mixture
(ii) Why is chlorobenzene resistant to nucleophilic substitution reaction?

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. Carbohydrates are polyhydroxy aldehydes and ketones and those compounds which on hydrolysis give such compounds are also carbohydrates. The carbohydrates which are not hydrolysed are called monosaccharides. Monosaccharides with aldehydic group are called aldose and those which free ketonic groups are called ketose. Carbohydrates are optically active. Number of optical isomers $= 2^n$.
Where n = number of asymmetric carbons. Carbohydrates are mainly synthesised by plants during photosynthesis. The monosaccharides give the characteristic reactions of alcohols and carbonyl group (aldehydes and ketones). It has been found that these monosaccharides exist in the form of cyclic structures. In cyclization, the $-$OH groups (generally C_5 or C_4 in aldohexoses and C_5 or C_6in ketohexoses) combine with the aldehyde or keto group. As a result, cyclic structures of five or six membered rings containing one oxygen atom are formed, e.g., glucose forms a ring structure. Glucose contains one aldehyde group, one 1° alcoholic group and four 2° alcoholic groups in its open chain structure.
Answer the following questions :
(a) What is the name the first member of ketose sugar?
(b) How many optical isomers are present in $CH_2OH(CHOH)_4CHO$?
(c) Write the reaction of glucose with hydroxylamine.

or

(d) How many moles of acetic anhydride are needed for acetylation of glucose? What does it confirm?

30. A solution containing 30 g of non-volatile solute exactly in 90 g of water has a vapour pressure of 2.8 K Pa at 298 k Further 18 g of water is added to this solution. The new vapour pressure becomes 2.9 k Pa at 298 K When a non-volatile solute is added to a solvent, the surface has molecules of solute and solvent both. Thus, the number of molecules of solvent present in upper surface is less. The number of solvent molecules escaping from the surface is reduced.
Answer the following questions :
(a) Write down the expression for relative lowering of vapour pressure with the mole fraction of the solute.
(b) Calculate the vapour pressure of water at 298 K.
(c) Find out the molecular mass of solute?

or

(d) Name two factors on which the vapour pressure of the liquid depends.

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. Give two reactions that show the acidic nature of Phenol. Compare its acidity with that of ethanol.

32. (a) Differentiate between Osmosis and diffusion. How is osmotic pressure determined by Berkeley-Hartlay method?

(b) 18 g of glucose ($C_6H_{12}O_6$) was added to 1 kg water at 1.013 bar atmospheric pressure in a vessel. At which temperature will water boil? K_b for water is 0.52 K Kg mol^{-1}.

or

(a) What do you mean by the term 'elevation of boiling point'?

(b) State Raoult's law. How is it useful in determining the molecular weight of non-electrolyte solute?

33. Arrange the compounds of each set in order of reactivity towards S_N2 displacement:

(i) (a) 2-Bromo-2-methylbutane
(b) 1-Bromopentane
(c) 2-Bromopentane

(ii) (a) 1-Bromobutane-3-methylbutane
(b) 2-Bromo-2-methylbutane
(c) 2-Bromo-3-methylbutane

(iii) (a) Bromobutane
(b) 1-Bromo-2, 2-dimethylpropane
(c) 1-Bromo-2-methylbutane
(d) 1-Bromo-3-methylbutane.

or

Write the structure of the major organic product in each of the following reaction :

1. $CH_3CH_2CH_2Cl + NaI \xrightarrow{\text{acetone, heat}}$
2. $(CH_3)_3CBr + KOH \xrightarrow{\text{ethanol heat}}$
3. $CH_3CH(Br)CH_2CH_3 + NaOH \xrightarrow{\text{Water}}$
4. $CH_3CH_2Br + KCN \xrightarrow{\text{aq ethanol}}$
5. $C_6H_5ONa + C_2H_5Cl \longrightarrow$
6. $CH_3CH_2CH_2OH + SOCl_2 \longrightarrow$
7. $CH_3CH_2CH = CH_2 + HBr \xrightarrow{\text{Peroxide}}$
8. $CH_3CH = C(CH_3)_2 + HBr \longrightarrow$

□□□□□□□

Sample Paper 13

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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 one of the following is the strongest base in aqueous solution?

(a) Methylamine (b) Trimethylamine

(c) Aniline (d) Dimethylamine

2. Which is not colligative property?

(a) Freezing Point (b) Lowering of vapour pressure

(c) Depression of freezing point (d) Elevation of boiling point

3. Which of the following compounds is used as a refrigerant?

(a) Acetone (b) CCl_4

(c) CF_4 (d) CCl_4F_2

4. Osmotic pressure of a solution at a given temperature:

(a) increases with concentration

(b) decreases with concentration

(c) remains same

(d) initially increases and then decreases

5. The coordination number of a central metal atom in a complex is determined by

(a) the number of ligands around a metal ionbonded by sigma and pi-bonds both

(b) the number of ligands around a metal ion bonded by pi-bonds

(c) the number of ligands around a metal ion bonded by sigma bonds

(d) the number of only anionic ligands bonded to the metal ion

6. A catalyst is used

(a) only for increasing the velocity of the reaction

(b) for altering the velocity of the reaction

(c) Only for decreasing the velocity of the reaction

(d) All a, b and c are correct

7. Which of the following is non-electrolyte?

(a) NaCl (b) $CaCl_2$

(c) $C_{12}H_{22}O_{11}$ (d) CH_3COOH

8. The number of essential amino acids in man is

(a) 8 (b) 10

(c) 18 (d) 20

9. The oxidation state of Cr in $K_2Cr_2O_7$ is:

(a) $+5$ (b) $+3$

(c) $+6$ (d) $+7$

10. Fuel cells are preferred to other energy producing devices in space because of

(a) high efficiency (b) pollution free

(c) less weight (d) all of these

11. The reaction given below is known as

$$C_2H_5ONa + IC_2H_5 \rightarrow C_2H_5OC_2H_5 + NaI$$

(a) Kolbe's synthesis (b) Wurtz' synthesis

(c) Williamson's synthesis (d) Grignard's synthesis

12. Which of the following is incorrect?

(a) $NaHSO_3$ is used in detection of carbonyl compound.

(b) $FeCl_3$ is used in detection of phenolic group.

(c) Tollen reagent is used in detection of unsaturation.

(d) Fehling solution is used in detection of glucose.

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Nitrobenzene is used as a solvent in Friedel-Craft's reaction.
Reason : Fusion of nitrobenzene with solid KOH gives a low yield of a mixture of o-and p -nitrophenols.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** Alcohols are easily protonated as compared to phenols.
Reason : Alcohols undergo intermolecular hydrogen bonding due to the presence of highly electronegative oxygen.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :** The [Ni $(en)_3$] Cl_2 (en = ethylene-diamine) has lower stability than [Ni $(NH_3)_6$]Cl_2.
Reason : In [Ni $(en)_3$]Cl_2, the geometry of Ni is trigonal bipyramidal.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion :** $p - O_2N \cdot C_6H_4 \cdot COCH_3$ is prepared by Freidel Craft's acylation of nitrobenzene.
Reason : Nitrobenzene easily undergoes electrophilic substitution reaction.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

SECTION-B

Directions (Q. No. 17-21) : This section contains 5 questions with internal choice in two questions. The following questions are very short answer type and carry 2 marks each.

17. What do you mean by electrode potential ?

18. In first transition series density increases from titanium (Z=22) to copper (Z=29). Give reason.

19. Dipole moments of aldehydes and ketones are higher than those of alcohols Explain.

20. Write the equation relating $[R]$, $[R]_0$ and reaction time t for a zero order reaction. $[R]$ = concentration of reactant at time t and $[R]_0$ = initial concentration of reactant.

or

Draw the graph that relates the concentration R, of the reactant and t the reaction time for a zero order reaction.

21. How will you convert benzene to chlorobenzene?

SECTION-C

Directions (Q. No. 22-28) : This section contains 5 questions with internal choice in two questions. The following questions are short answer type and carry 3 marks each.

22. Write a reaction which shows that aldehyde group is present in glucose.

23. What is salt bridge ? Give its functions.

24. Explain the variation of molar conductivity with the change in the concentration of the electrolyte. Give reasons.

25. Compare the stability of +2 oxidation state for the elements of the first transition series.

26. 1. How will you distinguish between isopropyl alcohol and ethyl alcohol.
2. How will you distinguish between isopropyl alcohol and t-butyl alcohol.

27. Give reasons for the following :
Aniline is less basic than methylamine.

or

What is the basic structural difference between starch and cellulose?

28. How will you convert (Give only chemical equation):

(i) Propanamide to ethylamine

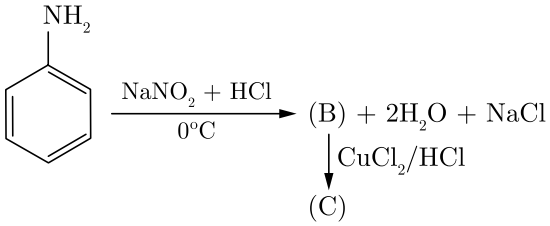
(ii) Ethyl amine to methane

(iii) Aniline to acetanilide.

or

Identify A, B and C in the following equations :

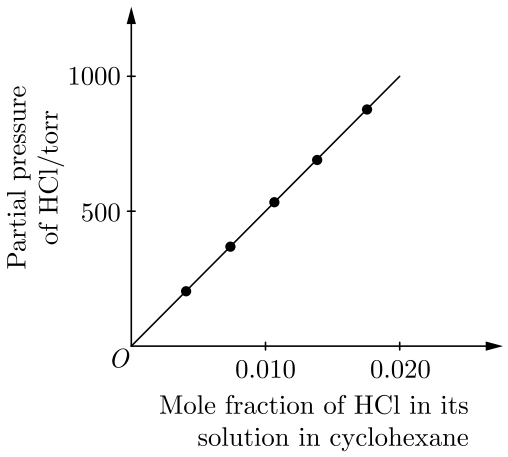
(i) $C_6H_5NO_2 \xrightarrow[6[H]]{Sn/HCl} (A) + H_2O$

(ii) 

SECTION-D

Directions (Q. No. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. Many gases dissolve in water, Oxygen dissolves only to small extent which sustains all aquatic life. NH_3 and HCl are highly soluble in water. Solubility of gases increases with increase in pressure and decreases with increase in temperature.



Henry's law states "The partial pressure of the gas in vapour phase (p) is proportional to the mole fraction of the gas in the solution. $p = K_H x$."

Where, K_H is Henry's law constant. If we draw a graph between partial pressure of the gas versus mole fraction of gas in solution, then we will get straight line as shown in graph.

Different gases have different K_H values of the same temperature. This suggests, K_H is a function of nature of gas.

Answer the following questions :

(a) What is significance of K_H?

(b) What is slope of the line given in graph?

(c) (i) Why does solubility of gas in liquid decreases with increase solution in cyclohexane in temperature?

(ii) Why are cold drinks filled with CO_2 at high pressure?

or

(i) What is cause of anoxia at high altitude?

(ii) Why do scuba divers take air diluted with helium?

30. Phenols are acidic in nature. In substituted phenols, electron withdrawing groups such as —NO_2, enhances acidic strength of phenol, if —NO_2 group is present at o- and p-position. It is due to effective delocalisation of negative charge on phenoxide ion. Electron releasing groups, such as alkyl groups, do not favour formation of phenoxide ions resulting in decrease in acid strength e.g. cresols are less acidic than phenols.

The following table gives values of some Phenols and Ethanol.

Compound	**Formula**	pK_a
o-Nitrophenol	o-O_2N—C_6H_4—OH	7.2
m-Nitrophenol	m-O_2N—C_6H_4—OH	8.3
p-Nitrophenol	p-O_2N—C_6H_4—OH	7.1
Phenol	C_6H_5OH	10.0
o-Cresol	o-CH_3—C_6H_4—OH	10.2
m-Cresol	m-CH_3—C_6H_4—OH	10.1
p-Cresol	p-CH_3—C_6H_4—OH	10.2
Ethanol	C_2H_5OH	15.9

Answer the following questions :

(a) From the above data, how many times phenol is more acidic than ethanol?

(b) Out of phenols given in the table, which phenol is most acidic and why?

(c)

(i) **Arrange the following in increasing order of acidic strength :** phenol, o-nitro phenol, m-nitro phenol, p-nitro phenol, p-cresol

(ii) Why are phenols less acidic than carboxylic acids?

or

(i) Arrange 2, 4, 6-trinitro phenol, 3,5-dinitro phenol, 3-nitro phenol, phenol, propan-1-ol, 4-methyl phenol in increasing order of acidic character.

(ii) Convert phenol to 2, 4, 6-trinitro phenol.

SECTION-E

Directions (Q. No. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. Write a note of effect of substituents on the acidity of phenols.

32. What do you mean by vapour pressure ? What happens to the vapour pressure, when (i) volatile solute is dissolved in solution. (ii) non-volatile solute is dissolved in solution ?

or

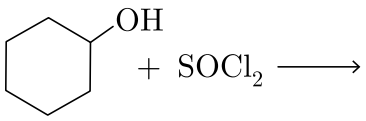
Define osmotic pressure. Prove that osmotic pressure is a molecular property.

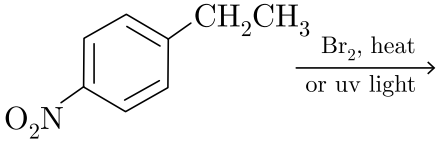
33. Write the following :

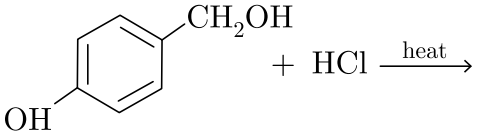
1. Allylic halogenation
2. Markovnikov's rule
3. Kharasch effect
4. Swarts reaction
5. Finkelstein reaction
6. Hundsdiecker reaction
7. Sandmeyer reaction
8. Preparation of Iodobenzene
9. Balz-Schiemann reaction
10. Gattermann reaction.

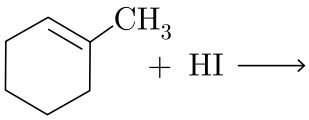
or

Draw the structures of major mono-halo products in each of the following :

(i) 

(ii) 

(iii) 

(iv) 

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Sample Paper 14

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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. As a result of osmosis, the volume of the solution :

(a) gradually decreases (b) gradually increases

(c) is not affected (d) suddenly increases

2. Alcohols of low molecular weight are

(a) Soluble in water (b) Soluble in water on heating

(c) Insoluble in water (d) Insoluble in all solvents

3. The conductivity of strong electrolyte is

(a) Increase on dilution electrolyte is

(b) Decrease on dilution

(c) Does not change with dilution

(d) Depends upon density of electrolytes itself

4. Which of the following aqueous solution has minimum freezing point ?

(a) 0.01 m NaCl (b) 0.005 m C_2H_5OH

(c) 0.005 m MgI_2 (d) 0.005 m $MgSO_4$

5. Units of rate constant of first and zero order reactions in terms of molarity M unit are respectively

(a) $\sec^{-1}, \mathrm{M}\sec^{-1}$

(b) $\sec^{-1}, \mathrm{M}$

(c) $\mathrm{M}\sec^{-1}, \sec^{-1}$

(d) $\mathrm{M}, \sec^{-1}$

6. The number of unpaired electrons in the complex ion $\left[\mathrm{CoF_6}\right]^{3-}$ is (Atomic no.: Co=27).

(a) zero

(b) 2

(c) 3

(d) 4

7. Isotonic solutions have same:

(a) Molar concentration

(b) Molality

(c) Normality

(d) None of these

8. The compound obtained by heating a mixture of a primary amine and choloroform with ethanolic potassium hydroxide (KOH) is :

(a) an alkyl cyanide

(b) a nitro compound

(c) an alkyl isocyanide

(d) an amide

9. The electronic configuration of gadolinium (Atomic number 64) is :

(a) $[\mathrm{Xe}]\,4f^8 5d^0 6s^2$

(b) $[\mathrm{Xe}]\,4f^3 5d^5 6s^2$

(c) $[\mathrm{Xe}]\,4f^6 5d^2 6s^2$

(d) $[\mathrm{Xe}]\,4f^7 5d^1 6s^2$

10. Haloforms are trihalogen derivatives of

(a) Ethane

(b) Methane

(c) Propane

(d) Benzene

11. Complete hydrolysis of cellulose gives

(a) D-ribose (b) D-glucose

(c) L-glucose (d) D-fructose

12. The reagent (s) which can be used to distinguish acetophenone from benzophenone is (are)

(a) 2, 4-Dinitrophenylhydrazine

(b) Aqueous solution of $NaHSO_3$

(c) Benedict reagent

(d) l_2 and Na_2CO_3

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Aniline is better nucleophile than anilium ion
Reason : Anilium ion have positive charge.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** The two strands of DNA are complementary to each other.
Reason : Adenine specifically forms hydrogen bonds with guanine whereas cytosine forms hydrogen bonds with thymine.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :** NF_3 is a weaker ligand than $N(CH_3)_3$.
Reason : NF_3 ionizes to give F^- ions in aqueous solution.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion :** Anilinium chloride is more acidic than ammonium chloride.
Reason : Anilinium ion is resonance stabilized.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

SECTION-B

Directions (Q. No. 17-21) : This section contains 5 questions with internal choice in two questions. The following questions are very short answer type and carry 2 marks each.

17. Define standard reduction potential of electrode.

18. Why transition metals have high enthalpies of ionization?

or

Why to transition elements show variable oxidation state?

19. Write the integrated equation for a first order reaction in terms of $[R]$, $[R]_0$ and t.

20. Write the chemical reaction of carbonyl group with : H_2O

21. Write a reaction which shows the presence of a primary alcoholic $(-OH)$ group in glucose.

SECTION-C

Directions (Q. No. 22-28) : This section contains 5 questions with internal choice in two questions. The following questions are short answer type and carry 3 marks each.

22. What are cells? Name the two types of cells.

23. What is electrolysis? Give the reactions occurring at two electrodes during electrolysis of molten sodium chloride.

24. Calculate the number of unpaired electrons in the following gaseous ions : Mn^{3+}, Cr^{3+}, V^{3+} and Ti^{3+}. Which one of these is the most stable in aqueous solution?

25. What is meant by hydroboration-oxidation reaction? Illustrate it with an example

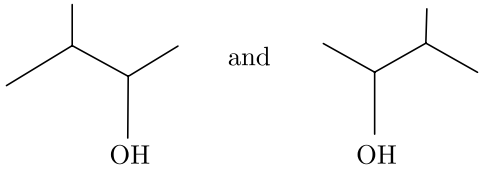
26. Ethylamine is soluble in water whereas aniline is not ?

27. What are essential and non essential amino acids? Give two examples of each type.

or

How do you explain the amphoteric behaviours of amino acids?

28. (i) Identify the chiral molecule in the following pair:



(a) (b)

(ii) Write the structure of the product when chlorobenzene is treated with methyl chloride in the presence of sodium metal and dry ether.

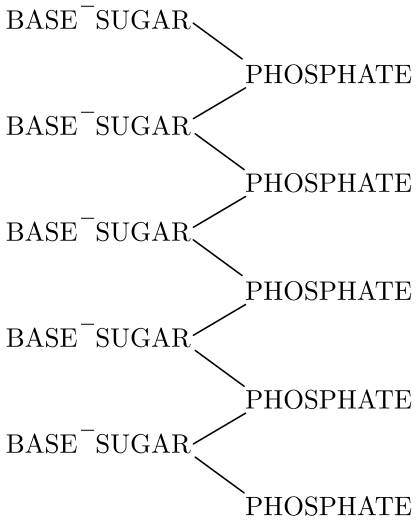
(iii) Write the structure of the alkene formed by dehydrohalogenation of 1-bromo-1-methylcyclohexane with alcoholic KOH.

SECTION-D

Directions (Q. No. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. The basic chemical formula of DNA is now well established. As shown in figure it consists of a very long chain, the backbone of which is made up of alternate sugar and phosphate groups, joined together in regular 3' 5' phosphate di-ester linkages. To each sugar is attached a nitrogenous base, only four different kinds of which are commonly found in DNA. Two of these— adenine and guanine— are purines, and the other two thymine and cytosine-are pyrimidines. A fifth base, 5-methyl cytosine, occurs in smaller amounts in certain organisms, and a sixth, 5-hydroxy-methyl-cytosine, is found instead of cytosine in the T even phages. It should be noted that the chain is unbranched, a consequence of the regular internucleotide linkage. On the other hand the sequence of the different nucleotides is, as far as can be ascertained, completely irregular. Thus, DNA has some features which are regular, and some which are irregular. A

similar conception of the DNA molecule as a long thin fiber is obtained from physico-chemical analysis involving sedimentation, diffusion, light scattering, and viscosity measurements. These techniques indicate that DNA is a very asymmetrical structure approximately 20 A° wide and many thousands of angstroms long. Estimates of its molecular weight currently centre between 5×10^6 and 10^7 (approximately 3×10^4 nucleotides). Surprisingly each of these measurements tend to suggest that the DNA is relatively rigid, a puzzling finding in view of the large number of single bonds (5 per nucleotide) in the phosphate-sugar back bone. Recently these indirect inferences have been confirmed by electron microscopy.



Chemical formula (diagrammatic) of a single chain of deoxyribonucleic acid.
Answer the following questions :

(a) Name the purines present in DNA.

(b) What is the name of the linkage between nucleotides in DNA?

(c) (i) What is backbone of DNA?

(ii) Out of four different kinds of nitrogenous bases which are commonly formed in DNA has been replaced in some organisms.

or

(d) (i) Which component makes DNA chiral?

(ii) Between which carbon atoms of deoxyribose sugars of nucleotide are phosphodiester linkage present?

Continue on next page.....

30. Observe the table in which azeotropic mixtures are given along their boiling points of pure components and azeotropes.

Some Azeotropic Mixtures					
A	B	Minimum Boiling Azeotropes	A	B	Mixture Azeotropes
H_2O H_2O CH_3COCH_3	C_2H_5OH C_3H_7OH CS_2	95.37% 71.69% 67%	373K 373K 329.25K	351.3K 370.19K 319.25K	351.15 350.72 312.30
H_2O	HCl	20.3%	373K	188K	383K
H_2O	HNO_3	68.0%	373K	359K	393.5K
H_2O	$HClO_4$	71.6%	373K	383K	476K

Answer the following questions :

(a) Why do ethanol and H_2O show positive deviation from Raoult's law ?

(b) Why do H_2O and HCI form maximum boiling azeotropes?

(c) (i) What are azeotropes ?

(ii) How are azeotropes separated ?

or

(d) If $p^\circ_A = 450$ mm, $p^\circ_B = 200$ mm, what is mole fraction of A in vapour phase if $x_A = 0.3$ in liquid phase ?

SECTION-E

Directions (Q. No. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. Write various methods of preparation of phenol.

32. Define the following terms :

1. Mole fraction
2. Molality
3. Molarity
4. Normality
5. Percentage
6. ppm

or

State Henry's Law an mention some important applications.

33. Predict the alkenes that would be formed by dehydrohalogenation of the following halides. With sodium ethoxide in ethanol and identity the major alkene.

(i) 1-Bromo-1-methyl cyclohexane

(ii) 2-Chloro-2-methylbutane

(iii) 3-Bromo-2, 2, 3-trimethylpentane

or

Give the preparation of chlorobenzene from benzene diazonium chloride and give its reaction with:

(i) Na

(ii) CH_3Cl is the presence of anhydrous $AlCl_3$

(iii) H_2SO_4

(iv) HNO_3 in the presence of cone. H_2SO_4.

□□□□□□□

Sample Paper 15

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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. Oxidation number of Ni in $\left[Ni(C_2O_4)_3\right]^{4-}$ is

(a) 3 (b) 4

(c) 2 (d) 6

2. An ester is boiled with KOH. The product is cooled and acidified with concentrated HCl. A white crystalline acid separates. The ester is

(a) Methyl acetate (b) Ethyl acetate

(c) Ethyl formate (d) Ethyl benzoate

3. Several blocks of magnesium are fixed to the bottom of a ship to

(a) make the ship lighter

(b) prevent action of water and salt

(c) prevent puncturing by under-sea rocks

(d) keep away the sharks

4. In respect of the equation $k = Ae^{-E_a/RT}$ in chemical kinetics, which of the following statements is correct?

(a) A is adsorption factor
(b) E_a is energy of activation
(c) R is Rydberg's constant
(d) k is equilibrium constant

5. Diethyl ether on heating with conc. HI gives two moles of

(a) ethanol
(b) iodoform
(c) ethyl iodide
(d) methyl iodide

6. Which of the following forms colourless compound ?

(a) Sc^{3+}
(b) V^{3+}
(c) Ti^{3+}
(d) Cr^{3+}

7. Which one is a colligative property ?

(a) boiling point
(b) vapour pressure
(c) osmotic pressure
(d) freezing point

8. Consider the following sequence of reactions:

$$\text{Compound [A]} \xrightarrow{\text{Reduction}}$$

$$\text{[B]} \xrightarrow{HNO_2} CH_3CH_2OH$$

The compound [A] is:

(a) CH_3CH_2CN
(b) CH_3NO_2
(c) CH_3NC
(d) CH_3CN

9. When glucose reacts with bromine water, the main product is

(a) gluconic acid
(b) glyceraldehyde
(c) saccharic acid
(d) acetic acid

10. Which of the following is the use of electrolysis?

(a) Electro-refining
(b) Electroplating
(c) Both (a) and (b)
(d) None of these

11. Chloropicrin is

(a) $C_2H_5C(NO)_5SH$
(b) CCl_3CHO
(c) CCl_3NO_2
(d) CCl_3NO_3

12. The molecular weight of benzoic acid in benzene as determined by depression in freezing point method corresponds to:

(a) ionization of benzoic acid.

(b) dimerization of benzoic acid.

(c) trimerizatin of benzoic acid.

(d) solvationof benzoic acid.

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** KCl, NaCl and NH_4Cl cannot be used in the salt bridge of a cell containing silver.
Reason : A salt bridge contains concentrated solution of an inert electrolyte like KCl, KNO_3, K_2SO_4 or solidified solution of such an electrolyte in agar-agar and gelatine.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** Members of $4d$ and $5d$ series of transition elements have nearly same atomic radii.
Reason : Atomic and ionic radii for transition elements are smaller than their corresponding s -block elements.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :** AgCl dissolves in NH_4OH solution.
Reason : Due to formation of a complex.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion :** Nitration of aniline can be conveniently done by protecting the amino group by acetylation.
Reason : Acetylation increases the electron-density in the benzene ring.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

SECTION-B

Directions (Q. No. 17-21) : This section contains 5 questions with internal choice in two questions. The following questions are very short answer type and carry 2 marks each.

17. Write down the half cell reaction and cell reaction for the Daniel cell.
$Zn\,(s)\,|\,Zn^{+2}(aq.)\,(1M)\,||\,Cu^{+2}(aq.)\,(1M)\,|\,Cu\,(s)$

18. What is denaturation of alcohol?

19. Write two main functions of carbohydrates in plants.

20. How will rate of a reaction change when $[A]_0$ is doubled and tripled for

1. zero order reaction.
2. second order reaction ?

or

State the order with respect to each reactant and overall order for the following reaction −

$$2NOBr\,(g) \longrightarrow 2NO\,(g) + Br_2(g)$$

$$\text{Rate} = k\,[NOBr]^2$$

What are the units of rate constant ?

21. Why is it not possible to measure the single electrode potential ?

Continue on next page.....

SECTION-C

Directions (Q. No. 22-28) : This section contains 5 questions with internal choice in two questions. The following questions are short answer type and carry 3 marks each.

22. Why aldehydes are more reactive than ketones ?

23. What are the fuel cells? How are they different from galvanic cells? Give the construction of H_2, O_2 fuel cell?

24. For M^{2+}/M and M^{3+}/M^{2+} systems, E° values for some metals are as follows :

$$Cr^{2+}/Cr = -0.9\,V$$
$$Cr^{3+}/Cr^{2+} = -0.4\,V$$
$$Mn^{2+}/Mn = -1.2\,V$$
$$Mn^{3+}/Mn^{2+} = +1.5\,V$$
$$Fe^{2+}/Fe = -0.4\,V$$
$$Fe^{3+}/Fe^{2+} = +0.8\,V$$

Use this data to comment upon:

1. the stability of Fe^{3+} in acid solution as compared to that of Cr^{3+} and Mn^{3+}.
2. the ease with which iron can be oxidised as compared to a similar process for either chromium or manganese metal.

25. Explain why propanol has higher boiling point than that of the hydrocarbon, butane?

26. Describe method of nitration of benzene.

27. What are Carbohydrates ? Give the classification of carbohydrates.

or

(i) What are vitamins?

(ii) How are vitamins classified? Name the vitamin responsible for coagulation of blood?

28. Give the IUPAC names of the following:

(i) $Cl - CH_2C \equiv C - CH_2 - Br$

(ii) $CH_3CH_2CH(CH_3)CH(C_2H_5)Cl$

SECTION-D

Directions (Q. No. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. The stability of complex in solution refers to degree of association between the two species involved in the state of equilibrium. The magnitude of the equilibrium constant (stability or formation) for the association, quantitatively expresses the stability. If complex is formed in steps then the stepwise and overall stability constant is related as follows—

$$\beta_n = k_1 \times k_2 \times k_3 \times k_4 ... k_n$$

The addition of four amine groups to copper shows a pattern found for most formation constants, in which the successive stability constant decreases. The instability constant or the dissociation constant of coordination compound is defined as reciprocal of formation constant β_4.

Table : Stability Constants of Some Complexes

	Complex	**Stability Constant** (β)
1.	$[Cu(NH_3)_4]^{2+}$	4.5×10^{11}
2.	$[Cu(CN)_4]^{2-}$	2.0×10^{27}
3.	$[Ag(NH_3)_2]^{+}$	1.6×10^{7}
4.	$[Co(NH_3)_6]^{3+}$	5.0×10^{33}
5.	$[Ag(CN_2)^{-}$	5.4×10^{18}
6.	$[Ni(NH_3)_6]^{2+}$	6.1×10^{18}
7.	$[Ni(en)_3]^{2+}$	4.6×10^{18}
8.	$[Fe(CN)_6]^{3-}$	1.2×10^{31}
9.	$[Fe\ (CN)_6]^{4-}$	1.8×10^{6}
10.	$[Cd(NH_3)_4]^{2+}$	1.0×10^{7}

According to the given paragraph, answer the following questions :

(a) Why is stability constants of cyanides are higher than complexes with NH_3 as a ligand?

(b) Which of the complexes given in table is least stable? Why?

(c) (i) Why is $[Fe(CN)_6]^{3-}$ is more stable than $[Fe(CN)_6]^{4-}$?

(ii) Why is $[Ag(NH_3)_2]^{+}$ is less stable than $[Cu(NH_3)_4]^{2+}$?

or

(d) Calculate the overall complex dissociation equilibrium constant for the $[Cu(NH_3)_4]^{2+}$ ion, given that for this complex $\beta_4 = 2.0 \times 10^{13}$.

or

(d) K(Dissociation constant) $= \frac{1}{\beta_4} = \frac{1}{2.0 \times 10^{13}} = 5 \times 10^{-13}$

30. The vapour pressure of solvent is lowered by the presence of non-volatile solute and this lowering of vapour pressure is governed by Raoult's law, according to which 'the relative lowering of vapour pressure of the solvent over a solution is equal to mole fraction of solute present in the solution. However in a binary solution if both components are volatile then another form of Raoult's law is used. The partial vapour pressure of each component is directly proportional to their mole fractions and $p_{\text{total}} = p_1^0 x_1 + p_2^0 x_2$. Solutions which obey Raoult's law over the entire range of concentration are called ideal solutions. Two types of deviations from Raoult's law are observed, positive and negative by non-ideal solution depending upon interaction between the components. Azeotropes are formed due to very large deviations from Raoult's law.
Read the passage and answer the following questions:

(a) What type of solution is formed by ethanol and water?

(b) What type of solution is formed by benzene and toluene?

(c) The vapour pressure of pure 'A' and 'B' are 450 mm and 700 mm Hg respectively at 350 K. What are the mole fraction of 'A' and 'B' in vapour phase, if total pressure on mixing is 600 mm.

or

(d) Calculate the mass of solute (non-volatile) with molar mass 40 g/mol which must be dissolved in 114 g octane to reduce its vapour pressure to 80%.

SECTION-E

Directions (Q. No. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. Write chemical reactions of following :

1. Phenol with zinc dust.
2. Electrophilic aromatic substitution of phenol.

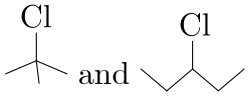
32. State the Explain :

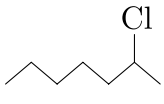
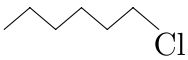
1. Raoult's law for volatile solute.
2. Raoult's law for non-volatile solute.

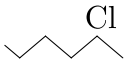
or

Give the difference between ideal and non-ideal solutions.

33. In the following pairs of halogen compounds which compound undergo faster S_N1 reaction ?

(i)  and

(ii)  and 

Since 2° carbocation are more stable than 1° carbocation therefore  will react faster in S_N1 reaction.

or

Write the following reaction :

(i) Friedel-Crafts acylation.

(ii) Wurtz-Fitting reaction.

(iii) Dow's process.

(iv) Ullmann biaryl synthesis.

□□□□□□□

Sample Paper 16

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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. For the reaction $2N_2O_5 \longrightarrow 4NO_2 + O_2$, rate and rate constant are $1.02 \times 10^{-4} mol\, L^{-1} s^{-1}$ and $3.4 \times 10^{-5}\, sec^{-1}$ respectively then concentration of N_2O_5 at that time will be

(a) 1.732 M (b) 3 M

(c) 3.4×10^5 M (d) 1.02×10^{-4} M

2. If A contains 2% NaCl and is separated by a semi-permeable membrane from B Which contains 10% NaCl, then which event will occur ?

(a) NaCl will flow from A to B

(b) NaCl will flow from B to A

(c) Water will net flow from A to B

(d) Water will net flow from B to A

3. The standard reduction potential at 25°C of $Li^+/Li, Ba^{2+}/Ba, Na^+/Na$ and Mg^{2+}/Mg are $-3.03, -2.73, -2.71$ and -2.37 volt respectively. Which one of the following is the strongest oxidising agent?

(a) Na^+ (b) Li^+

(c) Ba^{2+} (d) Mg^{2+}

4. Chloroform is used as

(a) Fire extinguisher (b) Industrial solvent

(c) Refrigerant (d) Insecticide

5. Faraday's law of electrolysis is related to :

(a) Atomic number of cation (b) Speed of cation

(c) Speed of anion (d) Equivalent weight of element

6. Which of the following organometallic compound is σ and π bonded?

(a) $[Fe(\eta^5 - C_5H_5)_2]$ (b) $Fe(CH_3)_3$

(c) $K[PtCl_3(\eta^2 - C_2H_4)]$ (d) $[Co(CO)_5NH_3]^{2+}$

7. On distilling phenol with Zn dust, one gets :

(a) Toluene (b) Benzaldehyde $+ ZnO$

(c) $ZnO +$ benzene (d) Benzoic acid

8. A reaction involving two different reactants can never be

(a) bimolecular reaction (b) second order reaction

(c) first order reaction (d) unimolecular reaction

9. Photographic films and plates have an essential ingredient of:

(a) Silver nitrate (b) Silver bromide

(c) Sodium Chloride (d) Oleic acid

10. In the diazotization of arylamines with sodium nitrite and hydrochloric acid, an excess of hydrochloric acid is used primarily to:

(a) Suppress the concentration of free aniline available for coupling

(b) Suppress hydrolysis of phenol

(c) Ensure a stoichiometric amount of nitrous acid

(d) Neutralise the base liberated

11. If formaldehyde and KOH are heated, then we get

(a) Methane (b) Methyl alcohol

(c) Ethyl formate (d) Acetylene

12. Which of the following protein destroy the antigen when it enters in body cell?

(a) Antibodies (b) Insulin

(c) Chromoprotein (d) Phosphoprotein

Directions (Q. No. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Acetaldehyde on treatment with alkali gives aldol.
Reason : Acetaldehyde molecule contains α-hydrogen atom.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** Alpha (α)- amino acids exist as internal salt in solution as they have amino and carboxylic acid groups in near vicinity.
Reason : H^+ ion given by carboxylic group ($-COOH$) is captured by amino group ($-NH_2$) having lone pair of electrons.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :** Nucleophilic substitution reaction on an optically active alkyl halide gives a mixture of enantiomers.
Reason : The reaction occurs by S_N1 mechanism.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion :** Acetamide has more polar $>C=O$ group than ethyl acetoacetate.
Reason : $\ddot{N}H_2$ is more electron donating than $\ddot{O}C_2H_5$

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Define Vapour pressure.

18. Draw the structure of
1. hex-1-en-3 ol
2. 3-aminopentan-2-ol

or

What is 'Wood spirit'?

19. Explain with one example each the terms weak and strong electrolytes.

20. Write the use of formaldehyde (HCHO).

or

Write the IUPAC names of :
1. $CH_3 - CH_2Br - COOH$
2. $COOH - CH_2 - CH_2 - COOH$

21. Suggest a way to determine the Λ°_m value of water.

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. What is the difference between inner orbital or low spin complex and outer orbital or high spin complex?

23. Which one of the following has the highest dipole moment?
(i) CH_2Cl_2
(ii) $CHCl_3$
(iii) CCl_4

24. Give the representation of a galvanic cell.

25. Write the IUPAC names of the following coordinate compounds:

1. $[Pt(NH_3)_2Cl_2]Cl_2$
2. $[Cr(NH_3)_4Cl_2]^+$

26. The treatment of alkyl chloride with aqueous KOH leads to the formation of alcohols but in presence of alcoholic KOH, alkenes are the major products. Explain why ?

27. Give the dissimilarities between $>C=O$ bond and $-\overset{|}{C}=\overset{|}{C}-$ Bond.

or

Arrange the following compounds in increasing order of boiling points ?

1. Pentan-1-ol, butan-1-ol, butan-2-ol, propan-1-ol, methanol.
2. Pentan-1-ol, *n*-butane, pentanal, ethoxyethane.

28. Write main series of transition metals.

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. Colour may arise from a entirely different cause in ions with incomplete *d* or *f* shells. This source of colours very important in most of the transition metal ions. In free isolated gaseous ion the five *d* orbitals are degenerate, i.e. they are identical in energy. In real life situations, the ion will be surrounded by solvent molecules if it is in solution; by other ligands if it is in a complex; or by other ions if it is in crystal lattice. The surrounding groups affect the energy of some orbitals more than others. Thus the *d* orbitals are no longer degenerate, and they form two groups of orbitals of different energies. Thus in transition element ions with a partly filled d shell, it is possible to promote electrons from *d* level to another *d* level of higher energy. The corresponds to a fairly small energy difference and so light is absorbed in the visible region. The colour of a transition meltal complex is dependent on how big the energy difference is between the two *d* levels. This in turn depends on the nature of the ligand, and on the type of complex formed. Thus the octahedral complex $[Ni(NH_3)_6]^{2+}$ is blue, $[Ni(H_2O)_6]^{2+}$ is green and $[Ni(NO_2)_6]^{4-}$ is brown-red. The colour changes with the ligand,used the colour also depends on the Number of ligands and the shape of the complex formed.

Answer the following questions :

(a) Account for the following : Copper(I) compounds are white whereas copper(II) compounds are coloured.

(b) Cu^{2+} salts are coloured, while Zn^{2+} salts ire white.

(c) Which of following cations are coloured in aqueous solutions and why ?
Sc^{3+}, V^{3+}, Ti^{4+}, Mn^{2+}
(At. nos..Sc = 21, V = 23, Ti = 22, Mn = 25)

or

(d) How would you account for the following : Transition metals form coloured compounds ?

30. Amines are alkyl or aryl derivatives of ammonia formed by replacement of one or more hydrogen atoms. Allcyl derivatives are called aliphatic amines and aryl derivatives are known as aromatic amines. The presence of aromatic amines can be identified by performing dye test. Aniline is the simplest example of aromatic amine. It undergoes electrophilic substitution reactions in which-NH_2, group strongly activates the aromatic ring through delocalisation of lone pair of electrons of N-atom. Aniline undergoes electrophilic substitution reactions. Ortho and para positions to the-NH_2 group become centres of high electrons density. Thus,-NH_2 group is ortho and para-directing and powerful activating group.

Read the above passage and answer the following question:

(a) What does oxidation of aniline in presence of MnO_2, and, H_2SO_4 produce ?

(b) How will you distinguish cyclohexylamine and aniline ?

(c) What is the major product obtained by acetylation of aniline followed by nitration (conc. HNO_3 + conc. H_2SO_4) and then alkaline hydrolysis ?

or

(d) What does aniline produce in carbylamine reaction? Write chemical equation of the reaction involved.

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. What are carbohydrates ? How are they classified ?

32. Describe the kinetics of a first order reaction. Why is a first order reaction never completed?

or

What do you mean by first order reaction ? Find the expression for first order reaction.

33. Describe the general characteristics of transition elements with special reference to the following :

(i) Formation of colour salt

(ii) Variable oxidation state

or

(a) Account for the following;

1. Mn shows the highest oxidation state of +7 with oxygen but with fluorine, it shows the oxidation sate of +4.
2. Cr^{2+} is a strong reducing agent.
3. Cu^{2+} salts are coloured, while Zn^{+2} salts are white.

(b) Complete the following equations:

1. $2MnO_2 + 4KOH + O_2 \xrightarrow{\Delta}$
2. $Cr_2O_7^{2-} + 14H^+ + 6I^- \longrightarrow$

□□□□□□□

Sample Paper 17

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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. Sodium formate on heating yields

(a) Oxalic acid and H_2 (b) Sodium oxalate and H_2

(c) CO_2 and NaOH (d) Sodium oxalate

2. Blood cells retain their normal shape in solution which are:

(a) hypotonic to blood (b) isotonic to blood

(c) hypertonic to blood (d) equinormal to blood

3. The complex ion $[Co(NH_3)_6]^{3+}$ is formed by sp^3d^2 hybridisation. Hence the ion should posses.

(a) Octahedral geometry (b) Tetrahedral geometry

(c) Square planar geometry (d) Tetragonal geometry

4. The activation energy for a simple chemical reaction $A \longrightarrow B$ is E_a in forward direction. The activation energy for reverse reaction

(a) is always double of E_a (b) is negative of E_a

(c) is always less than E_a (d) can be less than or more than E_a

5. Which of the following is an insulator ?

(a) Graphite (b) Aluminium

(c) Diamond (d) Silicon

6. In a reversible reaction the energy of activation of the forward reaction is 50 kcal. The energy of activation for the reverse reaction will be :

(a) <50 kcal

(b) either greater than or less than 50 kcal

(c) 50 kcal

(d) >50 kcal

7. Oxidation of primary alcohols with chlorine yields

(a) Acyl chloride (b) Alkyl chloride

(c) Aldehyde (d) Ketone

8. Butane-2-ol is

(a) Primary alcohol (b) Secondary alcohol

(c) Tertiary alcohol (d) Aldehyde

9. Which of the following reactions will not give a primary amine ?

(a) $CH_3CONH_2 \xrightarrow{Br_2/KOH}$ (b) $CH_3CN \xrightarrow{LiAlH_4}$

(c) $CH_3NC \xrightarrow{LiAlH_4}$ (d) $CH_3CONH_2 \xrightarrow{LiAlH_4}$

10. Co-ordination compounds have great importance in biological systems. In this context which of the following statements is incorrect?

(a) Cynacobalamin is B_{12} and contains cobalt

(b) Haemoglobin is the red pigment of blood and contains irons

(c) Chrolophylls are green pigments in plants and contain calcium

(d) Carboxyperptidase $-$ A is an enzyme and contains zinc.

11. Fused NaCl on electrolysis gives ..... on cathode.

(a) chlorine (b) sodium

(c) sodium amalgam (d) hydrogen

12. Which of the following statements about vitamin B_{12} is incorrect?

(a) It has a cobalt atom

(b) It also occurs in plants

(c) It is also present in rain water

(d) It is needed for human body in very small amounts

Directions (Q. No. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Acetylene on treatment with alkaline $KMnO_4$ produces acetaldehyde.
Reason : Alkaline $KMnO_4$ is a reducing agent.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** The order of the reaction
$CH_3COOC_2H_5 + H_2O \longrightarrow CH_3COOH + C_2H_5OH$ is 1.
Reason : The molecularity of this reactions is 2.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :** The $[Ni(en)_3]Cl_2$ (en = ethylenediamine) has lower stability than $[Ni(NH_3)_6]Cl_2$.
Reason : In $[Ni(en)_3]Cl_2$ the geometry of Ni is octahedral.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion :** ROCOl, $(RCO)_2O$ and RCOOR' all react with Grignard reagents to form 3° alcohols.
Reason : RCOCl reacts with R_2Cd to form ketones but $(RCO)_2O$ and RCOOR' do not react at all.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Define solubility. Name the factors on which solubility of a solute in a solvent depends.

18. How are ethers named in IUPAC system ?

or

Explain why is –OH group in phenols more strongly held as compared too OH group in alcohols.

19. Given the standard electrode potentials $K^+/K = -2.93\ V$ $Ag^+/Ag = 0.80V$, $Hg^{2+}/Hg = 0.79\ V$, $Mg^{2+}/Mg = -2.37\ V$, $Cr^{2+}/Cr = -0.74\ V$.
Arrange these metals in their increasing order of reducing power.

20. Show that carbonyl group is meta directing group.

21. Write IUPAC names of the following:

(a) $K_2[Ni(CN)_4]$

(b) $[CoCl_2(NH_3)_4]Cl$

Continue on next page.....

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. Depict the galvanic cell in which the reaction

$2Zn(s) + 2\,Ag^{+}(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s)$

takes place, Further, show

1. Which of the electrodes is negatively charged ?
2. The carriers of the current in the cell.
3. Individual reaction at each electrode.

23. Out of ethyl bromide and ethyl chloride which has higher boiling point and why ?

24. Specify oxidation numbers of the metals in the following co-ordination compounds:

(a) $K_4[Fe(CN)_6]$

(b) $[PtCl_4]$

25. Does the presence of two chiral carbon atoms always make the molecule optically active? Explain giving an example.

26. Write a note on Haloform reaction.

27. *p*-Nitrophenol is more acidic than phenol explain why ?

or

Define fermentation. How ethanol is formed by fermentation.

28. Explain two important uses of formalin.

or

Give reasons for the following :

1. Ethyne is more acidic than ethane.
2. Lower members of aldehyde are more soluble in water.

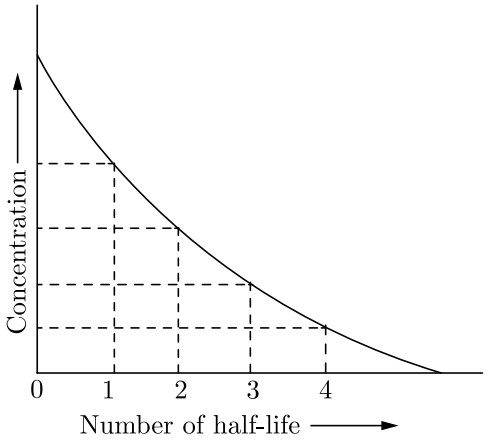
Continue on next page.....

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. The half-life of a reaction is the time required for the concentration of reactant to decrease by half, i.e.,

$$[A]_t = \frac{1}{2}[A]$$



For first order of reaction,

$$\underset{\frac{1}{2}}{t} \quad \frac{0.693}{k}$$

This means $t_{1/2}$ is independent of initial concentration. Figure shows that typical variation of concentration of reactant exhibiting first order kinetics. It may be noted that though the major portion of the first order kinetics may be over in a finite time, but the reaction will never cease as the concentration of reactant will be zero only at infinite time.
Read the above passage and answer the following questions:

(a) A first order reaction has a rate constant $k = 3.01 \times 10^{-3} s^{-1}$. How long will it take to decompose half of the reactant ?

(b) Draw the plot of $t_{1/2}$ vs initial concentration $[A]_0$ for a first order reaction.

(c) The rate constant for a first order reaction is $7.0 \times 10^{-4}\, s^{-1}$. If initial concentration of reactant is 0.080 M, what is the half life of reaction?

or

(d) The rate of a first order reaction is $0.04\, mol\, L^{-1} s^{-1}$ after 10 minutes and $0.03\, mol\, L^{-1} s^{-1}$ after 20 minutes of initiation. What is the half-life of reaction?

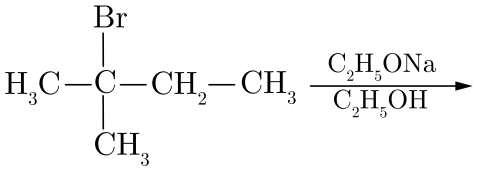
30. When haloalkanes with β-hydrogen atom are boiled with alcoholic solution of KOH, they undergo elimination of hydrogen halide resulting in the formation of alkenes. These reactions are called β-elimination reactions or dehydrohalogenation reactions. These reactions follow Saytzeff's rule. Substitution and elimination reactions often compete with each other. Mostly bases behave as nucleophiles and therefore can engage in substitution or elimination reactions depending upon the alkyl halide and the reaction conditions.
Answer the following questions :

(a) Which of the following is the correct method for synthesising methyl tert-butyl ether and why?

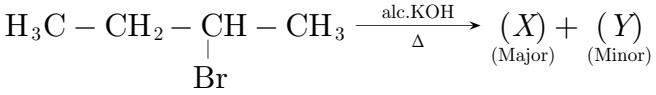
(i) $(CH_3)_3CBr + NaOCH_3 \rightarrow$

(ii) $CH_3Br + NaO - tert - butyl \rightarrow$

(b) What will be the major product in the following reaction?



(c) Consider the following reaction:



Identify (x) and (y)

or

(d) Predict all the alkenes that would be formed by dehydrohalogenation of 2,2,3-trimethyl-3-bromopentane with sodium ethoxide in ethanol ?

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. Draw the structures of α-D-glucose and β-D-glucose.

32. Define rate constant of a reaction. Derive an expression for the rate constant of 1st order reaction

or

1. Define zero order reaction.
2. Derive integrated rate equation for zero order reaction.
3. Derive an expression for half life period of a zero order reaction.

33. Describe the preparation of potassium permanganate from pyrolusite ore by electrochemical method. Discuss its important properties and uses.

or

What is lanthanoid contraction? Give its cause. What are the consequences of lanthanoid contraction?

□□□□□□□

Sample Paper 18

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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. The most durable metal plating on iron to protect against corrosion is

(a) nickel plating (b) copper plating

(c) tin plating (d) zinc plating

2. The rate of reaction between A and B increases by a factor of 100, when the concentration of A is increased 10 folds, the order of reaction with respect to A is

(a) 10 (b) 1

(c) 4 (d) 2

3. The rate of a first order reaction is 1.5×10^{-2} mol $L^{-1}min^{-1}$ at 0.5 M concentration of the reactant. The half life of the reaction is

(a) 0.383 min (b) 23.1 min

(c) 8.73 min (d) 7.53 min

4. Which one of the following ionic species will impart colour to an aqueous solution?

(a) Ti^{4+} (b) Cu^{+}

(c) Zn^{2+} (d) Cr^{3+}

5. If 96500 coulomb of electricity is passed through $CuSO_4$ solution, it will liberate :

(a) 63.5 g Cu (b) 31.76 g Cu

(c) 96500 g Cu (d) 100 g Cu

6. In which of the following conversions, phosphorous pentachloride is used as the reagent?

(a) $H_2C = CH_2 \longrightarrow CH_3CH_2Cl$ (b) $CH_3CH_2OH \longrightarrow CH_3CH_2Cl$

(c) $H_3C - O - CH_3 \longrightarrow CH_3Cl$ (d) $CH \equiv CH \longrightarrow CH_2 = CHCl$

7. Among the following, the compound that is both paramagnetic and coloured is

(a) $K_2Cr_2O_7$ (b) $(NH_4)_2(TiCl_6)$

(c) $CoSo_4$ (d) $K_3[Cu(CN)_4]$

8. Which of the following compounds does not react with $NaNO_2$ and HCl ?

(a) C_6H_5OH (b) $C_6H_5NH_2$

(c) $(CH_3)_3CNO_2$ (d) $(CH_3)_3CNO_2$

9. Ethylene reacts with Baeyer's reagent to give

(a) ethane (b) ethyl alcohol

(c) ethylene glycol (d) none

10. Which one of the following esters cannot undergo Clasien self-condensation?

(a) $CH_3 - CH_2 - CH_2 - CH_2 - COOC_2H_5$ (b) $C_6H_5COOC_2H_5$

(c) $C_6H_5CH_2COOC_2H_5$ (d) $C_6H_{11}CH_2COOC_2H_5$

11. The pyrimidine bases present in DNA are

(a) cytosine and thymine (b) cytosine and uracil

(c) cytosine and adenine (d) cytosine and guanine

12. If 0.1 M solution of glucose and 0.1 M solution of urea are placed on two sides of the semi-permeable membrane to equal heights, then it will be correct to say that:

(a) there will be no net movement across the membrane

(b) glucose will flow towards urea solution

(c) urea will flow towards glucose solution

(d) water will flow from urea solution to glucose

Directions (Q. No. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Hydroxyketones are not directly used in Grignard reaction.
Reason : Grignard reagents react with hydroxyl group.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** An ether is more volatile than an alcohol of comparable molecular mass.
Reason : Ethers are polar in nature.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :** Magnetic moment values of actinides are lesser than the theoretically predicted values.
Reason : Actinide elements are strongly paramagnetic.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion :** Protonation of a carbonyl group increases its electrophilic character.
Reason : Protonation of a carbonyl group involves addition of an electrophile on nucleophilic oxygen.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Arrange the following carbonyl compounds and nucleophilic addition-climination reaction.
Ethane, Propanal, Propanone,Butanone
butanone<Propanone<Propanal<Ethanal

18. Discuss the factors responsible for rusting of iron.

19. What are the products obtained at the platinum anode and the platinum cathode respectively in the electrolysis of fused or molten NaCl ?

20. Explain hydrogenolysis reaction of an ester.

or

How is chemical reduction of esters done ? What are the products obtained ?

21. Write and IUPAC name of the following coordination compounds:

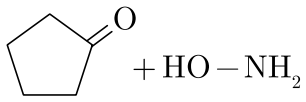
(a) $K_4[Fe(CN)_6]$ (b) $Ni(CO)_4$

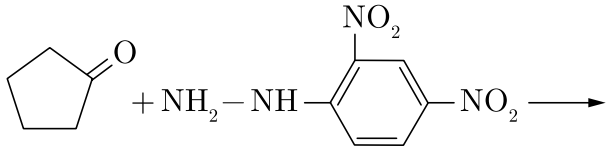
(c) $K_2[Pt(Cl)_6]$ (d) $Fe_4[Fe(CN)_6]_3$

SECTION-C

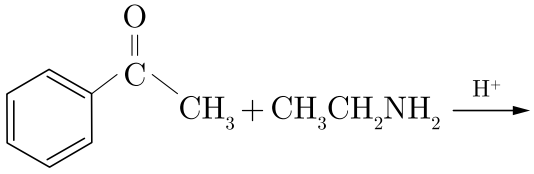
Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. Predict the products of the following reactions.

(i) 

(ii) 

(iii) $R-CH=CHCHO + NH_2-\overset{\overset{O}{\|}}{C}-NH-NH_2 \xrightarrow{H^+}$

(iv) 

23. Which aqueous solution has higher concentration : 1 molar or 1 molal solution of the same solute. Give reason.

24. How is molar conductivity of an aqueous electrolyte solution measured experimentally?

25. Write IUPAC names of the following :

(a) $[Cu(NH_3)_4]Cl_2$

(b) $K_4[Fe(CN)_6]$

26. Arrange each set of compounds in order of increasing boiling points.

(i) Bromomethane, bromoform, chloromethane, dibromomethane.

(ii) 1-Chloropropane, Isopropyl chloride, 1-chlorobutane.

27. Give important used of carboxylic acids.

or

Explain how does $-OH$ group attached to a carbon of benzene ring activate it towards electrophilic substitution?

28. Write down the electronic configuration of

1. Cr^{3+}
2. Cu^{+}
3. Co^{2+}
4. Mn^{2+}

Continue on next page.....

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. The amines are basic in nature due to the presence of a lone pair of electron on N-atom of the NH_2 group, which it can donate to electron deficient compounds. Aliphatic amines are stronger bases than NH_3 because of the $+I$ effect of the alkyl groups. Greater the number of alkyl groups attached to N-atom, higher is the electron density on it and more will be the basicity. Aniline is a weaker base compared to ammonia. This is because the lone pair of electrons on N-atom of aniline is less available for protonation due to its involvement in conjugation with the π-electrons of the benzene ring. Further the presence of electron withdrawing groups decreases the basicity while, the presence of electron donating groups activates the benzene ring and also increases the basicity.

Read the above passage and answer the following questions:

(a) $(CH_3)_2NH$ is more basic than $(CH_3)_3N$ in an aqueous solution. Give reason

(b) Arrange the following in increasing order of basic strength : $C_6H_5NH_2$,$C_6H_5NHCH_3$, $C_6H_5N(CH_3)_2$

(c)

(i) Arrange the following compounds in an increasing order of basic strength : $C_6H_5NH_2$, $C_6H_5N(CH_3)_2$, $(C_2H_5)_2NH$ and CH_3NH_2

(ii) Arrange the following compounds in a decreasing order of pK_b values.

$C_2H_5NH_2, C_6H_5NHCH_3, (C_2H_5)_2NH$, and $C_6H_5NH_2$

or

(d) Arrange the following in increasing order of basic strength : Aniline, p-nitroaniline and p -toluidine.

30. The unique behaviour of Cu, having a positive E°, accounts for its inability to liberate H_2 from acids. Only oxidising acids (nitric and hot concentrated sulphuric) react with Cu, the acids being reduced. The high energy to transform $Cu_{(s)}$ to $Cu^{2+}_{(aq)}$ is not balanced by its hydration enthalpy. The general trend towards less negative E° values across the series is related to the general increase in the sum of the first and second ionisation enthalpies. It is interesting to note that the value of E° for Mn, Ni, and Zn are more negative than expected from the trend.

The stability of the half-filled d sub-shell in Mn^{2+} and the completely filled d^{10} configuration in Zn are related to their E^- values, whereas E° for Ni is related to the highest negative $\Delta_{hyd}H^\circ$. An examination of the $E^\circ_{(M^{3+}/M^{2+})}$ values shows the varying trends. The low value for Sc reflects the stability of Sc^{3+} which has a noble gas configuration. The highest value for Zn is due to the removal of an electron from the stable d^{10} configuration of Zn^{2+}. The comparatively high value for Mn shows that $Mn^{2+}(d^5)$ is particularly stable, whereas comparatively low value for Fe shows the extra stability of $Fe^{3+}(d^5)$. The comparatively low value for V is related to the stability of V^{2+} (half-filled t_{2g} level).

Read the above passage and answer the following question :

(a) Cobalt (II) is very stable in aqueous solutions but gets easily oxidised in the presence of strong ligands.

(b) Why are $E^{\circ}_{(M^{2+}/M)}$ values of Mn and Zn more negative than expected ?

(c) Use the data to answer the following and also justify giving reasons :

	Cr	Mn	Fe	Co
$E^{\circ}_{(M^{2+}/M)}$	-0.91	-1.18	-0.44	-0.28
$E^{\circ}_{(M^{3+}/M^{2+})}$	-0.41	$+1.57$	$+0.77$	$+1.97$

(i) Which is a stronger reducing agent in aqueous medium, Cr^{2+} or Fe^{2+} and why ?

(ii) Which is the most stable ion in $+2$ oxidation state and why ?

or

(d)

	Cr	Mn	Fe	Co	Ni	Cu
$E^{\circ}_{(M^{2+}/M)}$	-0.91	-1.18	-0.44	-0.28	-0.25	$+0.34$

From the given data of E° values, answer the following questions :

(i) Why is $E^{\circ}_{\frac{M^{2+}}{Mn}}$ value highly negative as compared to other elements ?

(ii) Which is a stronger reducing agent Cr^{2+} or Fe^{2+} ? Give reason.

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. (i) What is starch?

(ii) Draw the structure of Amylose.

(iii) Draw the structure of Amylopectin.

32. Derive the integrated rate equation for a first order reaction.

or

Define threshold energy and activation energy. How are they related ?

33. Compare the chemistry of actinoids with that of lanthanoids with special reference to

1. Electronic configuration
2. Oxidation state
3. Atomic and ionic size
4. Chemical reactivity

or

What is lanthanoid contraction? What are the consequences of lanthanoid contraction?

□□□□□□□

Sample Paper 19

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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. When one Faraday of electric current is passed, the mass deposited, equal to

(a) One gram equivalent (b) One gram mole

(c) Electrochemical equivalent (d) Half gram equivalent

2. The most convenient method to protect the bottom of ship made of iron is

(a) Coating it with red lead oxide (b) White tin plating

(c) Connecting it with Mg Block (d) Connecting it with Pb block

3. Aldehydes and ketones will not form crystalline derivatives with

(a) Sodium bisulphite (b) Phenylhydrazine

(c) Semicarbazide hydrochloride (d) Dihydrogen sodium phosphate

4. Actinides;

(a) Are all synthetic elements (b) Include element 104

(c) Have any short lived isotopes (d) Have variable valency

5. $AgNO_3$ does not give precipitate with $CHCl_3$ because

(a) $CHCl_3$ does not ionise in water (b) $CHCl_3$ does not react with $AgNO_3$

(c) $CHCl_3$ is chemically inert (d) None of these

6. At 25°C, the highest osmotic pressure is exhibited by 0.1 M solution of :

(a) $CaCl_2$ (b) KCl

(c) Glucose (d) Urea

7. The bad smelling substance formed by the action of alcoholic caustic potash on chloroform and aniline is:

(a) Acetic acid (b) Acetone

(c) Methanol (d) Methylamine

8. RNA is different from DNA because RNA contains

(a) ribose sugar and thymine

(b) ribose sugar and uracil

(c) deoxyribose sugar and thymine

(d) deoxyribose sugar and uracil.

9. For a first order reaction $A \longrightarrow B$ the reaction rate at reactant concentration of 0.01 M is found to be $2.0 \times 10^{-5} \text{mol L}^{-1}\text{s}^{-1}$. The half life period of the reaction is

(a) 30 s (b) 220 s

(c) 300 s (d) 347 s

10. Correct name of $K_4[Fe(CN)_6]$ is

(a) Potassium ferricyanide

(b) Potassium ferrocyanide

(c) Potassium hexacyanoferrate (II)

(d) Potassium hexacyanoferrate (III)

11. Which of the following compounds is oxidised to prepare methyl ethyl ketone ?

(a) 2-Propanol (b) l-Butanol

(c) 2-Butanol (d) t-Butyl alcohol

12. For the reaction $A \longrightarrow B$, the rate law expression is : rate $= k[A]$. Which of the following statements is incorrect?

(a) The reaction follows first order kinetics

(b) The $t_{1/2}$ of reaction depends on initial concentration of reactants.

(c) k is constant for the reaction at a constant temperature.

(d) The rate law provides a simple way of predicting the concentration of reactants and products at any time after the start of the products at any time after the start of the reaction.

Directions (Q. No. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Isobutanal does not give iodoform test.
Reason : It does not have α-hydrogen

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** The rate of a reaction sometimes does not depend on concentrations.
Reason : Lower the activation energy faster is the reaction.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :** $[Co(NH_3)_5Br]SO_4$ gives white precipitate with barium chloride.
Reason : The complex dissociates in the solution to give Br^- and SO_4^{2-}.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion :** Nitration of benzoic acid gives m-intro-benzoic acid.
Reason : Carboxyl group increases the electron density at meta-position.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

Continue on next page.....

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Define ideal solution.

18. What are symmetrical and unsymmetrical ether ?

19. Name the two half-cell reactions that are taking place in the Daniel cell.

20. Name the following compounds according to IUPAC system of nomenclature :

1. $CH_3CH(CH_3)CH_2CH_2CHO$
2. $CH_3CH_2COCH(C_2H_5)CH_2CH_2Cl$
3. $CH_3CH = CHCHO$
4. $CH_3COCH_2COCH_3$

or

Write natural sources of formic acid, acetic acid and butyric acid.

21. Predict the geometrical shapes of all following :

(a) sp^3

(b) d^2sp^3

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. Identify the compounds A, B, C and D in the following sequence of reactions :

$$C_2H_5OH \xrightarrow[443\,K]{\text{conc. } H_2SO_4} A \xrightarrow{HBr} B \xrightarrow[443\,K]{KOH\,(aq)} C \xrightarrow{I_2,\,NaOH} D$$

23. How is a galvanic cell represented on paper as per IUPAC convention? Give one example.

24. Derive equilibrium constant from Nernst equation

25. (a) Give the IUPAC name of the complex salt $K_3[Fe(CN)_6]$.

(b) Calculate EAN (Effective Atomic Number) of Fe in this complex salt.

26. Point out the difference between :

(i) Chirality and chiral centre.

(ii) Diastereoisomers and Enantiomers.

27. Arrange the following compounds in increasing order of their reactivity toward HCN.
Acetaldehyde, Acetone, Di-tert-butyl ketone, Methyl tert-butyl ketone.

or

Explain why is ortho-nitrophenol more acidic than ortho-methoxy phenol ?

28. In a reaction, the rates of disappearance of different reactants or rates of formation of different products may not be equal but rate of reaction at any instant of time has the same value expressed in terms of any reactant or product. Further, the rate of reaction may not depend upon the stoichiometric coefficients of the balanced chemical equation. The exact powers of molar concentrations of reactants on which rate depends are found experimentally and expressed in terms of 'order of reaction: Each reaction has a characteristic rate constant depends upon temperature. The units of the rate constant depend upon the order of reaction.
Answer the following questions :

(a) The rate constant of a reaction is found to be $3 \times 10^{-3} \text{mol}^{-2}\text{L}^2\,\text{sec}^{-1}$. What is the order of the reaction?

(b) Rate of a reaction can be expressed by following rate expression, Rate $= k[A]^2[B]$, if concentration of A is increased by 3 times and concentration of B is increased by 2 times, how many times rate of reaction increases?

(c) The rate of a certain reaction is given by, rate $= k[\text{H}^+]''$. The rate increases 100 times when the pH changes from 3 to 1. What is the order (n) of the reaction ?

or

(d) In a chemical reaction $A + 2B \rightarrow$ products, when concentration of A is doubled, rate of the reaction increases 4 times and when concentration of B alone is doubled rate continues to be the same. What is the order of the reaction ?

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. The solubility of gases increases with increase of pressure. William Henry made a systematic investigation of the solubility of a gas in a liquid. According to Henry's law "the mass of a gas dissolved per unit volume of the solvent at constant temperature is directly proportional to the pressure of the gas in equilibrium with the solution".
Dalton during the same period also concluded independently that the solubility of a gas in a liquid solution depends upon the partial pressure of the gas. If we use the mole fraction of gas in the solution as a measure of its solubility, then Henry's law can be modified as "the partial

pressure of the gas in the vapour phase is directly proportional to the mole fraction of the gas in the solution."

Read the above passage and answer the following questions:

(a) What is the relation of K_H with temperature ?

(b) Write expression for Henry's law.

(c) Calculate solubility of methane in benzene at 298 K under 760 mm Hg. (Given Henry's constant $= 4.27 \times 10^5$ mm Hg) ?

or

(d) The partial pressure of ethane over a saturated solution containing 6.56×10^{-2} g of ethane is 1 bar. If the solution contains 5.00×10^{-2} g of ethane then what will be the partial pressure (in bar) of the gas ?

30. Proteins are high molecular mass complex biomolecules of amino acids. The important proteins required for our body are enzymes, hormones, antibodies, transport proteins, structural proteins, contractile proteins etc. Except for glycine, all α −amino acids have chiral carbon atom and most of them have L-configuration. The amino acids exists as dipolar ion called zwitter ion, in which a proton goes from the carboxyl group to the amino group. A large number of α -amino acids are joined by peptide bonds forming polypeptides. The peptides having very large molecular mass (more than 10,000) are called proteins. The structure of proteins is described as primary structure giving sequence of linking of amino acids; secondary structure giving manner in which polypeptide chains are arranged and folded; tertiary structure giving folding, coiling or bonding polypeptide chains producing three dimensional structures and quaternary structure giving arrangement of sub-units in an aggregate protein molecule.

Answer the following questions :

(a) What do you mean by proteins ?

(b) What is Zwitter ion ?

(c) Which type of bond is present in polypeptide? Give example ?

or

(d) Which type of bonding is present in α-helix and (β-pleated structure of proteins.

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. Define the following as related to proteins.

(i) Peptide linkage.

(ii) Primary structure.

(iii) Denaturation.

32. Define order of reaction and molecularity of reaction. Derive a general expression for specific rate constant of first order reaction.

or

Explain the effect of temperature on rate of a reaction.

33. Explain giving reasons:

1. Transition metals and many of their compounds show paramagnetic behaviour.
2. The enthalpies of atomisation of the transition metals are high.
3. The transition metals generally form coloured compounds.
4. Transition metals and their many compounds act as good catalysts.

or

Describe the preparation of potassium permanganate. How does the acidified permanganate solution react with (i) ion (II) ions (ii) SO_2 and (iii) oxalic acid? Write the ionic equations.

□□□□□□□

Sample Paper 20

Class XII 2023-24

Chemistry

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

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 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

Directions (Q. Nos. 1-16) : 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. Consider the following reaction :

$$C_6H_5NO_2 \xrightarrow{Sn/HCl} X \xrightarrow{C_6H_5COCl} Y + CHl$$

What is Y in the above reaction ?

(a) Acetanilide (b) Benzanilide

(c) Azobenzene (d) Hydrazobenzene

2. An industrial method of preparation of methanol is :

(a) catalytic reduction of carbon monoxide in presence of $ZnO - Cr_2O_3$

(b) by reacting methane with steam at $900^\circ C$ with a nickel catalyst

(c) by reducing formaldehyde with lithium aluminium hydride

(d) by reacting formaldehyde with aqueous sodium hydroxide solution

3. Which does not react with I_2 and NaOH.

(a) Ethyl Alcohol (b) Acetaldehyde

(c) Acetone (d) Propanol

4. The preparation of ethyl acetoacetate involves.

(a) Witting reaction (b) Cannizzaro's reaction

(c) Reformatsky reaction (d) Claisen condensation

5. An aqueous solution is 1.00 molal in KI. Which change will cause the vapour pressure of the solution to increase ?

(a) Addition of NaCl
(b) Addition of Na_2SO_4
(c) Addition of 1.00 molal KI
(d) Addition of water

6. Which of the following will show paramagnetism corresponding to 2 unpaired electrons ? (Atomic numbers : Ni=28, Fe=26)

(a) $[FeF_6]^{3-}$
(b) $[NiCl_4]^{2-}$
(c) $[Fe(CN)_6]^{3-}$
(d) $[Ni(CN)_4]^{2-}$

7. The fuel used in the cell used in Apollo mission was.

(a) H_2
(b) $H_2 - O_2$
(c) CH_4
(d) O_2

8. For the reaction :

$[N_2O_5(g) \longrightarrow 2NO_2(g) + \frac{1}{2}O_2(g)]$ the value of rate of disappearance of N_2O_5 is given as $6.25 \times 10^{-3} \text{mol L}^{-1}\text{s}^{-1}$. The rate of formation of NO_2 and O_2 is given respectively as

(a) 6.25×10^{-3} mol $L^{-1}s^{-1}$ and 6.25×10^{-3} mol $L^{-1}s^{-1}$
(b) 1.25×10^{-2} mol $L^{-1}s^{-1}$ and 3.125×10^{-3} mol $L^{-1}s^{-1}$
(c) 6.25×10^{-3} mol $L^{-1}s^{-1}$ and 3.125×10^{-3} mol $L^{-1}s^{-1}$
(d) 1.25×10^{-2} mol $L^{-1}s^{-1}$ and 6.25×10^{-3} mol $L^{-1}s^{-1}$

9. General electronic configuration of lanthanides is :

(a) $(n-2)f^{1-14}(n-1)s^2p^6d^{10}ns^2$
(b) $(n-2)f^{10-14}(n-1)d^{0-1}ns^2$
(c) $(n-2)f^{0-14}(n-1)d^{10}ns^2$
(d) $(n-2)d^{0-1}(n-1)f^{1-14}ns^2$

10. Kohlrausch's law states that at :

(a) finite dilution, each ion makes definite contribution to equivalent conductance of an electrolyte, whatever be the nature of the other ion of the electrolyte.
(b) infinite dilution each ion makes definite contribution to equivalent conductance of an electrolyte depending on the nature of the other ion of the electrolyte.
(c) infinite dilution, each ion makes definite contribution to conductance of an electrolyte whatever be the nature of the other ion of the electrolyte.
(d) infinite dilution, each ion makes definite contribution to equivalent conductance of an electrolyte, whatever be the nature of the other ion of the electrolyte.

11. The change in optical rotation (with time) of freshly prepared solutions of sugar is known as :

(a) Specific rotation
(b) Inversion
(c) Rotatory motion
(d) Mutarotation

12. When a biochemical reaction is carried out in laboratory in the absence of enzyme then rate of reaction obtained 10^{-6} times, then activation energy of reaction in the presence of enzyme is :

(a) $\frac{6}{RT}$ (b) different from E_a obtained in laboratory

(c) P is required (d) can't say anything

Directions (Q. No. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** The pK_a of acetic acid is lower than that of phenol.
Reason : Phenoxide ion is more resonance stabilised.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** The acetate ion is resonance stabilized.
Reason : Acetate ion is more basic than the methoxide ion.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :** Aromatic aldehydes and formaldehyde undergo Cannizzaro reaction.
Reason : These aldehydes which have α-H atom undergo Cannizzaro reaction.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion :** In acidic medium, $K_2Cr_2O_7$ exists as $Cr_2O_7^{2-}$ (orange) while in basic medium it is converted to CrO_4^{2-} (yellow).
Reason : $K_2Cr_2O_7$ is hygroscopic in nature and changes colour on reaction with water.

(a) Both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not the a correct explanation of the Assertion.

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Which out of molarity or molality will change in temperature why ?

18. Suggest some chemical reagents for the chemical reduction of carbonyl compounds ($\equiv$ aldehydes and ketones).

19. Write the Nernst equation for the EMF of the cell
$Ni_{(s)} \mid Ni^{2+}_{(aq)} \parallel Ag^{2+}_{(aq)} \mid Ag$

20. Write the reaction of formaldehyde with ammonia.

or

How will you convert ?

1. $CH_3COOH \longrightarrow CH_3 - CH_3$
2. $CH_3COOH \longrightarrow CH_3 - CH_2 - OH$
3. $C_6H_5COOH - C_6H_4 - Br - COOH$

21. Write the cell reaction for which $E_{cell} = E^0_{cell} - \dfrac{RT}{2F} \ln \dfrac{[Mg^{2+}]}{[Ag^{+}]^2}$

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. Complete the following reactions :

1. $CH_3 - O - C_2H_5 + HI \xrightarrow{373\,K}$
2. $C_6H_5ONa + CH_3Br \xrightarrow{\Delta}$
3. $CH_3 - O - CH_2CH_3 + HBr \xrightarrow{373\,K}$

23. How is standard Gibbs energy of a reaction is related to its equilibrium constant ?

24. What is a racemic mixture ? Give one example.

25. Discuss the following terms :

(a) Coordination Number.

(b) Effective Atomic Number.

26. Which would undergo S_N1 reaction faster in the following pair and why ?

$$CH_3-CH_2-Br \text{ and } H_3C-\underset{\displaystyle Br}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH_3$$

27. How substituents effect the acidity of carboxylic acids ?

28. How can one reduce carboxylic acid to alcohol?

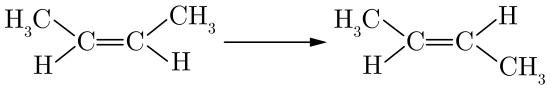
or

How carboxylic acids are commercially converted into alcohols ?

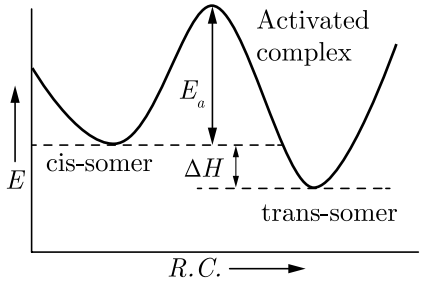
SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. A reaction is said to be unimolecular if, on the microscopic level, rearrangement of the structure of a single molecule produces the appropriate product molecules. An example of a unimolecular process is conversion of cis-2-butene to trans-2-butene (in the absence of any catalyst).



All that is required for this reaction to occur is a twist or rotation around the double bond interchanging the methyl group with the hydrogen atom on the right-hand side. Only one cis-2-butene molecule need to be involved as a reactant in this process. Rotating part of a molecule about a double bond is not easy, because it involves a distortion of the electron clouds forming the double bond. A considerable increase in energy is required to twist one end of cis-2-butene around the other. This is shown in figure.



The minimum quantity of energy required to surmount an energy barrier during a chemical reaction is called the activation energy, E_a and the molecular species at the top of the barrier is called the activated complex or transition state.

In the sample of gaseous cls-2-butene at room temperature, only a tiny fraction of molecules have enough energy to surmount the activation energy barrier. Not only do few molecules have enough energy to overcome the activation energy barrier, but fewer still have that energy concentrated so that it can cause the atomic movements needed for the reaction to occur. For a uni-molecular process, the reaction rate must always be directly proportional to the concentration of the reacting species. For a general uni-molecular process, $A \rightarrow$ products, the rate equation is, Rate $= k[A]$, where $[A]$ =concentration of A.

Read the above passage and answer the following questions:

(a) With the help of diagram, explain the physical significance of energy of activation (E_a) in chemical reactions.

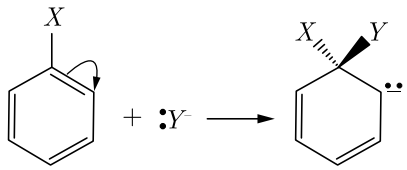
(b) Can molecularity of a reaction be zero ?

(c) Over a given period of time only a very small fraction of cis-2-butene molecule will be converted to trans-2-bttene. Give reason.

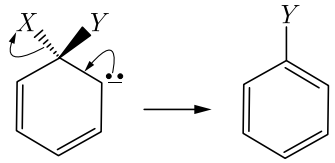
or

(d) How is the rate of reaction affected if the concentration of cis-2-butene is doubled ?

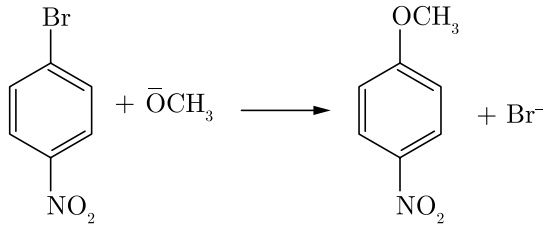
30. The simple aryl halides generally are resistant to attack by nucleophiles in either S_N1 or S_N2 reactions. However, this low reactivity can be changed dramatically by changes in the reaction conditions and the structure of the aryl halide. In fact, nuclephilic displacement becomes quite rapid.(i) when the aryl halide is activated by substitution with strongly electron attracting groups such as NO_2 and (ii) when very strongly basic nucleophilic reagents are used. The generally accepted mechanism of nucleophilic aromatic substitution of aryl halides carrying activating groups involve two steps. The first step involves attack of the nucleophile Y at the carbon bearing halogen substitutent to form an intermediate carbanion. The aromatic system is destroyed on forming the anion and the carbon at the reaction site changes from planar (sp^2 bonds) to tetrahedral (sp^3 bonds).

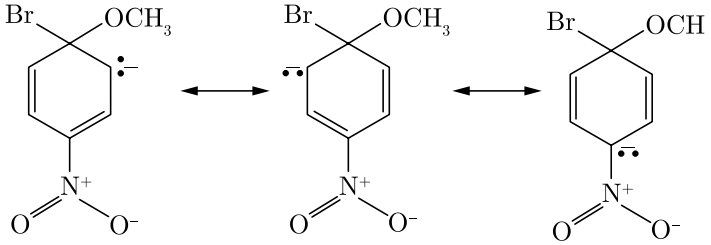


In the second step, loss of an anion, X^- or Y^-, regenerated an aromatic system and if X^- is lost, the overall reaction is nucleophilic displacement of X by Y



When strongly electron attracting groups are located on the ring at the ortho-parapositions, the intermediate anion is stabilised by the delocalization of the electrons from the ring carbons to more favourable locations on the substituent groups.





Read the above passage carefully and answer the following questions :

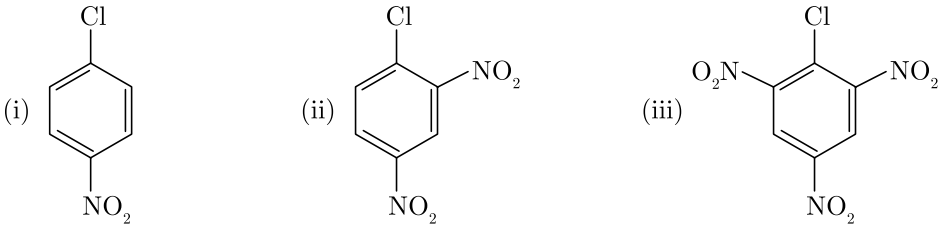
(a) Chlorobenzene is extremely less reactive towards a nucleophilic substitution reaction. Give two reasons for the same.

(b) Write the product formed when *p*-nitrochlorobenzene is heated with aqueous NaOH at 443 K followed by acidification.

(c) Why NO_2, group shows its effect only at ortho and para-positions and not at meta-position?

or

(d) Aryl halides are extremely less reactive towards nucleophilic substitution. Predict and explain the order of reactivity of the following compounds towards nucleophilic substitution :



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SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. Derive the Arrhenius equation.

or

Briefly explain the effect of adding catalyst on the rate of reaction.

32. (a) In the titration of $FeSO_4$ with $KMnO_4$ in the acidic medium, why is dil. H_2SO_4 used instead of dil. HCl ?

(b) Give reason :

1. Among transition metals, the highest oxidation states is exhibited on oxo-anions of a metal.
2. Ce^+ is used as an oxidising agent in volumetric analysis.
3. Transition metals form a number of interstitial compounds.
4. Zn^{2+} salts are white while Cu^{2+} salts are blue.

or

(a) A blackish brown coloured solid 'A' when fused with alkali metal hydroxides in presence of air produces a dark green coloured compound 'B' which an electrolytic oxidation in alkaline medium gives a dark purple coloured compound 'C'. Identify A, B and C and write the reactions involved.

(b) What happens when an acidic solution of the green compound (B) is allowed to stand for sometime ? Give the equation involved. What is this type of reaction called ?

33. Amino acids may be acidic, alkaline or neutral. How does this happen ?

□□□□□□□