SAMPLE QUESTION PAPER

BLUE PRINT

Time Allowed : 3 hours **Maximum Marks :** 70

S. No.	Chapter	Passage based/ MCQs/A & R (1 mark)	SA-I (2 marks)	SA-II (3 marks)	LA (5 marks)	Total
1.	The Solid State	–	–	–	1(5)	**10(23)**
2.	Solutions	2(2)	–	1(3)		
3.	Electrochemistry	1(1)	1(2)	–	–	
4.	Chemical Kinetics	1(1)	1(2)	1(3)	–	
5.	Surface Chemistry	1(4)	–	–	–	
6.	The *p*-Block Elements	1(1)	1(2)	1(3)	–	**10(19)**
7.	The *d*- and *f*-Block Elements	3(3)	1(2)	–	–	
8.	Coordination Compounds	1(1)	1(2)	–	1(5)	
9.	Haloalkanes and Haloarenes	1(1)	1(2)	1(3)	–	**13(28)**
10.	Alcohols, Phenols and Ethers	1(1)	1(2)	1(3)	–	
11.	Aldehydes, Ketones and Carboxylic Acids	1(1)	–	–	1(5)	
12.	Amines	1(1)	1(2)	–	–	
13.	Biomolecules	2(5)	1(2)	–	–	
	Total	**16(22)**	**9(18)**	**5(15)**	**3(15)**	**33(70)**

Subject Code : **043**

CHEMISTRY

Time allowed : 3 hours ***Maximum marks : 70***

General Instructions : Read the following instructions carefully.

(a) There are 33 questions in this question paper. All questions are compulsory.

(b) Section A : Q. No. 1 to 16 are objective type questions. Q. No. 1 and 2 are passage based questions carrying 4 marks each while Q. No. 3 to 16 carry 1 mark each.

(c) Section B : Q. No. 17 to 25 are short answer questions and carry 2 marks each.

(d) Section C : Q. No. 26 to 30 are short answer questions and carry 3 marks each.

(e) Section D : Q. No. 31 to 33 are long answer questions carrying 5 marks each.

(f) There is no overall choice. However, internal choices have been provided.

(g) Use of calculators and log tables is not permitted.

SECTION - A (OBJECTIVE TYPE)

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

Colloidal particles shows various properties like mechanical properties (*i.e.*, Brownian movement, sedimentation, diffusion), optical properties (Tyndall effect), electrical properties (electrophoresis and electro-osmosis). Colloidal solutions too exhibit colligative properties such as osmotic pressure, lowering of vapour pressure, depression in freezing point and elevation in boiling point.

The physical properties shown by colloidal particles are heterogeneity, filterability (can pass through ordinary filter papers as the size of the pores of filter paper is larger)non-setting nature, showing colour. Colour of the colloidal solution is not always the as the colour of the substances in bulk.

The colour depends on size and shape of colloidal particles, wavelength of source, nature of colloidal solution and method of preparation.

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

(i) Which of the following statements are correct?

(i) On the application of an electric field, the particles of lyophobic sol may move in both directions or not move at all.

(ii) Surface tension of lyophobic sols is similar to that of the dispersion medium.

(iii) Electro-osmosis is the movement of the particles of dispersion medium under the influence of an electric field.

(a) (i), (ii) and (iii) (b) (i) and (iii) (c) (ii) and (iii) (d) (i) and (ii)

(ii) Tyndall effect in a colloid is due to

(a) interference of light (b) diffraction of light

(c) reflection of light (d) scattering of light.

(iii) The simplest way to check whether a system is colloidal is by

(a) Tyndall effect (b) Brownian movement

(c) electrodialysis (d) measuring particle size.

OR

The presence of electric charge on colloidal particles is indicated by

(a) osmosis (b) dialysis (c) electrolysis (d) electrophoresis.

(iv) Separation of colloidal particles from those of molecular dimension with electricity is known as

(a) electrolysis (b) electrophoresis (c) electrodialysis (d) none of these.

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

Proteins are polypeptides with a biological function. The sequence of amino acids in protein is called its primary structure. The bond between C and N is somewhat shorter than a normal CN single bond because of mesomery with the C = O double bond. Each position in the primary structure can be occupied by any of the 20 common amino acids, the possible number of combination is huge. The secondary structure of protein in any regular, repetitive folding pattern in the molecule. It is stabilised by hydrogen bonds between amino and keto-groups of the peptide bonds, which carry a partial positive and negative charge, respectively.

Two secondary structures of proteins are,

1. α-helix : The α-helix, a common structural modification of proteins, consists of a right handed helix with a repeat length of 3.6 amino acid resides per helical turn.
2. β-strand : In the β-strand, the polypeptide backbone is stretched out to nearly maximum extension and then laid side by side which are held together by intermolecular hydrogen bonds. Several strands are aligned either in a parallel or antiparallel fashion.

In these questions (Q. No 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 :** β-pleated sheet structure of protein shows maximum extension.

Reason : Intermolecular hydrogen bonding is present in them.

(ii) **Assertion :** All enzymes are made up of proteins and all proteins have three dimensional structures.

Reason : Primary structures of protein are sequence of amino acids.

OR

Assertion : Insulin is water soluble.

Reason : Insulin is a globular protein.

(iii) **Assertion :** Peptides are composed of amino acids joined by amide bonds.

Reason : Amide bonds do not participate in hydrogen bonding.

(iv) **Assertion :** Helical structure is a secondary structure of proteins.

Reason : Helical structure is stablised by hydrogen bonding.

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

3. NaCl, $MgCl_2$ and $CaSO_4$ are known as
(a) 1 – 1, 2 – 1, and 2 – 2 type electrolytes respectively
(b) strong, weak and strong electrolytes respectively
(c) electrolytes with same molar conductivity
(d) none of these.

4. Hydrogen iodide cannot be prepared by the action of conc. H_2SO_4 on potassium iodide because
(a) HI is stronger reducing agent than H_2SO_4
(b) HI is more volatile than H_2SO_4
(c) H_2SO_4 is an oxidising agent
(d) H_2SO_4 forms complex.

OR

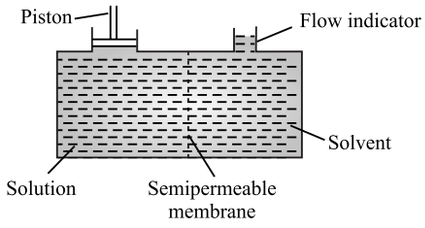
When I_2 is dissolved in CCl_4 the colour that results is
(a) brown (b) violet (c) colourless (d) bluish green.

5. The order of basic strength among the following amines in benzene solution is
(a) $CH_3NH_2 > (CH_3)_3N > (CH_3)_2NH$ (b) $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2$
(c) $CH_3NH_2 > (CH_3)_2NH > (CH_3)_3N$ (d) $(CH_3)_3N > CH_3NH_2 > (CH_3)_2NH$

OR

Aniline when treated with conc. HNO_3 and H_2SO_4 gives
(a) *p*-phenylenediamine (b) *m*-nitroaniline
(c) *p*-benzoquinone (d) nitrobenzene.

6. Study the following figure showing osmosis and mark the correct statement.



(a) The external pressure applied on the solution to stop osmosis is called osmotic pressure.
(b) The external pressure applied on the solvent to stop osmosis is called osmotic pressure.
(c) The hydrostatic pressure built up on solvent which just stops osmosis is osmotic pressure.
(d) Pressure developed by solvent while solution flows through semipermeable membrane.

7. The metals of group-12 are softer than other transition metals because
(a) group-12 metals have a cage-like structure
(b) group-12 metals have high ionisation energies
(c) *s*- as well as *d*-electrons take part in metallic bonding
(d) *d*-electrons do not take part in metallic bonding.

8. Last product of protein digestion is
(a) polypeptides (b) DNA (c) amino acids (d) peptones.

OR

Which one of the following statements about the structure of double-helical DNA is incorrect?

(a) Within the double helix there are 10 base pairs per turn of the helix.

(b) The forces that stabilize the DNA double helix are hydrogen bonds between complementary bases.

(c) Separation of the two strands of the double helix requires untwisting of the helix.

(d) The molar amount of adenine plus thymine equals the molar amount of guanine plus cytosine.

9. Which of the following has metal-metal bond?

(a) $Ni(CO)_4$ (b) $Fe(CO)_5$ (c) $Cr(CO)_6$ (d) $Mn_2(CO)_{10}$

OR

The complex that does not give a precipitate with $AgNO_3$ solution is

(a) $[Co(NH_3)_3Cl_3]$ (b) $[Co(NH_3)_6]Cl_3$

(c) $[Ag(NH_3)_2]Cl$ (d) $[Cr(NH_3)_4Cl_2]Cl$

10. The IUPAC name of $(CH_3)_2CH — CH_2 — CH_2Br$ is

(a) 1-bromopentane (b) 1-bromo-3-methylbutane

(c) 2-methyl-4-bromobutane (d) 2-methyl-3-bromopropane.

11. The highest magnetic moment is shown by the transition metal ion with outer electronic configuration

(a) $3d^2$ (b) $3d^5$ (c) $3d^7$ (d) $3d^9$

In the following questions (Q. No. 12-16) 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 :** Zr and Hf occur together in nature and are difficult to separate.

Reason : Zr and Hf have identical radii due to lanthanide contraction.

13. **Assertion :** Phenols cannot be converted into esters by direct reaction with carboxylic acids.

Reason : Electron withdrawing groups increase the acidity of phenols.

OR

Assertion : *tert*-Butyl methyl ether reacts with HBr to form *tert*-butyl bromide and methanol.

Reason : It follows S_N1 mechanism.

14. **Assertion :** Pressure does not have any effect on solubility of solids in liquids.

Reason : Solids and liquids are highly incompressible.

15. **Assertion :** α-Hydrogen atom in aldehydes and ketones are acidic.

Reason : The anion left after the removal of α-hydrogen is stabilized by inductive effect.

16. **Assertion :** For the reaction, $CHCl_3 + Cl_2 \rightarrow CCl_4 + HCl$

Rate = $k[CHCl_3][Cl_2]^{½}$

Reason : Rate of reaction is always equal to the sum of the stoichiometric coefficients of the reacting species in a balanced chemical equation.

SECTION - B

The following questions Q. No. 17-25 are short answer type and carry 2 marks each.

17. (a) Why are interhalogen compounds more reactive than its elemental form?

(b) Write the chemical reaction to show the formation of Cl_2 from bleaching powder.

18. How would you account for the following :

(i) Zn, Cd and Hg are soft metals.

(ii) Most of the transition metal ions exhibit characteristic colours in aqueous solutions.

OR

Explain giving reasons :

(i) Transition metals and their compounds generally exhibit a paramagnetic behaviour.

(ii) The chemistry of actinoids is not as smooth as that of lanthanoids.

19. (i) The rate constant of a zero order reaction is 1×10^{-3} mol L^{-1} s^{-1}. Starting with 50 moles, calculate the time in minutes in which the concentration decreases to 10 moles.

(ii) What is zero order reaction? Give one example of zero order reaction.

20. The specific conductance of *N*/50 solution of a cell of KCl at 25°C is 0.002765 mho cm^{-1}. If the resistance of a cell containing this solution is 400 ohm, find out the cell constant.

21. (a) Which of the following is more stable complex and why?
$[Co(NH_3)_6]^{3+}$ and $[Co(en)_3]^{3+}$

(b) Arrange the following complexes in the increasing order of conductivity of their solution : $[Co(NH_3)_3Cl_3]$, $[Co(NH_3)_4Cl_2]Cl$, $[Co(NH_3)_6]Cl_3$, $[Co(NH_3)_5Cl]Cl_2$

22. Answer the following :

(i) What type of linkage is responsible for the primary structure of proteins?

(ii) Name the location where protein synthesis occurs in our body.

23. Allylic and benzylic halides show high reactivity towards the S_N1 reaction. Give reasons.

OR

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

(i) $2CH_3-\underset{\underset{Cl}{|}}{CH}-CH_3 \xrightarrow[\text{Dry ether}]{Na}$

(ii) $CH_3-CH_2-Br \xrightarrow{AgCN}$

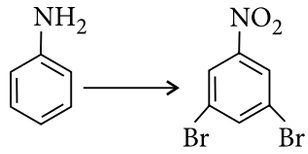
24. (a) How is the following conversion carried out : Anisole to *p*-bromoanisole ?

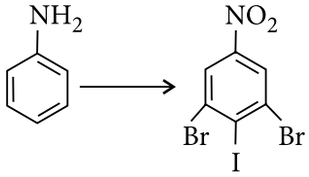
(b) Give mechanism of preparation of ethoxyethane from ethanol.

25. Before reacting aniline with HNO_3 for nitration, it is converted to acetanilide. Why is this done and how is nitroaniline obtained subsequently?

OR

How will you carry out the following conversions?

(i) 

(ii) 

SECTION - C

Q. No. 26-30 are short answer type II carrying 3 marks each.

26. (i) Write the name of the reagents and equations in the conversion of

(a) phenol to salicylaldehyde

(b) anisole to *p*-methoxyacetophenone.

(ii) Ethers are soluble in water. Why?

27. The degree of dissociation of $Ca(NO_3)_2$ in dilute aqueous solution containing 7.0 g of salt per 100 g of water at 100 °C is 70%. If vapour pressure of water at 100 °C is 760 mm, calculate the vapour pressure of the solution.

OR

Vapour pressures of chloroform ($CHCl_3$, 119.5 g mol^{-1}) and dichloromethane (CH_2Cl_2, 85 g mol^{-1}) at 298 K are 200 mm Hg and 415 mm Hg respectively. Calculate

(a) vapour pressure of the solution prepared by mixing 25.5 g of $CHCl_3$ and 40 g of CH_2Cl_2 at 298 K and

(b) mole fraction of each component in vapour phase.

28. (a) Explain why fluorine forms only one oxoacid, HOF.

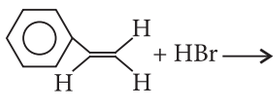
(b) Arrange the following in the order of property indicated for each set :

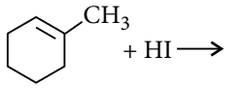
(i) F_2, Cl_2, Br_2, I_2 – increasing bond dissociation enthalpy

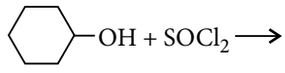
(ii) HF, HCl, HBr, HI – increasing acid strength

(iii) H_2O, H_2S, H_2Se, H_2Te – increasing volatility

29. Complete the equations for the following reactions :

(i) 

(ii) 

(iii) 

OR

Compound '*A*' with molecular formula C_4H_9Br is treated with aqueous KOH solution. The rate of this reaction depends upon the concentration of the compound '*A*' only. When another optically active isomer '*B*' of this compound was treated with aqueous KOH solution, the rate of reaction was found to be dependent on concentration of compound and KOH both.

(i) Write down the structural formula of both compounds '*A*' and '*B*'.

(ii) Out of these two compounds, which one will be converted to the product with inverted configuration.

30. The half-life for decay of radioactive C-14 is 5730 years. An archeological artifact containing wood has only 80% of the C-14 activity as found in living trees. Calculate the age of the artifact.

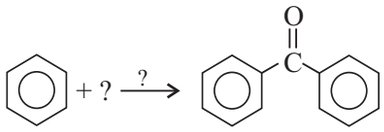
SECTION - D

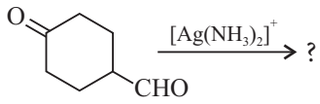
Q. No. 31-33 are long answer type carrying 5 marks each.

31. An organic compound *A* (C_3H_6O) is resistant to oxidation but forms compound *B* (C_3H_8O) on reduction. *B* reacts with HBr to form the compound *C*. *C* with Mg forms Grignard reagent *D* which reacts with *A* to form a product which on hydrolysis gives *E*. Identify *A* to *E*.

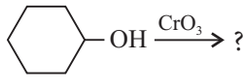
OR

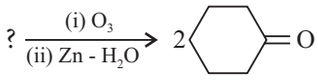
Complete each synthesis by giving missing starting material, reagents or products.

(a) 

(b) 

(c) $CH_3COCH_2COOC_2H_5 \xrightarrow[(ii)\ H^+]{(i)\ NaBH_4} ?$

(d) 

(e) 

32. (a) Explain hybridisation in the complex which contains hexacyanidoferrate(III) ion.

(b) Based on the valence bond theory describe the formation and nature of hexaaminecobalt(III) chloride.

OR

(i) Using crystal field theory, draw energy level diagram, write electronic configuration of the central metal atom/ion and determine the magnetic moment value in the following :

(a) $[CoF_6]^{3-}$ (b) $[FeF_6]^{3-}$ (c) $[Fe(CN)_6]^{4-}$

(ii) $FeSO_4$ solution mixed with $(NH_4)_2SO_4$ solution in 1:1 molar ratio gives the test of Fe^{2+} ion but $CuSO_4$ solution mixed with aqueous ammonia in 1 : 4 molar ratio does not give the test of Cu^{2+} ion. Explain why?

33. (i) What is the coordination number of atoms in a (a) *bcc* structure and (b) *fcc* structure?

(ii) The unit cell of an element of atomic mass 108 u and density 10.5 g cm^{-3} is a cube with edge length, 409 pm. Find the type of unit cell of the crystal.

[Given : Avogadro's constant = 6.022×10^{23} mol^{-1}]

(iii) If NaCl is doped with 10^{-3} mole percent $SrCl_2$, what will be the concentration of cation vacancies? ($N_A = 6.022 \times 10^{23}$ mol^{-1})

OR

(i) What is the formula of a compound in which the element *Y* forms *ccp* lattice and atoms of *X* occupy 1/3rd of tetrahedral voids?

(ii) An element crystallises in a *bcc* lattice with cell edge of 500 pm. The density of the element is 7.5 g cm^{-3}. How many atoms are present in 300 g of the element?

(iii) ZnO turns yellow on heating. Why?