

DAV PUBLIC SCHOOL, MCL, KALINGA AREA

PRACTICE PAPER - 06

# 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

(7 Marks)

### Passage Based Questions

1. Read the passage given below and answer the following questions :

(1×4=4 Marks)

Dioxygen is a colourless, odourless gas which liquefies at 90 K and freezes at 55 K. It is generally neutral towards litmus. Molecular oxygen  $O_2$  is paramagnetic due to the presence of two unpaired electrons.

Oxygen atom has three isotopes  $^{16}O$ ,  $^{17}O$  and  $^{18}O$ .

Dioxygen directly reacts with nearly all metals and non-metals except (Au, Pt) and some noble gases. Its reaction with other elements is strongly exothermic.

However, to initiate the reaction, some external heating is required as bond dissociation enthalpy of oxygen-oxygen double bond is high ( $493.4 \text{ kJ mol}^{-1}$ ).

A binary compound of oxygen with other element is called oxide. In many cases, one element forms two or more oxides. Oxides can be simple ( $MgO$  and  $Al_2O_3$ ) or mixed ( $Pb_3O_4$  and  $Fe_3O_4$ ). Ozone is an allotropic form of oxygen.

It occurs in minute traces in air, especially in sea air. In upper atmosphere, it is found in larger quantities. At a height of about 20 km in the atmosphere, it is formed from the oxygen in the presence of sunlight.

It protects earth's surface from an excessive concentration of UV-radiation. The formation of ozone from oxygen is an endothermic reaction, hence it is necessary to use a silent electrical discharge in its preparation to prevent its decomposition.

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

- (i) Which of the following oxides is amphoteric in nature ?  
(a)  $\text{Cl}_2\text{O}_7$  (b)  $\text{Na}_2\text{O}$   
(c)  $\text{N}_2\text{O}$  (d)  $\text{Al}_2\text{O}_3$
- (ii) Ozone ( $\text{O}_3$ ) is  
(a) an allotropic form of oxygen  
(b) too reactive to remain for long in the atmosphere at sea level  
(c) formed from atmospheric oxygen in the presence of sunlight at a height of about 20 km  
(d) All the above statements are correct
- (iii) Pure ozone has pale blue, dark blue and violet-black. These phases are  
(a) solid, liquid and gas  
(b) gas, liquid and liquid  
(c) gas, solid and liquid  
(d) gas, liquid and solid
- Or
- Starch paper moistened with solution of KI turns blue in ozone because  
(a) alkali is formed  
(b) iodine is liberated  
(c) ozone reacts with litmus paper  
(d) oxygen is liberated
- (iv) Angular shape of ozone molecule consists of  
(a) 1  $\sigma$ -bond and 1  $\pi$ -bond  
(b) 2  $\sigma$ -bond and 2  $\pi$ -bonds  
(c) 1  $\sigma$ -bond and 2  $\pi$ -bonds  
(d) 2  $\sigma$ -bond and 1  $\pi$ -bond

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

Alkyl halides are colourless when pure. However, bromides and iodides develop colour when exposed to light. Many volatile halogen compounds have sweet smell. Methyl chloride, methyl bromide, ethyl chloride and some chlorofluoromethanes are gases at room temperature. Higher member are liquids

or solids. As we have already learnt, molecules of organic halogen compounds are generally polar. Due to greater polarity as well as higher molecular mass as compared to the parent hydrocarbon, the intermolecular force's of attraction (dipole-dipole and van der Waals are stronger in the halogen derivatives. That is why the boiling point of chlorides, bromides and iodides are considerably higher than those of the hydrocarbons of comparable molecular mass.

For the same alkyl group, the boiling points of alkyl halides decrease in the order :

$\text{RI} > \text{RBr} > \text{RCl} > \text{RF}$ . This is because with the increase in size and mass of halogen atom, the magnitude of van der Waals' forces increases.

Bromo, iodo and polychloro derivatives of hydrocarbons are heavier than water. The density increases with increase in number of carbon atoms, halogen atoms and atomic mass of the halogen atoms.

The haloalkanes are only very slightly soluble in water. In order for a haloalkane to dissolve in water, energy is required to overcome the attractions between the haloalkane molecules and break the hydrogen bonds between water molecules. Less energy is release when new attractions are setup between the haloalkane and the water molecules as these are not as strong as the original hydrogen bonds in water.

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** Boiling point of alkyl halides increases with increase in molecular weight.

**Reason** Boiling point of alkyl halides are in the order  $\text{RI} > \text{RBr} > \text{RCl} > \text{RF}$ .

- (ii) **Assertion** Alkyl halides are soluble in organic solvents.

**Reason** *p*-dichlorobenzene possesses low melting point.



(iii) **Assertion** Lower members of alkyl halides are colourless gases.

**Reason** Alkyl halides in general turn black.

Or

**Assertion** Haloalkanes does not show H-bonding.

**Reason** Haloalkanes are soluble in water.

(iv) **Assertion** Fluoride has the lowest and iodide has the highest boiling point.

**Reason** Boiling points of haloalkanes increases with increasing atomic mass.

### Multiple Choice Questions

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

3. Oxygen and sulphur exist as;
- polyatomic and monoatomic molecule respectively
  - diatomic and polyatomic molecule respectively
  - monoatomic and diatomic molecule respectively
  - polyatomic and diatomic molecule respectively

Or

All the hydrides (of group-16 elements) except one possess reducing property and this character increases from  $H_2S$  to  $H_2Te$ . Identify the hydrides.

- (a)  $H_2Se$  (b)  $H_2O$  (c)  $H_2S$  (d)  $H_2Te$

4. Which of the following is a monosaccharide?

- (c) Lactose (d) Maltose  
(c) Fructose (d) Cellulose

5. 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

6. Among the C—X bond (where, X = Cl, Br, I) the correct decreasing order of bond energy is

- (a) C—I > C—Cl > C—Br  
(b) C—I > C—Br > C—Cl  
(c) C—Cl > C—Br > C—I  
(d) C—Br > C—Cl > C—I

Or

Bond length is maximum in

- (a) HF (b) HCl (c) HI (d) HBr

7. The  $pK_b$  values of different amines are given below.

S. No	Compound	$pK_b$
1.	Methanamine	3.38
2.	N,N- dimethyl aniline	8.92
3.	Ethanamine	3.29
4.	Phenyl methanamine	4.70

Among the given compounds, which one is the weakest base ?

- (a) Methanamine  
(b) N, N - dimethyl aniline  
(c) Ethanamine  
(d) Phenyl methanamine

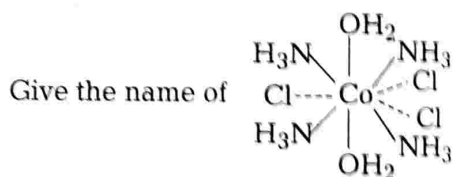
8. Iodoform test is not given by

- (a) 2- pentanone (b) 3-pentanone  
(c) ethanal (d) ethanol

9. Coordination number of Fe in  $[Fe(CN)_6]^{4-}$  and  $[Fe(CN)_6]^{3-}$  are respectively

- (a) 2 and 3 (b) 6 and 6  
(c) 6 and 3 (d) 6 and 4

Or



- (a) tetraammineaquacobalt chloride  
(b) tetraamminediaquacobalt (III) chloride  
(c) tetraamminediaquacobalt (IV) chloride  
(d) None of the above

10. For the given rate expression =  $k[A]^1[B]^1$ , unit of rate constant is

- (a)  $mol^{-1} Ls^{-1}$   
(b)  $mol^{-1} Ls$   
(c)  $mol^{-1} L^{-1}$   
(d) None of the above

11. For the given rate expression =  $k[A]^{3/2}[B]^{-1}$ , the overall order of a reaction is

- (a) zero (b) half  
(c) one (d) two

Or

The unit of the rate constant of  $n$ th order is

- (a)  $\text{mol}^{1-n} \text{L}^{n-1} \text{s}^{-1}$
- (b)  $\text{mol}^{n-1} \text{L}^{1-n} \text{s}^{-1}$
- (c)  $\text{mol}^{n-1} \text{L}^{n-1} \text{s}$
- (d)  $\text{mol}^n \text{L}^{1-n} \text{s}^{-1}$

### 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) Both Assertion and Reason are correct statements and Reason is the correct explanation of the Assertion.
  - (b) Both Assertion and Reason are correct statements, but Reason is not the correct explanation of the Assertion.
  - (c) Assertion is correct, but Reason is incorrect statement.
  - (d) Assertion is incorrect, but Reason is correct statement.
12. **Assertion** For adsorption,  $\Delta G$  is negative.  
**Reason** Adsorption is an exothermic process accompanied by decrease in randomness.
13. **Assertion** Phenol is less acidic than  $p$ -nitrophenol.

**Reason** Phenolate ion is more stable than  $p$ -nitro phenolate ion.

14. **Assertion** Order of the following reaction,  $2\text{NO}(g) + 2\text{H}_2(g) \longrightarrow 2\text{H}_2\text{O}(g) + \text{N}_2(g)$  is 3.

**Reason** Order of the reaction with respect to given reactant is the power of the reactant's concentration in the rate equation.

Or

**Assertion** Decomposition of gaseous ammonia on a hot platinum surface is a zero order reaction at high pressure.

**Reason** At high pressure, the metal surface gets saturated with gas molecules.

15. **Assertion** In the coordination compound  $[\text{Co}(\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2)_3]_2$ , ethane-1,2-diamine is a neutral molecule.  
**Reason** Oxidation number of Co in the complex ion is +3.

16. **Assertion** Ethanol and acetone show positive deviation from Raoult's law.  
**Reason** Pure ethanol molecule show hydrogen bond and on adding acetone hydrogen bond between ethanol molecules break.

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

17. Why does an addition of 1 mole of NaCl to 1 L water increases its boiling point, whereas addition of 1 mole of  $\text{CH}_3\text{OH}$  to 1 L water decreases its boiling point?
18. Account for the following :
- (i) Based on solute-solvent interactions, arrange the following in the increasing order of solubility in  $n$ -octane.  
Cyclohexane, KCl,  $\text{CH}_3\text{OH}$ ,  $\text{CH}_3\text{CN}$ .
  - (ii) What do you mean by saturated solution?

Or

The molecular masses of polymers are determined by osmotic pressure method

and not by measuring other colligative properties. Give two reasons.

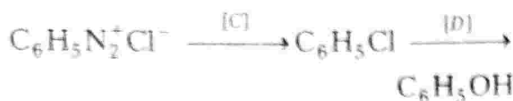
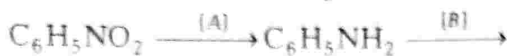
19. What are essential and non-essential amino acids? Give two examples each.

Or

Despite having an aldehyde group, glucose do not give 2, 4-DNP test. Why?

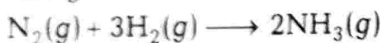
20. Answer the following questions :
- (i) Give a chemical test to distinguish between methanol and dimethyl ether.
  - (ii) Which of the reagents between methanol and dimethyl ether will not react with Grignard reagent?

21. Identify the compounds A, B, C and D required for the following conversion.



22. On the basis of crystal field theory explain why Co(III) form diamagnetic octahedral complex with strong field ligands.
23. Account for the following :
- How can you obtain iodoethane from ethanol, when no other iodine containing reagent except NaI is available in the laboratory?
  - Write the correct order of reactivity of alkyl halides ( $1^\circ$ ,  $2^\circ$ ,  $3^\circ$ ,  $-\text{CH}_3$ ) towards  $\text{S}_\text{N}1$  reaction.

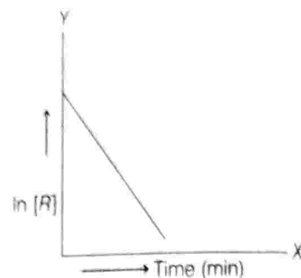
24. For the given reaction,



if  $\Delta[\text{NH}_3] / \Delta t = 4 \times 10^{-8} \text{ mol L}^{-1} \text{ s}^{-1}$ ,  
then what is the value of  $-\Delta[\text{H}_2] / \Delta t$ ?

Or

Consider the following :  
 $\ln [R]$  vs time (min) plot.



- What is the order of the reaction?
  - What are the units of rate constant,  $(k)$  for the reaction?
25. Write the structure of the major organic products in each of the following reactions :
- $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} + \text{SOCl}_2 \longrightarrow$
  - $\text{CH}_3\text{CH}_2\text{CH} = \text{CH}_2 + \text{HBr} \xrightarrow{\text{Peroxide}}$

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

26. A strip of nickel metal is placed in a 1M solution of  $\text{Ni}(\text{NO}_3)_2$  and a strip of silver metal is placed in a 1M solution of  $\text{AgNO}_3$ . An electrochemical cell is created when the two solutions are connected by a salt bridge and the two strips are connected by wires to a voltmeter.

$$\text{Given, } E_{\text{Ni}^{2+}/\text{Ni}}^\circ = -0.25 \text{ V}$$

$$E_{\text{Ag}^+/\text{Ag}}^\circ = 0.80 \text{ V}$$

Write the balanced equations for the overall reactions occurring in the cell and calculate the cell potential.

27. (i) Draw the structures of the following molecules:
- $\text{H}_2\text{S}_2\text{O}_7$
  - $\text{XeOF}_4$
- (ii) Complete the following chemical equations:
- $\text{SO}_3 + \text{H}_2\text{SO}_4 \longrightarrow$
  - $\text{XeF}_6 + \text{H}_2\text{O} \longrightarrow$

Or Answer the following :

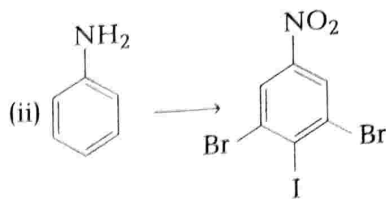
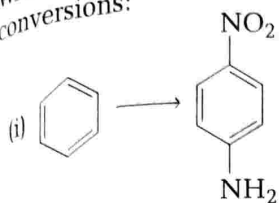
- Which of the following does not exist and why?  
 $\text{XeOF}_4$ ,  $\text{NeF}_2$ ,  $\text{XeF}_2$ ,  $\text{XeF}_6$
  - Why does fluorine not play the role of a central atom in interhalogen compounds?
  - Why do noble gases have very low boiling points?
28. An organic compound 'A' having molecular formula,  $\text{C}_6\text{H}_6\text{O}$  gives a characteristic colour with aq.  $\text{FeCl}_3$  solution 'A' on treatment with  $\text{CO}_2$  and  $\text{NaOH}$  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.



29. Aluminium crystallises in a cubic closed packed structure. Its metallic radius is 125 pm.

- (i) What is the length of the side of the unit cell ?  
 (ii) How many unit cells are there in  $100 \text{ cm}^3$  of aluminium?

30. Write the steps to carry out the following conversions:



Or

- (i) Give reason for the following :  
 (a) Gabriel phthalimide synthesis is not preferred for synthesising aromatic primary amines.  
 (b) *tert*-butylamine cannot be prepared by the action of  $\text{NH}_3$  on *tert*-butyl bromide.  
 (ii) Give one chemical test to distinguish between ethyl nitrile and nitroethane.

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

31. (i) 100 mg of a protein is dissolved in enough water to make 10.0 mL of a solution. If this solution has an osmotic pressure of 13.3 mm Hg at  $25^\circ\text{C}$ , what is the molar mass of protein?  
 ( $R = 0.0821 \text{ L atm mol}^{-1} \text{ K}^{-1}$  and  $760 \text{ mm Hg} = 1 \text{ atm}$ )

(ii) What is the molarity of  $\text{H}_2\text{SO}_4$  solution which has a density 1.84 g/cc at  $35^\circ\text{C}$  and contains 98% by weight ?

Or (i) Define each of the following :

- (a) Osmotic pressure  
 (b) Ebullioscopic constant

(ii) At some temperature, the vapour pressure of pure  $\text{C}_6\text{H}_6$  is 0.256 bar and that of pure  $\text{C}_6\text{H}_5\text{CH}_3$  (toluene) is 0.0925 bar. If the mole fraction of toluene is 0.0925 bar. If the mole fraction of toluene in solution is 0.6. Then,

- (a) what will be the total pressure of the solution?  
 (b) what will be the mole fraction of each component in vapour phase ?

32. (i) An organic compound A with the molecular formula  $\text{C}_9\text{H}_{10}\text{O}$  forms 2, 4-DNP derivative which reduces Tollen's reagent and undergoes Cannizzaro reaction.

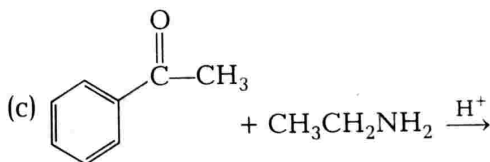
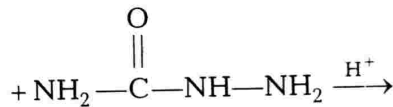
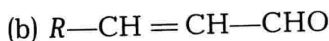
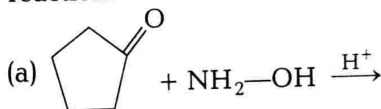
On vigorous oxidation, it gives 1,2-benzene dicarboxylic acid.

Identify the compound A.

- (ii) Give simple chemical tests to distinguish between the following pairs of compounds:  
 Ethanal and propanal.

Or

- (i) Predict the products of the following reactions :



- (ii) Give the chemical reaction of the following :

(a) Bromination of phenol to 2, 4, 6-tribromophenol.

(b) Hydroboration of propene and then oxidation to propanol.

33. (i) Write down the electronic configuration of  
(a)  $\text{Cr}^{3+}$  (b)  $\text{Cu}^+$  (c)  $\text{Co}^{2+}$  (d)  $\text{Mn}^{2+}$
- (ii) Describe the cause of the following variations :
- (a)  $\text{Cr}^{2+}$  is stronger reducing agent than  $\text{Fe}^{2+}$ .
- (b)  $E^\circ(\text{M}^{2+}/\text{M})$  value for copper is positive (+ 0.34 V).
- (c) Cobalt (II) is stable in aqueous solution but in the presence of complexing reagents, it is easily oxidised.

Or

- (i) Calculate the magnetic moment of a divalent ion in aqueous solution,  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ , if atomic number of Fe is 26.
- (ii) Explain the following :
- (a) Why does Cu not displace hydrogen from acids?
- (b) Why  $E^\circ$  values for Mn, Ni and Zn are more negative than expected?
- (c) Why first ionisation of Cr is lower than that of Zn ?