

PRE-BOARD / XII / CHEMISTRY / 2020-21

Time: 3 Hrs.

MM : 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 2 are case based questions having four MCQs or Reason Assertion type based on given passage each carrying 1 mark.
- c) Section A: Q.No. 3 to 16 are MCQs and Reason Assertion type questions carrying 1 mark each.
- d) Section B: Q. No. 17 to 25 are short answer questions and carry 2 marks each.
- e) Section C: Q. No. 26 to 30 are short answer questions and carry 3 marks each.
- f) Section D: Q. No. 31 to 33 are long answer questions carrying 5 marks each.
- g) There is no overall choice. However, internal choices have been provided.
- h) Use of calculators and log tables is not permitted.

SECTION A (OBJECTIVE TYPE)

Q1. Read the passage given below and answer the following questions: 1 X 4

Phenols on treatment with chloroform in the presence of aqueous sodium hydroxide or potassium hydroxide solution gives hydroxy aldehydes. In this reaction the the formyl group is directed to ortho position. However if one of the ortho positions is occupied then para product is formed. The reaction is electrophilic substitution reaction.

- i) The name of the reaction mentioned in the above paragraph is 1
 - a) Kolbe's reaction.
 - b) Wurtz's reaction.
 - c) Reimer-Tiemann reaction.
 - d) Cannizzaro reaction.
- ii) What is the name of the final product formed in the reaction mentioned in the paragraph? 1
 - a) 2-Hydroxy benzoic acid
 - b) 2-Hydroxyacetophenone.
 - c) 2-Hydroxy benzaldehyde.
 - d) 2-Acetoxy benzoic acid.

- iii) Methanol and ethanol can be distinguished by using 1
 a) Fehling's test
 b) Iodoform test
 c) Tollen's test
 d) Carbylamine test

OR

- iii) Neutral ferric chloride test can be used to distinguish between 1
 a) Alcohols and ethers
 b) Phenols and alcohols
 c) Amines and aldehydes
 d) Aldehydes and ketones
- iv) The major product of reaction between sodium ethoxide and 2-Chloro-2-methylpropane is 1
 a) tert-butylethyl ether
 b) 2-Methylpropene.
 c) Butene
 d) 2-Chloro-2-methylpropene

Q2. Read the passage given below and answer the following questions: 1 X 4

Colloidal solutions are heterogeneous solutions which contain particles of intermediate size between those of true solutions and suspensions. These particles do not settle down under gravity but settle on centrifugation. Based on the nature of interaction between dispersion medium and dispersed phase, these are classified as lyophilic (particles of dispersed phase have greater affinity towards dispersion medium) and lyophobic (particles of dispersed phase have no affinity towards dispersion medium). These are also classified as multimolecular (sols of gold), macromolecular (starch sol) and associated colloids (soap solution). We notice many applications of these in our daily life.

In these questions, 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 : Finest gold sol has red colour. 1
 Reason : The colour arises due to scattering of light by colloidal gold particles.
- ii) Assertion : Lyophilic colloids are called as reversible sols. Reason : 1
 Lyophilic sols are liquid loving.

OR

- ii) Assertion : The micelle formed by sodium stearate in water has COO^- groups at the surface. 1
- Reason : Surface tension of water is reduced by the addition of stearate
- iii) Assertion : For the coagulation of sols carrying positive charge, PO_4^{3-} ions are more efficient than SO_4^{2-} or Cl^- ions. Reason : This follows Hardy Schulze rule. 1
- iv) Assertion : Detergents with low CMC are more economical to use. Reason : Cleansing action of detergents involves the formation of micelles. These are formed when the concentration of detergents becomes equal to CMC. 1
- Q3.** The rate law for a reaction between the substances A and B is given by, rate = $k[\text{A}]^n[\text{B}]^m$. On doubling the concentration of A and halving the concentration of B, the ratio of the new rate to the earlier rate of the reaction will be as 1
- a) $1/2^{(m+n)}$
- b) $(m+n)$
- c) $(n-m)$
- d) $2^{(n-m)}$
- Q4.** The linkage which holds various amino acid units in primary structure of proteins is 1
- a) Glycosidic linkage
- b) Hydrogen bond.
- c) Peptide linkage.
- d) Ionic linkage.
- OR**
- Which base is present in RNA but not in DNA? 1
- a) Cytosine.
- b) Guanine.
- c) Uracil
- d) Thymine.
- Q5.** In comparison to a 0.01 M solution of glucose, the depression in freezing point of a 0.01 M MgCl_2 solution is 1
- a) the same.
- b) about twice.
- c) about three times.
- d) about six times.

- Q6.** Which of the following statements is not suitable for the capacity of transition metal to form complex compounds ? 1
- a) Transition metal ions are small in size
 - b) Nuclear charge of transition metal ion is comparatively more.
 - c) Co-ordination covalent bond is not directional.
 - d) Transition metal ions possess variable oxidation states.

OR

- The pair that has similar atomic radii is 1
- a) Mn and Re
 - b) Ti and Hf
 - c) Mo and W
 - d) Sc and Ni

- Q7.** Gabriel phthalimide synthesis is used for the preparation of 1
- a) primary aromatic amines.
 - b) secondary amines.
 - c) aliphatic primary amines.
 - d) tertiary amines.

OR

- Reduction of aromatic nitro compounds using Fe and HCl gives 1
- a) aromatic oxime
 - b) aromatic hydrocarbon
 - c) aromatic primary amine
 - d) aromatic amide

- Q8.** The correct IUPAC name of $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ is 1
- a) Diamminedichloridoplatinum (II)
 - b) Diamminedichloridoplatinum (IV)
 - c) Diamminedichloridoplatinum (0)
 - d) Dichloridodiammineplatinum (IV)

OR

- Which of the following species is not expected to be a ligand? 1
- a) NH_4^+
 - b) NO
 - c) $\text{NH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
 - d) CO

- Q9.** Indicate the complex ion which shows geometrical isomerism. 1
- a) $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]^+$
 - b) $[\text{Pt}(\text{NH}_3)_3\text{Cl}]$
 - c) $[\text{Co}(\text{NH}_3)_6]^{3+}$
 - d) $[\text{Co}(\text{CN})_5(\text{NC})]^{3-}$

- Q10.** What should be the correct IUPAC name for Diethylbromomethane? 1
- a) 1-Bromo-1,1-diethylmethane
 - b) 3-Bromopentane
 - c) 1-Bromo-1-ethylpropane
 - d) 1-Bromopentane

- Q11. Which of the following statements is not true about glucose? 1
- a) It is an aldohexose.
 - b) On heating with HI it forms n-hexane.
 - c) It is present in furanose form.
 - d) It does not give 2,4-DNP test.

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.
- Q12. Assertion: All naturally occurring α -amino acids except glycine are optically active. 1
Reason: Most naturally occurring amino acids have D-configuration.
- Q13. Assertion: HNO_3 makes iron passive. 1
Reason: HNO_3 forms a protective layer of ferric nitrate on the surface of iron.
- Q14. Assertion : When methyl alcohol is added to water, the boiling point of water increases. 1
Reason : When a non volatile solute is added to a solvent elevation in the boiling point is observed.

OR

- Assertion : Sodium chloride cannot be used to clear snow on the roads. 1
Reason : Sodium chloride depresses the freezing point of water.
- Q15. Assertion: N, N-Diethylbenzene sulphonamide is insoluble in alkali. 1
Reason: Sulphonyl group attached to nitrogen atom is a strong electron withdrawing group.
- Q16. Assertion: Aldehydes and ketones, both react with Tollen's reagent to form silver mirror. 1
Reason: Both, aldehydes and ketones contain a carbonyl group.

SECTION B

- Q17. How will the following conversions be carried out in not more than 2 steps? 2
- a) Chloroethane to propan-1-amine.
 - b) Benzene to aniline.
- Q18. A solution containing 15 g urea (molar mass = 60g/mol) per litre of solution in water has the same osmotic pressure as a solution of glucose (molar mass = 180 g/mol) in water. Calculate the mass of glucose present in one litre of its solution. 2

Q19. i) Write the IUPAC name of coordination isomer of $[\text{Cu}(\text{NH}_3)_4][\text{PtCl}_4]$. 2

ii) On the basis of crystal field theory, write the electronic configuration of d^6 in terms of t_{2g} and e_g in an octahedral field when $\Delta_o < P$.

Q20. The half-life for radioactive decay of ^{14}C is 5730 years. An archaeological artifact containing wood had only 80% of the ^{14}C found in a living tree. Estimate the age of the sample. (log 5 = 0.6990 log 4 = 0.6021) 2

OR

Starting from 10 g of a radioactive element, 0.25 g was left after 5 years. Calculate rate constant for the decay of the radioactive element. (log 40 = 1.6021) 2

Q21. The rate of reaction, $2\text{NO} + \text{Cl}_2 \rightarrow 2\text{NOCl}$ is doubled when concentration of Cl_2 is doubled and becomes eight times when concentration of both NO and Cl_2 are doubled. Determine the order of the reaction. 2

Q22. a) Write the products formed when chlorobenzene is treated with methyl chloride in the presence of sodium metal and dry ether. 2

b) Write the structure of the alkene formed by dehydrohalogenation of 1-bromo-1-methylcyclohexane with alcoholic KOH .

OR

Explain why: 2

a) The dipole moment of chlorobenzene is lower than that of cyclohexyl chloride.

b) Alkyl halides though polar are immiscible in water.

Q23. Account for the following 2

i) Mn^{2+} is more stable than Fe^{2+} towards oxidation to +3 state.

ii) The enthalpy of atomization is lowest for Zn in 3d series of the transition elements.

Q24. i) Which alkyl halide from the following pair : $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$ and $\text{CH}_3\text{CH}(\text{Br})\text{CH}_2\text{CH}_3$ 2

a) is chiral

b) undergoes faster $\text{S}_{\text{N}}2$ reaction ?

ii) Out of $\text{S}_{\text{N}}1$ and $\text{S}_{\text{N}}2$ which reaction occurs with

a) inversion of configuration

b) racemisation ?

Q25. a) An alloy of gold and cadmium crystallizes with a cubic structure in which gold atoms occupy the corners and cadmium atoms fit into the face centres. Assign formula for this alloy. 2

b) What type of stoichiometric defect and non stoichiometric defect is shown by NaCl ?

OR

Pure silicon is an insulator. Silicon doped with phosphorous is a semiconductor. Silicon doped with gallium is also a semiconductor. Explain the difference between the two semiconductors? 2

SECTION C

- Q26.** i) (i) Calculate the spin magnetic moment of $M^{2+}(aq)$ ion. Atomic number (Z) = 27. 3
ii) Chromium is typical hard metal while mercury is liquid, explain.
iii) There is a close similarity in physical and chemical properties of the 4d and 5d series of the transition elements, much more than expected on the basis of usual family relationship. Explain why?

OR

- i) Name the element of 3d transition series which shows maximum number of oxidation states. Why does it show so? 3
ii) Which transition metal of 3d series has positive $E^\circ(M^{2+}/M)$ value and why?
iii) Out of Cr^{3+} and Mn^{3+} , which is a stronger oxidizing agent and why?
Q27. a) Arrange the following compounds in an increasing order of basic strength : 3
 $C_6H_5NH_2$, $C_6H_5N(CH_3)_2$, $(C_2H_5)_2NH$ and CH_3NH_2
b) Account for the following
i) Aniline is a weaker base than cyclohexyl amine.
ii) It is difficult to prepare pure amines by ammonolysis of alkyl halides.

OR

- a) Write the chemical equations involved in the following reactions: 3
(i) Hoffmann-bromamide degradation reaction
(ii) Carbylamine reaction
b) Give a chemical test to distinguish between Aniline and Benzylamine
Q28. An element crystallizes in a structure having fcc unit cell of an edge 200 pm. Calculate the density if 200 g of this element contains 24×10^{23} atoms. 3
Q29. a) Give one point of difference between Keratin and Insulin. 3
b) What type of bonding helps in stabilising the α -helix structure of proteins?
c) What is the structural difference between a nucleoside and a nucleotide?
Q30. i) Draw the molecular structures of the following: 3
a) BrF_3 b) XeF_6
ii) Write the conditions to maximize the yield of ammonia by Haber's process.

SECTION D

- Q31.** a) What happens when (2 + 3)
(i) Chlorine gas is passed through a hot concentrated solution of NaOH.
(ii) XeF_4 undergoes hydrolysis.
(Give the chemical equations involved).

- b) Account for the following observations:
 (i) SF₄ is easily hydrolysed but SF₆ is not .
 (ii) Chlorine water is a powerful bleaching agent.
 (iii) Bi(V) is a stronger oxidising agent than Sb(V)

OR

- a) Complete the following equations (2 + 3)
 i) XeF₄ + O₂F₂ →
 ii) C + H₂SO₄(conc) →
- b) Account for the following observations:
 i) NF₃ is an exothermic compound while NCl₃ is not.
 ii) HCl is a stronger acid than HF though fluorine is more electronegative than chlorine.
 iii) Sulphur in vapour state exhibits paramagnetism.
- Q32.** a) Two moles of organic compound A on treatment with a strong base gives two compounds B and C. Compound B on dehydrogenation with Cu gives A while acidification of C yields carboxylic acid D with molecular formula CH₂O₂. Identify A, B, C, D. Write reaction for conversion of A to B and C. (3 + 2)
- b) Write simple tests to distinguish between
 i) Benzoic acid and phenol
 ii) Propanal and propanone.

OR

- a) An organic compound A with molecular formula C₈H₁₆O₂ was hydrolysed with dilute sulphuric acid to give carboxylic acid B and an alcohol C. Oxidation of C with chromic acid also produced B. On dehydration C gives but-1-ene. Write equations for reactions involved (3 + 2)
- b) Account for the following:
 i) CH₃CHO is more reactive than CH₃COCH₃ towards reaction with HCN.
 ii) Carboxylic acid is a stronger acid than phenol.
- Q33.** i) A voltaic cell is set up at 25⁰ C with the following half cells: (3 + 2)
 Al/Al³⁺(0.0010M) and Ni⁺²(0.50M)/Ni
 Write the equation for the cell reaction that occurs when the cell generates an electric current and determine the cell potential. (Given E⁰Ni⁺²/Ni = -0.25V, E⁰Al³⁺/Al = -1.66V log 2 = 0.3010)
- ii) Define limiting molar conductivity. Why does conductivity of an electrolyte solution decrease with the decrease in concentration?

OR

- i) The electrical resistance of a column of 0.05 moles per litre NaOH solution of diameter 1 cm and length 50 cm is 5.55 X 10³ ohm. Calculate its resistivity, conductivity and molar conductivity. (3 + 2)
- ii) Define molar conductivity of a substance and depict how molar conductivity changes with change in concentration of solution, for weak and strong electrolytes graphically.