DAV PUBLIC SCHOOL, MCL,KALINGA AREA

PRACTICE PAPER - 03

CHEMISTRY

Max. Marks : **70**

Time : **3 hrs**

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 Mark)*

Passage Based Questions

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

The phenomenon of the flows of solvent through a semipermeable membrane from pure solvent to the solution is known as osmosis. Semipermeable membranes can be of animal or vegetable origin and these occur naturally such a pig's bladder or parchment or can be synthetic such as cellophane.

If the osmosis takes place between the solutions of different concentration, then solvent molecules will move from the solution of low solute concentration to that of higher solute concentration. The flow will continue till the equilibrium in attained.

The osmotic pressure of a solution is the excess pressure that must be applied to a solution to prevent osmosis, i.e. to stop the passage of solvent molecules through a semipermeable membrane into the solution. It is shown in figure. It is a colligative property as it depends on the number of solute molecules and not on their nature.

Osmotic pressure is proportional to the molarity (C) of the solution at a given temperature T.

Thus, $\Pi \propto C, \pi = CRT$

The osmotic pressure π depends on the molar concentration of the solution ($\pi = CRT$). If two solutions are of equal solute concentration and, hence, have the same osmotic pressure.

They are said to be **isotonic**. If two solutions are of unequal osmotic pressures, the more concentrated solutions is said to be **hypertonic** and the more diluted solution is described as **hypotonic**.

The following questions (i-iv) are multiple choice questions. Choose the most appropriate answer :

(i) At a given temperature, osmotic pressure of the concentrated solution of a substance
  (a) is higher than that of the dilute solution
  (b) is lower than that of the dilute solution
  (c) is same as that of the dilute solution
  (d) cannot be compared with osmotic pressure of dilute solution

(ii) 0.1 M NaCl and 0.005 M $BaCl_2$ solutions are separated by a semipermeable membrane in a container. For this system, choose the correct answer.
  (a) There is no movement of any solution across the membrane
  (b) Water flows from $BaCl_2$ solution to NaCl solution
  (c) Water flows from NaCl solution to $BaCl_2$ solution
  (d) Osmotic pressure of 0.1 M NaCl is lower than that of $BaCl_2$ (assume complete dissociation)

(iii) The osmotic pressure of 0.2 molar solution of urea at 27°C ($R = 0.082$ L atm mol^{-1} K^{-1}) is
  (a) 4.92 atm
  (b) 1 atm
  (c) 0.2 atm
  (d) 27 atm

(iv) A 6% solution of urea is isotonic with
  (a) 0.05 M solution of glucose
  (b) 6% solution of glucose
  (c) 25% solution of glucose
  (d) 1 M solution of glucose

Or

Solutions A, B, C and D are respectively 0.1 M glucose, 0.05 M NaCl, 0.05 M $BaCl_2$ and 0.1 M $AlCl_3$. Which one of the following pairs is isotonic?
(a) A and B
(b) B and C
(c) A and D
(d) A and C

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

Amines are basic because they possess a pair of unshared electrons, which they can share with other atoms. These unshared electrons create an electron density around the nitrogen atom. The greater the electron density, the more basic is the molecule. Groups that donate or supply electrons will increase the basicity of amines while groups that decrease the electron density around the nitrogen decrease the basicity of the molecule.
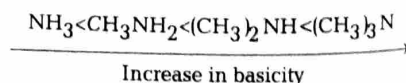
Due to this property of the alkyl group attached to the nitrogen of the amine, the electron density around the nitrogen atom increases due to which its electron releasing ability increases. Due to the greater and easier release of electrons in the alkyl amine, the molecule becomes more basic than ammonia.

Whereas in ammonia, no such releasing group is attached. So, obviously the basicity of ammonia is much less than that of an alkyl amine.
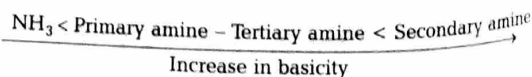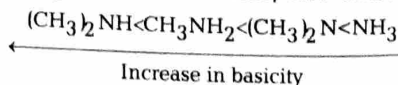
Lone pair of electrons →

R → N—H

Alkyl group in an electron releasing group
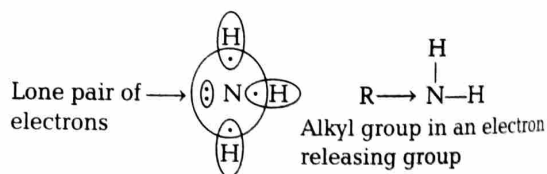
The basicity amine in the gras phase and aqueous solutions are varies.

(a) In the gas phase, the order of base strength is given below :

$$NH_3 < CH_3NH_2 < (CH_3)_2 NH < (CH_3)_3 N$$
Increase in basicity →

(b) In aqueous solutions, the order of basicity
$$(CH_3)_2 NH < CH_3NH_2 < (CH_3)_2 N < NH_3$$
← Increase in basicity

NH_3 < Primary amine – Tertiary amine < Secondary amine →
Increase in basicity

The differences in the basicity order in the gas phase and aqueous solutions are the result of solvation effects.

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 wrong statement.

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

(i) **Assertion** Order of basicity of amines in gaseous phase is $NH_3 >$ primary amine $>$ secondary amine $>$ tertiary amine.

Reason In gaseous phase, the basic nature of aliphatic amine increases with the increase in number of alkyl groups.

(ii) **Assertion** Aliphatic amines are weaker bases than ammonia and aromatic amines are stronger bases than ammonia.

Reason $+I$-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.

(iii) **Assertion** $MeNH_2$ is the weaker base than MeOH.

Reason N is less electronegative than O, lone pair of electrons on N is more easily available for the donation in $MeNH_2$.

(iv) **Assertion** Aniline is a weaker base than cyclohexyl amine.

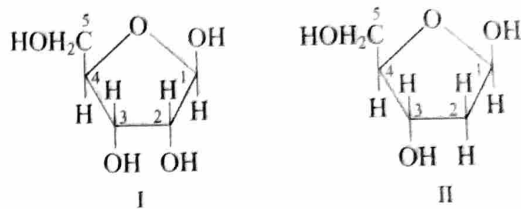**Reason** Aniline undergoes halogenation even in absence of a catalyst.

Or

Assertion Ammonia is less basic than water.

Reason Nitrogen is less electronegative than oxygen.

Multiple Choice Questions

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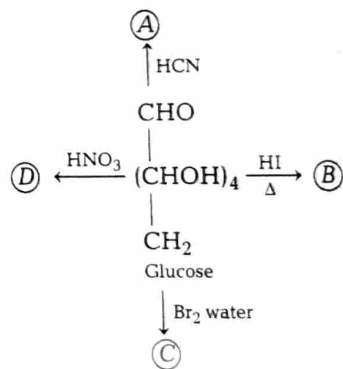
3. Consider the following structures

Identify structure I and II and choose the correct option.

	I	II
(a)	β-D-ribose	β-D-2-deoxyribose
(b)	α-D-ribose	β-D-3-deoxyribose
(c)	β-D-deoxyribose	β-D-ribose
(d)	β-D-deoxyribose	α-D-ribose

Or

Consider the following reaction,

Here, A, B, C and D respectively are

(a) n-hexane, gluconic acid, glucose cyanohydrin, saccharic acid

(b) glucose cyanohydrin, n-hexane, gluconic acid, saccharic acid.

(c) saccharic acid, glucose cyanohydrin, n-hexane, gluconic acid.

(d) n-hexane, gluconic acid, saccharic acid and glucose cyanohydrin.

4. Some reactions alongwith the units of their rate constants are given below :

| S.No	Reaction	Unit of rate constant
1.	$SO_2Cl_2 \longrightarrow SO_2 + Cl_2$	s^{-1}
2.	$NO + O_3 \longrightarrow NO_2 + O_2$	$L\,mol^{-1}s^{-1}$
3.	$2NO + Cl_2 \longrightarrow 2NOCl$	$L^2\,mol^{-2}s^{-1}$

Which of the following represents a third order reaction ?

(a) $SO_2Cl_2 \longrightarrow SO_2 + Cl_2$

(b) $NO + O_3 \longrightarrow NO_2 + O_2$

(c) $2NO + Cl_2 \longrightarrow 2NOCl$

(d) None of the above

5. Which one of the following is reduced with Zn and HCl to give corresponding hydrocarbon?

(a) Ethyl acetate   (b) Butan-2-one

(c) Acetic acid   (d) Acetamide

6. In which of the following structure unit cell shows the triclinic structure?

(a)   (b)

(c)   (d)
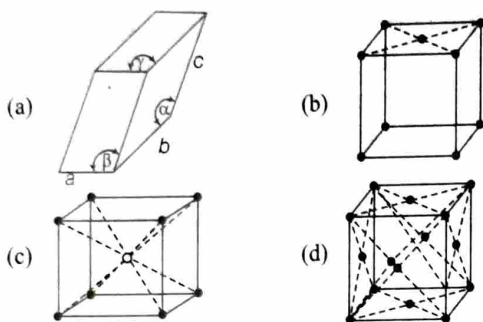
Or

How many number of atoms are there in a cubic unit cell having one atom on each corner and two atoms on each body diagonal of cube?

(a) 8   (b) 6   (c) 4   (d) 9

7. 'Spin-only' formula to calculate magnetic moment is expressed as,

(a) $\mu = n(n+2)$ (b) $\mu = \dfrac{\sqrt{n+2}}{n}$

(c) $\mu = \sqrt{n(n+2)}$ (d) $\mu = \dfrac{n+2}{\sqrt{n}}$

8. Oxygen shows only negative oxidation state as −2 except in the case of

(a) OH_2 (b) OF_2 (c) OCl_2 (d) CO_2

Or

Tetrafluorides of elements of group-16 have hybridisation and structure respectively are

(a) sp^3 and trigonal pyramidal

(b) sp^3d and tetrahedral

(c) sp^3d and trigonal bipyramidal

(d) sp^3d and tetrahedral

9. Acid catalysed hydration of alkenes except ethene leads to the formation of

(a) primary alcohol

(b) secondary or tertiary alcohol

(c) mixture of primary and secondary alcohol

(d) mixture of secondary and tertiary alcohols

10. Which among the following will be named as dibromido*bis* (ethylenediammine) chromium (III) bromide ?

(a) $[Cr(en)_3] Br_3$ (b) $[Cr(en)_2 Br_2] Br$

(c) $[Cr(en)Br_4]^-$ (d) $[Cr(en)Br_2] Br$

Or

A magnetic moment of 1.73 BM will be shown by one among the following.

(a) $[Cu(NH_3)_4]^{2+}$ (b) $[Ni(CN)_4]^{2-}$

(c) $TiCl_4$ (d) $[CoCl_6]^{4-}$

11. Oxygen shows only negative oxidation state as −2 except in the case of

(a) OH_2 (b) OF_2

(c) OCl_2 (d) CO_2

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 wrong statement.

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

12. **Assertion** Carbon oxygen bond length of phenol is slightly less than that of methanol.

Reason There exist a partial double bond character and sp^2-hybridisation of carbon to which oxygen is attached in phenol.

13. **Assertion** Compounds containing — CHO group are easily oxidised to corresponding carboxylic acids.

Reason Carboxylic acids can be reduced to alcohols by treatment with $LiAlH_4$.

14. Assertion Bond cleavage in haloarene is difficult than haloalkane.

Reason Phenyl carbocation is more stable than alkyl carbocation.

15. Assertion A bright silver mirror is produced during the warming of an aldehyde with freshly prepared ammoniacal silver nitrate solution.

Reason A bright silver mirror is produced due to the formation of silver metal.

16. Assertion Aromatic primary amines cannot be prepared by Gabriel phthalimide synthesis.

Reason Aryl halides do not undergo electrophilic substitution with anion formed by phthalimide.

Or

Assertion (A) p-fluoroanilinium ion is more acidic than anilinium ion.

Reason (R) Electron density in the N—H bond of p-fluoroanilinium ion decreases and release of a proton from p-fluoroanilinium ion is much easier than from anilinium ion.

SECTION B : Short Answer Type I Questions (2 Marks)

17. Write the structure of the products formed.

(i)

O
‖
C
—H + $C_6H_5MgBr \xrightarrow[\text{ether}]{\text{Dry}}$

(ii)

CH₃
OH $\xrightarrow[H_2O]{H^-}$
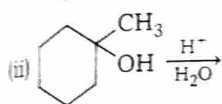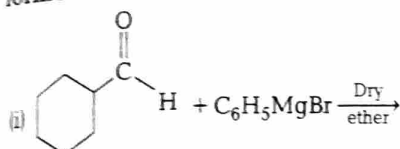
18. The resistance of a conductivity cell containing 0.001 M KCl solution at 298 K is 1500 Ω. What is the cell constant if the conductivity of 0.001 M KCl solution at 298 K is 0.146×10^{-3} S cm^{-1} ?

19. Give reason for the following :
(i) Mn(II) shows maximum paramagnetic character amongst the divalent ions of the first transition series.
(ii) Most of the transition metals do not displace hydrogen from dilute acids.

Or

First, second, third and fourth ionisation energies of Ni and Pt are given below :

Element	$(IE)_1 + (IE)_2$	$(IE)_3 + (IE)_4$
Ni	2.49 kJ mol^{-1}	8.80 kJ mol^{-1}
Pt	2.66 kJ mol^{-1}	6.70 kJ mol^{-1}

Compare the stability of Ni^{2+}, Pt^{2+} and Ni^{4+}, Pt^{4+} compounds.

20. What happens, when
(i) aniline reacts with aqueous solution of bromine in the absence of catalyst?
(ii) aniline is treated with acetic anhydride?

Or Define :
(i) Carbylamine reaction.
(ii) Hofmann bromamide reaction.

21. For the complex, [Fe(en)₂Cl₂]Cl (en =ethylenediamine), identify and write
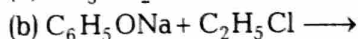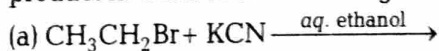(i) oxidation number of iron.
(ii) number of hybrid orbitals and the shape of the complex.

22. Account for the following :
(i) Draw the Fischer projection of L-glucose and D-Glucose and also give the product of D-Glucose on reaction with Tollen's reagent ?
(ii) Glucose or sucrose are soluble in water but cyclohexane or benzene (simple six membered ring compounds) are insoluble in water. Why?
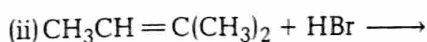
23. (i) Write the structure of the major organic product in each of the following reactions :
(a) $CH_3CH_2Br + KCN \xrightarrow{aq.\ ethanol}$
(b) $C_6H_5ONa + C_2H_5Cl \longrightarrow$
(ii) Arrange $CH_3F, CH_3Br, CH_3I, CH_3Cl$ in increasing order of nucleophilic substitution reactions.

24. Suggest two tests used to distinguish between ethanol and phenol.

25. Complete the following reactions :

(i)

CH₃
+ HI $\longrightarrow$

(ii) $CH_3CH = C(CH_3)_2 + HBr \longrightarrow$

Or

Account for the following :

(i) ![Cl on branched structure] reacts faster than ![Cl on zigzag structure]. why?
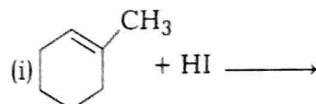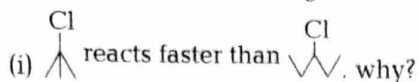
(ii) The treatment of an alkyl chloride with aqueous KOH leads to the formation of an alcohol whereas in the presence of alcoholic KOH, alkene is the major product.

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

26. (i) Give reason for the following:

    (a) Dioxygen is a gas but sulphur is a solid.

    (b) SF_6 is known but SCl_6 is not.

(ii) What happen, when SO_2 is passed through an aqueous solution of Fe(III) salts?

27. Two elements A and B form compounds having formula AB_2 and AB_4. When dissolved in 20 g of benzene (C_6H_6), 1 g of AB_2 lowers the freezing point by 2.3 K, whereas 1.0 g of AB_4 lowers it by 1.3 K. The molal depression constant for benzene is 5.1 K kg mol^{-1}.

Calculate the atomic masses of A and B.

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

Or

$[Cr(NH_3)_6]^{3+}$ is paramagnetic while $[Ni(CN)_4]^{2-}$ is diamagnetic. Explain, why?

29. An element with density 11.2 g cm^{-3} forms a fcc lattice with edge length of 4×10^{-8} cm. Calculate the atomic mass of the element.

30. Give reasons for the following :

(i) The air becomes dry when passed over silica gel.

(ii) Colloidal medicines are more effective in the treatment of diseases.

(iii) When a gas is adsorbed by an adsorbent, the sign of ΔH and ΔS is negative.

Or

Explain the following observations :

(i) Artificial rain is caused by spraying salt over clouds.

(ii) The white precipitate of silver halide become coloured in the presence of dye eosin.

(iii) Lyophilic colloid is more stable than lyophobic colloid.

SECTION D : *Long Answer Type Questions* (5 Marks)

31. (i) In a first order reaction, the reactant concentration decreases from 0.8 M to 0.4 M in 15 min. What is the time taken for the concentration to change from 0.1 M to 0.025 M?

(ii) A first order reaction takes 100 min for completion of 60% of the reaction. Find the time when 90% of the reaction will be completed.

Or

(i) For a reaction, $H_2 + Cl_2 \xrightarrow{h\nu} 2HCl$

    Rate $= k$
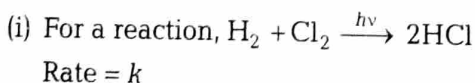
(a) Write the order and molecularity of this reaction.

(b) Write the unit of k.

(ii) A reaction is of second order in A and first order in B.

(a) Write the differential rate equation.

(b) How is the rate affected on increasing the concentration of A three times?

(c) How is the rate affected when the concentration of both A and B is doubled?

32. (i) Explain, why mercury (I) ion exists as Hg_2^{2+} ions while copper (I) exists as Cu^+ ion.

(ii) Describe the cause of the following :
   (a) Transition metal compounds are paramagnetic.
   (b) Interstitial compounds are well known for transition metals.
   (c) In the series Sc to Zn, the enthalpy of atomisation of zinc is the lowest.

Or (i) What happens,
   (a) when Cu^{2+} ion is treated with KI?
   (b) to the halides of transition metals when the oxidation state of transition metals is increased ?

(ii) Explain the following :
   (a) Mn^{3+} is a good oxidising agent.
   (b) $E^\circ_{M^{2+}/M}$ values are not regular for first row transition metals (3d-series).
   (c) Although, F is more electronegative than O, the highest Mn fluoride is MnF_4, whereas the highest oxide is Mn_2O_7.

33. How will you convert ?
   (i) Benzoic acid to *m*-fluoro benzoic acid.
   (ii) Benzaldehyde to 3-phenylpropan-1-ol.
   (iii) Benzene to benzaldehyde.
   (iv) Acetone to 2-hydroxypropanoic acid.
   (v) Benzene to phenyl acetic acid.

Or Write the structure of A to E in the following :

(i) ⬡ $\xrightarrow[\text{AlCl}_3]{\text{CH}_3\text{COCl}}$ A

(ii) ⬡–CHO $\xrightarrow{\text{Zn/Hg-HCl}}$ B

(iii) ⬡–COCH$_3$ $\xrightarrow[\text{(ii) H}_3\text{O}^+]{\text{(i) I}_2\text{/ NaOH}}$ C

(iv) ⬡–COOH $\xrightarrow{\text{(i) Br}_2\text{/ FeBr}_3}$ D

(v) ⬡–CHO $\xrightarrow{\text{KOH (aq.)}}$ $E + F$