DAV PUBLIC SCHOOL, MCL, KALINGA AREA

PRACTICE PAPER - 02

CHEMISTRY

Time : **3 hrs**

Max. Marks : **70**

Instructions

1. There are 33 questions in this question paper. All questions are compulsory.
2. **Section A :** Q. no. 1-2 are case-based questions having four MCQs or Assertion-Reason type based on given passage each carrying 1 mark and Question 3 to 16 are MCQs and Assertion-Reason type questions carrying 1 mark each.
3. **Section B :** Q. no. 17 to 25 are short answer type I questions and carry 2 marks each.
4. **Section C :** Q. no. 26 to 30 are short answer type II questions and carry 3 marks each.
5. **Section D :** Q. no. 31 to 33 are long answer questions carrying 5 marks each.
6. There is no overall choice. However, an internal choices have been provided.
7. Use of calculators and log tables is not permitted.

SECTION A : *Objective Questions* (1 Marks)

Passage Based Questions

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

The state of the substance in which dispersed phase (solute) and dispersion medium (solvent) floats with each other is called **colloidal state**.

Depending on the size of particles of the dispersed phase, colloids are classified as multimolecular, macromolecular and associated colloids. Associated colloids are very important in our day-to-day life.

There are some substances which at low concentrations behave as normal strong electrolytes, but at higher concentrations exhibit colloidal behaviour due to the formation of aggregates. The aggregated particles thus formed are called **micelles**. These are also known as associated colloids.

The formation of micelles takes place only above a particular temperature called **Kraft temperature** (T_K) and above a particular concentration called **Critical Micelle Concentration** (CMC). On dilution, these colloids revert back to individual ions. Surface active agents such as soaps and synthetic detergents belong to this class. For soaps, the CMC is 10^{-4} to 10^{-3} mol L^{-1}. These colloids have both lyophobic and lyophilic parts. Micelles may contain as many as 100 molecules more.

Taking an example of soap solution in which soap is sodium salt of higher fatty acid and may be represented $RCOO^-Na^+$ (e.g. sodium stearate $CH_3(CH_2)_{16}COO^-Na^+$ or sodium palmitate $CH_3(CH_2)_{14}COO^-Na^+$). When soap is dissolved in water, it dissociates into $RCOO^-$ and Na^+ ions. The $RCOO^-$ ions consist of two parts hydrocarbon chain R (non-polar tail) which is hydrophobic (water-repelling), and a polar group COO^- (polar ionic) which is hydrophilic (water-loving).

The following questions are multiple choice questions. Choose the most appropriate answer.

(i) A large number of atoms or molecules of a substance aggregate together to form species having size in the colloidal range, these species are called
   (a) multimolecular colloids
   (b) macromolecular colloids
   (c) solid sol
   (d) emulsion

(ii) Gold sols and sulphur sols are the examples of
   (a) multimolecular colloids
   (b) macromolecular colloids
   (c) associated colloids
   (d) All of the above

(iii) Which of the following colloids resemble to the true solutions?
   (a) Micelles
   (b) Macromolecular colloids
   (c) Lyophobic colloids
   (d) All of the above

Or The formation of micelles takes place above the particular range of temperature termed as
   (a) critical temperature (b) Kraft temperature
   (c) CMC   (d) boiling point

(iv) Soaps and synthetic detergents belong to the class of
   (a) macromolecular colloids
   (b) associated colloids
   (c) multimolecular colloids
   (d) Both (b) and (c)

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

The spontaneous flow of solvent molecules from solvent side to solution side or from a region of lower concentration to a region of higher concentration through a semipermeable membrane is called osmosis. It is different from that of diffussion, where the movement is in reverse direction. The minimum pressure that has to be exerted/applied on the solution to prevent the entry of solvent into solution through semipermeable membrane is called Osmotic pressure.

This concept is used in desalination of sea water. The growth of plants depends mainly on the phenomenon of osmosis. Two solutions having same osmotic pressure are called isotonic. Osmotic pressure is a colligative property. Molecular mass of a solute can be determined from the osmotic pressure measurements. Osmotic pressure is represented by π. Also $\pi V = nRT$. When there are two solutions and if one of the solutions is of lower osmotic pressure, it s called hypotonic and the other is called hypertonic with respect to other the osmotic pressure can be experimentally measured by using Berkeley Heartley method.

In these questions (i-iv) a statement of Assertion followed by a statement of Reason is given. Choose the correct answer out of the following choices :
   (a) Assertion and Reason both are correct statements and Reason is correct explanation for Assertion.
   (b) Assertion and Reason both are correct statements but Reason is not correct explanation for Assertion.
   (c) Assertion is correct statement but Reason is incorrect statement.
   (d) Assertion is incorrect statement but Reason is correct statement.

(i) **Assertion** Osmosis is one sided movement solvent molecules.
   Reason In osmosis the net movement of solvent particles from lower concentration towards higher concentration takes place through semipermeable membrane.

(ii) **Assertion** For isotonic solution, $C_1 = C_2$.
   Reason For isotonic solution, $\pi_1 = \pi_2$.

(iii) **Assertion** Osmotic pressure of non-aqueous solutions can be determined by Berkeley Heartley method.

Reason The semipermeable membrane used in Berkeley Hartley method is $Cu_2[Fe(CN)_6]$.

(iv) **Assertion** If red blood cells are removed from the body and placed in pure water pressure inside the cell increases.

Reason The concentration of salt content in the cell increases.

Or **Assertion** Out of various colligative properties, osmotic pressure is used for determination of molecular masses of polymers.

Reason Polymers solutions do not posses a constant boiling point or freezing point.

Multiple Choice Questions

Following questions (No. 3-11) are multiple choice questions carrying 1 mark each :

3. According to IUPAC nomenclature, sodium nitroprusside is named as
(a) sodium pentacyanonitrosyl ferrate (II)
(b) sodium pentacyanonitrosyl ferrate (III)
(c) sodium nitroferricyanide
(d) sodium nitroferrocyanide

4. The cell constant of a conductivity cell
(a) changes with change of electrolyte
(b) changes with change of concentration of electrolyte
(c) changes with temperature of electrolyte
(d) remains constant for a cell

5. The type of solids which are electricity conductions and malleable are
(a) ionic solids   (b) molecular solids
(c) metallic solids   (d) amorphous solids

Or Sodium chloride can be prepared by heating sodium in the atmosphere of chlorine, which is yellow in colour. The cause of yollow colour is
(a) presence of Na^+ ions in the crystal lattice
(b) presence of Cl^- ions in the crystal lattice
(c) presence of e^- in the crystal lattice
(d) presence of face centred cubic lattice

6. When a solution of formaldehyde and KOH is heated, it will give
(a) acetylene and methane
(b) methanol and potassium formate
(c) methanol and methane
(d) methanol and acetylene

7. Which amino acid has phenolic —OH group as it backbone?
(a) Glycine   (b) Leucine
(c) Serine   (d) Tyrosine

8. The process used converting a precipitate into colloidal sol by shaking it with dispersion medium in the presence of a small amount of electrolyte is called
(a) coagulation   (b) peptisation
(c) emulsification   (d) precipitation

Or

Which of the following is most effective in the coagulation of an arsenic sulphide solution?
(a) K^+ (b) Mg^{2+}
(c) Al^{3+} (d) CN^-

9. Which one of the following gases has the lowest value of Henry's law constant?
(a) N_2 (b) He
(c) CO_2 (d) O_2

10. Replacement of Cl from chlorobenzene to give phenol requires drastic conditions but chlorine of 2, 4-dinitrochlorobenzene is readily replaced because
(a) NO_2 makes ring electron rich at ortho and para position
(b) NO_2 withdraws electrons from meta position
(c) NO_2 donates electron to meta position
(d) NO_2 withdraws electrons from ortho and para positions

Or

Chlorobenzene is
(a) less reactive than benzyl chloride
(b) more reactive than ethyl bromide
(c) nearly same reactive as that of methyl chloride
(d) more reactive than isopropyl chloride

11. Morphine an alkaloid is
(a) anaesthetic agent   (b) analgesics
(c) antibiotics   (d) antihistamine

Or The cationic detergent that is used in hair conditioners
(a) sodium dodecyl benzene sulphonate
(b) sodium lauryl sulphate
(c) cetyl trimethyl ammonium bromide
(d) sodium stearyl sulphate

Assertion-Reason

In the following questions (Q.No. 12-16) a statement of Assertion followed by a statement of Reason is given. Choose the correct answer out of the following choices.

(a) Assertion and Reason both are correct statements and Reason is correct explanation for Assertion.

(b) Assertion and Reason both are correct statements but Reason is not correct explanation for Assertion.

(c) Assertion is correct statement but Reason is incorrect statement.

(d) Assertion is incorrect statement but Reason is correct statement.

12. **Assertion** Glucose and fructose are reducing sugars.

    Reason Glucose and fructose contain a free aldehydic and ketonic group adjacent to a >CHOH group respectively.

13. **Assertion** Addition of HCN to carbonyl compounds gives cyanohydrins.

    Reason Pure HCN reacts with aldehydes and ketones.

14. **Assertion** 2-chloro-3-methylbutane on treatment with alcoholic potash gives 2-methyl but-2-ene as major product.

    Reason Above reaction occurs according to Saytzeff rule.

15. **Assertion** Cl_2 gas bleaches the articles permanently.

    Reason Cl_2 is a strong reducing agent.

16. **Assertion** The reaction,
    $$H_2 + Br_2 \longrightarrow 2HBr$$
    has molecularity of two.
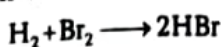
   **Reason** Order of the given reaction is 2.

    Or Assertion In the reaction,
    $N_2 + 3H_2 \longrightarrow 2NH_3$, the rate of reaction is different in terms of N_2, H_2 and NH_3.

    Reason Rate of reaction is equal to the rate of disappearance of formation divided by the stoichiometric coefficient.
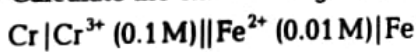
SECTION B : Short Answer Type I Questions (2 Marks)

17. Arrange the following compounds in the increasing order of dipole moment. Give reason.

    $CH_3CH_2CH_3, CH_3CH_2NH_2, CH_3CH_2OH$
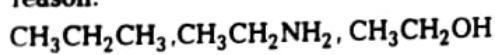
18. ClF_3 molecule has a T-shaped structure and not a trigonal planar one. Explain.

19. Calculate the emf for the given cell at 25°C

    $Cr|Cr^{3+} (0.1 M)||Fe^{2+} (0.01 M)|Fe$

    [Given, $E^\circ_{Cr^{3+}/Cr} = -0.74 V$

    $E^\circ_{Fe^{2+}/Fe} = -0.44 V$]

20. What will be the correct order for the wavelength of absorption in the visible region for the following?

    $[Ni(NO_2)_6]^{4-}, [Ni(NH_3)_6]^{2+}, [Ni(H_2O)_6]^{2+}$
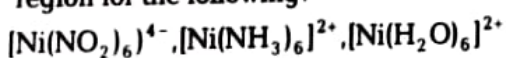
    Or

    A coordination compound $CoCl_3 \cdot 4H_2O$ precipitates silver chloride when treated with silver nitrate. This compound dissociates into two ions in solution. Write the structural formula of the compound and name it.

21. Give reason for the following :

    (i) Physisorption decreases with increase of temperature.

    (ii) Ester hydrolysis slow in the beginning and becomes fast after sometime.

22. Write the equations involved in the Williamson's ether synthesis of tertiary butyl methyl ether.

    Or

    Why is the reactivity of all the three classes of alcohols with conc. HCl and $ZnCl_2$ (Lucas reagent) different?

23. What happens, when NH_4OH solution is added dropwise to copper sulphate solution till excess?

    Or $KMnO_4$ is a strong oxidising agent in acidic medium. To provide acidic medium H_2SO_4 is used instead of HCl. Why?

24. (i) The value of Λ° for HCl, KCl and CH_3COOK are 425.1, 121.3 and $94.0\Omega^{-1}cm^2mol^{-1}$ respectively. Calculate Λ° for acetic acid (CH_3COOH

(ii) How many coulombs of charge are required for the reduction of 1 mole of Cu^{2+} to Cu?
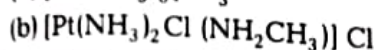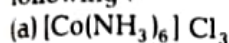
25. Calculate molality and molarity of KI if the density of 20% (mass/mass) aq. KI is 1.202 g mL^{-1}.

SECTION C : Short Answer Type II Questions (3 Marks)

26. Account for the following :
   (i) Fluorine forms only one oxoacid, HOF.
   (ii) Two O—O bond lengths in ozone molecule are equal.
   (iii) SF_6 is inert towards hydrolysis.

27. (i) Write the systematic names of the following :
   (a) $[Co(NH_3)_6] Cl_3$
   (b) $[Pt(NH_3)_2 Cl (NH_2CH_3)] Cl$
   (ii) Write the formula of the following compounds:
   (a) Sodium hexanitrito-N-cobaltate (III)
   (b) Tetraaquadichlorochromium (III) chloride
   (iii) Calculate the oxidation state of Cu in $[Cu(NH_3)_4] SO_4$.

Or Explain, why $[Co(NH_3)_6]^{3+}$ is an inner orbital complex whereas $[Ni(NH_3)_6]^{2+}$ is an outer orbital complex.

28. An element with molar mass 27 g mol^{-1} forms a cubic unit cell with edge length 4.05×10^{-8} cm. If its density is 2.7 g cm^{-3}, what is the nature of the cubic unit cell?

29. (i) Complete the following chemical equation
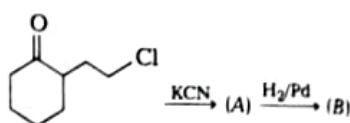 $CH_3NH_2 + CH_3COCl \longrightarrow$ ...... + ...

(ii) What happens, when
   (a) ethylamine reacts with Grignard reagent?
   (b) aniline reacts with HNO_2 and HCl at temperature 273-278 K.

Or

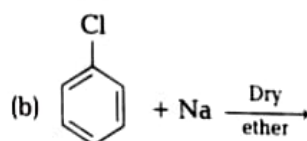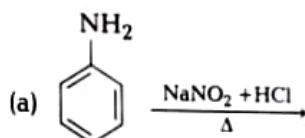(i) Write the structure of A and B in the following reaction.

$\xrightarrow{KCN}$ (A) $\xrightarrow{H_2/Pd}$ (B)

(ii) Convert the following :
   (a) Nitrobenzene to benzoic acid
   (b) Aniline to benzyl alcohol

30. (i) Complete the following reactions:

(a)

$\xrightarrow[\Delta]{NaNO_2 + HCl}$

(b)

+ Na $\xrightarrow[ether]{Dry}$

(ii) How is chlorobenzene halogenate in presence of halogen carrier? Write related equation.

SECTION D : Long Answer Type Questions (5 Marks)

31. (i) How is the variability in oxidation states of transition metals different from that of the non-transition metals ? Illustrate with examples.

   (ii) Give reason for the following :
   (a) It is difficult to separate Zr and Hf.
   (b) Fe^{3+} is more stable than Fe^{2+}.

Or (i) To what extent do the electronic configuration decide the stability of

oxidation states in the first series of the transition elements? Illustrate your answer with examples.

(ii) Explain the following trends in the properties of the members of 3d series.
   (a) Cu^+ ion is not stable in aqueous solution.
   (b) Mn exhibit maximum number of oxidation states.

32. For the reaction,

$$2NO(g) + Cl_2(g) \longrightarrow 2NOCl(g)$$
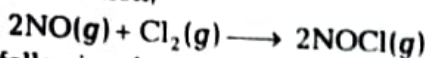
The following data were collected at 270 K.

Exp. No.	Initial [NO] mol L^{-1}	Initial [Cl$_2$] mol L^{-1}	Initial rate of disappearance of Cl$_2$ (mol/min)
1	0 15	0 15	0 60
2.	0 15	0 30	1 20
3	0 30	0 15	2 40
4	0 25	0 25	x

(i) Write expression for rate law.

(ii) Calculate rate constant and write its unit.

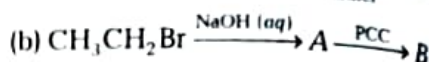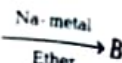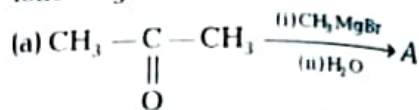(iii) Find initial rate of disappearance of Cl_2 in experiment number (4).

Or

(i) Mention the factors that affect the rate of a chemical reaction.

(ii) A reaction is of second order with respect to a reactant. How is the rate of reaction affected, if the concentration of the reactant is

(a) doubled?   (b) reduced to half?

(iii) What is the effect of temperature on the rate constant of a reaction?

33. (i) How will you convert the following :

(a) Acetophenone to benzoic acid.

(b) Ethyl cyanide to ethanoic acid.

(c) Benzoic acid to benzaldehyde.

(ii) Write the structures of A and B are the following.

(a) $CH_3 - \underset{\underset{O}{\|}}{C} - CH_3 \xrightarrow[\text{(ii)}H_2O]{\text{(i)}CH_3MgBr} A$

$\xrightarrow[\text{Ether}]{\text{Na-metal}} B$

(b) $CH_3CH_2Br \xrightarrow{\text{NaOH (aq)}} A \xrightarrow{\text{PCC}} B$

Or

A ketone $A(CH_2H_8O)$ which undergoes a haloform reaction gives compound B on reduction, heating with sulphuric acid gives a compound C which forms mono-ozonide D. D on hydrolysis with zinc dust gives only E. Identify A, B, C, D and E write the reactions involved.

How does compound A gives iodoform reaction?