

# DAV PUBLIC SCHOOL, MCL, KALINGA AREA

## PRACTICE PAPER - 07

# 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 Mark)

#### Passage Based Questions

1. Read the given passage and answer the 1 to 5 that follows :

The replacement of hydrogen atom(s) from a hydrocarbon, aliphatic or aromatic by halogen atom(s) (i.e. F, Cl, Br, I) results in the formation of alkyl halide (haloalkane) and aryl halide (haloarene), respectively.

Haloalkanes contain halogen atom(s) attached to the  $sp^3$ -hybridised carbon atom of an alkyl group, whereas haloarenes contain halogen atom(s) attached to  $sp^2$ -hybridised carbon atom(s) of an aryl group.

In alkyl halides, the halogen atom (X) is bonded to an alkyl group (R). They form homologous series of compounds represented by the formula  $C_nH_{2n+1}X$ .

They are further classified as primary ( $1^\circ$ ), secondary ( $2^\circ$ ) or tertiary ( $3^\circ$ ) depending upon the nature of carbon atom to which the halogen is attached.

In allylic halides, the halogen is bonded to the  $sp^3$ -hybridised carbon atom next to a carbon-carbon double bond (which is also called allylic carbon) and hence, these halides are called allylic halides.

In benzylic halides, the halogen atom is bonded to the  $sp^3$ -hybridised carbon atom next to an aromatic ring, i.e. to a benzylic carbon, whereas in vinylic halides the halogen atom is bonded to the  $sp^2$ -hybridised carbon of one of the carbon atoms of a double bond.

\* To boost the confidence at last moment, students can advised to attempt this sample paper only a day before the exam.

Naming of alkyl halide and aryl halide is an important topic of study. In IUPAC system, alkyl halides are named as halosubstituted hydrocarbons, i.e. haloalkanes. The names are written by the word 'halo' to the name of alkane corresponding to the longest continuous carbon chain having the halogen atom.

Haloarenes are the common as well as IUPAC names of aryl halides. For dihalogen derivatives, the prefixes *o*-, *m*-, *p*- are used in common system but in IUPAC system, the numerals 1, 2, 1, 3 and 1, 4 are used.

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

(i) To which hybridised carbon atom, halogen is attached in haloarenes?

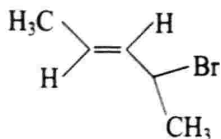
- (a)  $sp^3$  (b)  $sp^2$   
(c)  $sp$  (d)  $sp^3 d$

Or

Which of the following is benzyl halogen compound?

- (a)  $\text{Br} - \text{C}_6\text{H}_4\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$   
(b)  $(\text{CH}_3)_3\text{CCH}_2\text{CH}(\text{Br})\text{C}_6\text{H}_5$   
(c)  $(\text{CH}_3)_2\text{CHCH}(\text{Cl})\text{CH}_3$   
(d) None of the above

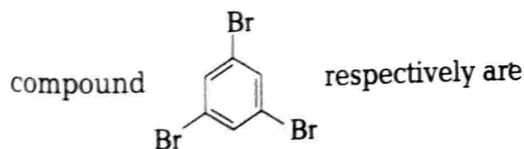
(ii) The IUPAC name of  
(a) 2-bromopent-4-ene  
(b) 2-bromopent-3-ene  
(c) 4-bromopent-2-ene  
(d) 4-bromopent-1-ene



(iii) The numerals given to *ortho*, *meta* and *para* positions are

- |     | <i>Ortho</i> | <i>Meta</i> | <i>Para</i> |
|-----|--------------|-------------|-------------|
| (a) | 1, 1         | 1, 2        | 1, 3        |
| (b) | 1, 2         | 1, 3        | 1, 4        |
| (c) | 1, 3         | 1, 4        | 1, 2        |
| (d) | 1, 2         | 1, 4        | 1, 3        |

(iv) The common and IUPAC names of the



- (a) *sym*-tribromobenzene and 1, 2, 5 tribromobenzene  
(b) *sym*-tribromobenzene and 1, 3, 5-tribromobenzene  
(c) *o*, *m*, *p*-tribromobenzene and 1, 3, 5-tribromobenzene  
(d) None of the above

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

Matter can exist in three status namely solid, liquid and gas. Solids differ from liquids, and gases in the fact that gases and liquids possess fluidity, i.e. they can flow and hence called fluids, whereas solids do not possess fluidity, instead they possess rigidity. Solids can be crystalline or amorphous.

A **crystalline solid** usually consists of a large number of small crystal, each of them having a definite characteristic geometrical shape. They have a sharp melting point that means they are true solid. They are anisotropic in nature.

Whereas an **amorphous solid** consists of particles of irregular shape. The arrangement of constituent particles in such a solid has only short range order. A regular and periodically repeating pattern is observed over short distances only.

Crystalline solids are further sub classified in many types. These are as follows:

- In **molecular solids**, constituent particles are molecules.
- In **ionic solids**, constituent particles are ions. Cations and anions are arranged in three-dimensional space. These ions are held together by strong coulombic (electrostatic) forces.
- In **metallic solids**, constituent particles are positively charged metal ions called Kernels and free electrons. These electrons can easily flow throughout the metal crystal like water in the sea.

Covalent solids are strong and directional in nature, therefore atoms are held very strongly at their positions. These solids are very hard, brittle and have extremely high melting points. They are insulators and do not conduct electricity.

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** Amorphous solids soften over a range of temperature.

**Reason** These can be moulded and blown into various shapes.



Or

**Assertion** Crystalline solids are isotropic.

**Reason** These have different arrangement of particles along different directions.

(ii) **Assertion** In covalent solids, atoms are held very strongly.

**Reason** Covalent bonds are strong and directional in nature.

(iii) **Assertion** HCl, SO<sub>2</sub> are the examples of polar molecular solids.

**Reason** These are good conductors of electricity.

(iv) **Assertion** Ionic solids are hard and brittle.

**Reason** In molten state, ionic solids are conductor of electricity.

### Multiple Choice Questions

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

3. The rate constant for a chemical reaction has unit  $\text{L mol}^{-1} \text{s}^{-1}$ , order of the reaction will be  
(a) 0 (b) 1 (c) 2 (d) 3

4. The number of chloride ion produced by complex tetrammimedichloroplatinum (IV) chloride in an aqueous solution is  
(a) two (b) four (c) one (d) three

5.  $2\text{SO}_2(g) + \text{O}_2(g) \xrightarrow{\text{Catalyst}} 2\text{SO}_3(g)$

Identify the catalyst from the options given below.

- (a) V<sub>2</sub>O<sub>5</sub> (b) CuCl<sub>2</sub>  
(c) MnO<sub>2</sub> (d) Either (a) or (b)

Or

Arrange the following acids in the correct increasing order of their acidic strength:

HCl, HBr, HI and HF

- (a) HI < HBr < HCl < HF  
(b) HF < HCl < HBr < HI  
(c) HCl < HBr < HI < HF  
(d) HBr < HI < HF < HCl
6. What would be the side products formed with primary amine in the Hofmann bromamide degradation reaction?  
(a) Na<sub>2</sub>CO<sub>3</sub> + NaBr  
(b) NaBr + H<sub>2</sub>O + NaOH

(c) NaBr + H<sub>2</sub>O + Na<sub>2</sub>CO<sub>3</sub>

(d) Br<sub>2</sub> + H<sub>2</sub>O + Na<sub>2</sub>CO<sub>3</sub>

Or

The correct order of increasing boiling points for the bases, CH<sub>3</sub>NH<sub>2</sub>, (CH<sub>3</sub>)<sub>2</sub>NH, (CH<sub>3</sub>)<sub>3</sub>N is

- (a) CH<sub>3</sub>NH<sub>2</sub> < (CH<sub>3</sub>)<sub>2</sub>NH < (CH<sub>3</sub>)<sub>3</sub>N  
(b) CH<sub>3</sub>NH<sub>2</sub> < (CH<sub>3</sub>)<sub>3</sub>N < (CH<sub>3</sub>)<sub>2</sub>NH  
(c) (CH<sub>3</sub>)<sub>3</sub>N < (CH<sub>3</sub>)<sub>2</sub>NH < CH<sub>3</sub>NH<sub>2</sub>  
(d) (CH<sub>3</sub>)<sub>3</sub>N < CH<sub>3</sub>NH<sub>2</sub> < (CH<sub>3</sub>)<sub>2</sub>NH

7. Which of the following has an imino (>NH) group instead of amino group (—NH<sub>2</sub>)?

- (a) Proline (b) Isoleucine  
(c) Tryptophan (d) Serine

8. The correct melting point order for group-15 elements is

- (a) N < P < As > Sb > Bi  
(b) N < P < As < Sb < Bi  
(c) N > P > As > Sb > Bi  
(d) N > P > As < Sb < Bi

Or

The molecule having one σ-bond and two π-bonds is

- (a) P<sub>4</sub> (b) As<sub>4</sub>  
(c) Sb<sub>4</sub> (d) N<sub>2</sub>

9. The main product of the reaction,

But-2-ene + chloroform  $\xrightarrow{\text{NaOH}}$  'X' is

- (a) butanoic acid  
(b) 2-methyl butanoic acid  
(c) 1, 1, 1-trichloro-2-methyl butane  
(d) 1, 4-butanediol

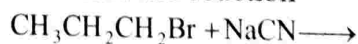
10. Select the correct options regarding the reaction,



- (a) The solvent used in the reaction is dry acetone  
(b) Precipitation of NaCl or NaBr might occur  
(c) The forward reaction is facilitated by Le-Chatelier's principle  
(d) All of the above

Or

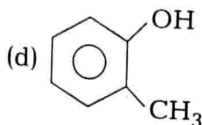
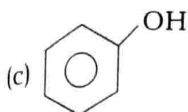
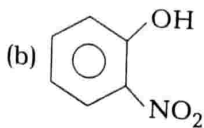
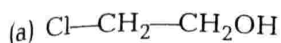
Consider the reaction



This reaction will be the fastest in

- ethanol
- methanol
- N, N' - dimethylformamide (DMF)
- water

11. Which one of the following compounds is most acidic?



### 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.

- Assertion and Reason both are correct statements and Reason is correct explanation for Assertion.
- Assertion and Reason both are correct statements but Reason is not correct explanation for Assertion.
- Assertion is correct statement but Reason is wrong statement.
- Assertion is wrong statement but Reason is correct statement.

12. **Assertion** Conductivity always decreases with dilution for weak electrolyte.

**Reason** The total number of ions in solution decreases on dilution.

13. **Assertion**  $\text{Mn}_2\text{O}_7$  is strongly acidic while  $\text{MnO}$  is basic in nature.

**Reason** Increase in oxidation state, increases acidic character.

Or

**Assertion**  $\text{Cu}^{2+}$  iodide is not known.

**Reason**  $\text{Cu}^{2+}$  oxidises  $\text{I}^-$  to iodine.

14. **Assertion** For  $d^4$ -configuration, low spin complex with configuration  $t_{2g}^3 e_g^1$  is formed.

**Reason** Low spin complexes are formed, if magnitude of CFSE is greater than pairing energy.

15. **Assertion** Gas masks on the principle of adsorption.

**Reason** Gas mask contains an adsorbent to remove poisonous gases.

16. **Assertion** Secondary structure of proteins is stabilised by intramolecular H-bonds between amide hydrogen and carbonyl oxygen.

**Reason** Imino acid, proline with amino acids like glycine act as helix breakers.

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

17. The depression in freezing point of water observed for the same amount of acetic acid, trichloroacetic and trifluoroacetic acid increases in the order as given. Explain briefly.

18. Consider the following reaction,

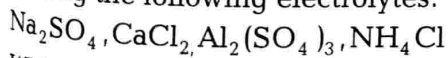


The rate of disappearance of B is  $1 \times 10^{-2} \text{ mol L}^{-1} \text{ s}^{-1}$ .

What will be

- rate of the reaction?
- rate of change in concentration of A and C?

19. Among the following electrolytes:



Which is the most effective coagulating agent for  $\text{Sb}_2\text{S}_3$  solution?

20. What happens, when  $\text{SO}_2$  gas is passed through lime water first slowly and then in excess?

21. Give example and suggest reasons for the following features of the transition metal chemistry.

- The lowest oxide of transition metal is basic, the highest is acidic.
- A transition metal exhibits higher oxidation states in oxides and fluorides.

22. What happens, when

- 2, 4, 6-trinitrochlorobenzene is subjected to hydrolysis?
- methyl chloride is treated with  $\text{AgCN}$ ?

Or

Why can aryl halides not be prepared by reaction of phenol with  $\text{HCl}$  in the presence of  $\text{ZnCl}_2$ ?

23. Give reasons for the following :
- m*-aminophenol is a stronger acid than *o*-aminophenol.
  - Alcohols act as weak bases.

Or

An organic compound *A* having molecular formula  $C_6H_6O$  gives a characteristic colour with aqueous  $FeCl_3$  solution. *A* on treatment with  $CO_2$  and  $NaOH$  at 400 K under pressure gives *B* which on acidification gives a compound *C*. The compound *C* reacts with acetyl chloride to give *D* which is a popular pain killer. Deduce the structure of *A*, *B*, *C* and *D*.

24. Calculate the distance between  $Na^+$  and  $Cl^-$  ions in  $NaCl$  crystal if its density is  $2.165 \text{ g cm}^{-3}$ .

[Molar mass of  $NaCl = 58.5 \text{ g mol}^{-1}$ ;  
 $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$ ]

25. How would you account for the following observations :
- The pentavalent bismuth is a strong oxidising agent.
  - $H_3PO_3$  is a diprotic acid.

Or

Draw the structural formulae of the following molecules :

- (i)  $Al_2Cl_6(s)$                       (ii)  $SF_4(g)$

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

26. (i) Write the formulae and the structures of noble gas species (one each) which are isostructural with

- $ICl_4^-$
- $BrO_3^-$

- (ii) Complete the following equations :

- $NaOH + Cl_2 \longrightarrow$   
(Cold and dil.)
- $XeF_6 + H_2O \longrightarrow$

27. (i) Predict which of the following will be coloured in aqueous solution?  
 $Ti^{3+}$ ,  $V^{3+}$ ,  $Cu^+$ ,  $Sc^{3+}$ ,  $Mn^{2+}$ ,  $Fe^{3+}$ ,  $Co^{2+}$  and  $MnO_4^-$

Give reason for each.

- (ii) On the basis of lanthanoid contraction, explain the following.

- Nature of bonding in  $La_2O_3$  and  $Lu_2O_3$ .
- Radii of *d* and *f*-block elements.

28. Answer the following

- Amino acids may be acidic, alkaline or neutral. How does this happen?
- The melting points and solubility of amino acids in water are generally higher than that of the corresponding halo acids. Explain.

Or Write two chemical test for the identification of glucose. Also, write chemical reaction for reaction of glucose with acetyl chloride.

29. Account for the following:

- $C_5H_{13}N$  reacts with  $HNO_2$  to give an optically active alcohol. What is this compound? Give its IUPAC name.
- What is product obtained, when aniline reacts with benzoyl chloride?

30. Explain the fact that in aryl ethers

- the alkoxy group activates the benzene ring towards electrophilic substitution.
- it directs the incoming substituents to *ortho* and *para* positions in benzene ring.

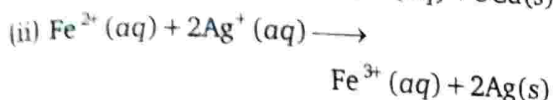
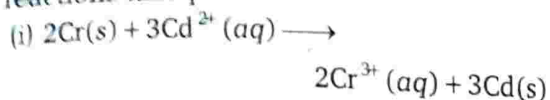
Or

- How are the following conversion carried out?  
 (a) Propene  $\rightarrow$  Propan-2-ol  
 (b) Benzyl chloride  $\rightarrow$  Benzyl alcohol  
 (c) Ethyl magnesium chloride  $\rightarrow$  Propan-1-ol  
 (d) Methyl magnesium bromide  $\rightarrow$  2-methyl propan-2-ol.
- Explain, why propanol has higher boiling point than that of butane?



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

31. Calculate the standard cell potentials of the galvanic cells in which the following reactions take place.



Calculate the  $\Delta_r G^\circ$  and equilibrium constant of the reaction.

Or

The conductivity of sodium chloride at 298 K has been determined at different concentrations and the results are given below:

conc / M	0.001	0.010	0.020	0.050	0.100
$10^2 \times \kappa / \text{sm}^{-1}$	1.237	11.85	23.15	55.53	106.74

Calculate  $\Lambda$  for all concentration and draw a plot between  $\Lambda$  and  $C^{1/2}$ . Find the value of  $\Lambda^\circ$ .

32. (i) Account for the following :
- When a coordination compound  $\text{CoCl}_3 \cdot 6\text{NH}_3$  is mixed with  $\text{AgNO}_3$ , 3 moles of  $\text{AgCl}$  are precipitated per mole of the compound. Write structural formula of the complex.
  - Explain the following  $[\text{Fe}(\text{CN})_6]^{4-}$  and  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$  are of different colours in dilute solutions.
  - How does VBT explain the formation of octahedral complexes?
- (ii) Explain  $[\text{Co}(\text{NH}_3)_6]^{3+}$  is an inner orbital complex whereas  $[\text{Ni}(\text{NH}_3)_6]^{3+}$  is an outer orbital complex.

Or

- The hexaquamanganese (II) ion contains five unpaired electrons, while the hexacyano ion contains only one unpaired electron. Explain using crystal field theory.
  - Explain on the basis of valence bond theory that  $[\text{Ni}(\text{CN})_4]^{2-}$  ion with square planar structure is diamagnetic and the  $[\text{NiCl}_4]^{2-}$  ion with tetrahedral geometry is paramagnetic.
33. (i) Complete the following reactions:
- $\text{CH}_3\text{COOH} \xrightarrow[\text{(ii) Br}_2, \text{KOH}]{\text{(i) NH}_3}$
  - $\text{C}_6\text{H}_5\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3 \xrightarrow[\text{D}]{\text{NaOH, I}_2} \dots + \text{C}_6\text{H}_5\text{COONa} + \text{NaI} + \text{H}_2\text{O}$
- (ii) An organic compound (A) (molecular formula  $\text{C}_8\text{H}_{16}\text{O}_2$ ) was hydrolysed with dilute sulphuric acid to give a carboxylic acid (B) and alcohol (C). Oxidation of (C) with chromic acid produced (B). (C) on dehydration gives but-1-ene. Write equations for the reactions involved.

Or

- How will you obtain
  - benzaldehyde from benzoic acid?
  - acetone from isopropyl alcohol?
- Explain with examples :
  - Cross-aldol condensation
  - Cannizaro reaction
  - HVZ reaction