

Total No. of Printed Pages—12

HS/XII/Sc/Ch/OC/20

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CHEMISTRY

(Theory)

(Old Course)

Full Marks : 70

Time : 3 hours

The figures in the margin indicate full marks for the questions

General Instructions :

- (i) Write all answers in the Answer Script.
- (ii) Attempt all parts of a question together in one place.
- (iii) All questions are compulsory.
- (iv) Marks for each question are indicated against it.
- (v) Question No. **1** of Part—I is of Multiple-choice Type, containing eight part questions, each of $\frac{1}{2}$ mark. Choose and write the correct answer in the Answer Script from the four options given.
- (vi) Question Nos. **2** to **9** of Part—II are Very Short-answer Type Questions of 1 mark each. Answer these either in *one* sentence or in *one* word each, wherever applicable.
- (vii) Question Nos. **10** to **17** of Part—III are Short-answer Type—I Questions of 2 marks each. Answer these in about 20–30 words each, wherever applicable.

(2)

- (viii) Question Nos. **18** to **26** of Part—IV are Short-answer Type—II Questions of 3 marks each. Answer these in about 40–50 words each, wherever applicable.
- (ix) Question Nos. **27** to **29** of Part—V are Long-answer Type Questions of 5 marks each. Answer these in about 70–80 words each, wherever applicable.
- (x) Use of non-programmable ordinary Scientific Calculators and Log Tables is allowed.
- (xi) Mobile Phones and Pagers are not allowed inside the Examination Hall.

PART—I

1. Choose and write the correct answer for the following in the Answer Script : $\frac{1}{2} \times 8 = 4$
- (a) Colligative properties depend on
 - (i) the nature of the solute particles dissolved in the solution
 - (ii) the number of solute particles in the solution
 - (iii) the physical properties of the solute particles dissolved in the solution
 - (iv) the nature of the solvent particles
 - (b) In case of the electrolyte which dissociates in solution the van't Hoff's factor, i is
 - (i) >1
 - (ii) <1
 - (iii) $=1$
 - (iv) $=0$

(3)

- (c) The Tyndall effect associated with colloidal particles is due to
- (i) presence of electrical charge
 - (ii) scattering of light
 - (iii) absorption of light
 - (iv) reflection of light
- (d) The electrical charge on a colloidal particle is indicated by
- (i) Brownian movement
 - (ii) electrophoresis
 - (iii) ultramicroscope
 - (iv) molecular sieves
- (e) $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$ and $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$ are related to each other as
- (i) ionization isomers
 - (ii) linkage isomers
 - (iii) coordination isomers
 - (iv) hydrate isomers
- (f) The coordination number of Ni in $[\text{Ni}(\text{C}_2\text{O}_4)_3]^{-4}$ is
- (i) 3
 - (ii) 6
 - (iii) 4
 - (iv) 5

(4)

(g) Methyl bromide reacts with AgF to give methyl fluoride and AgBr. This reaction is called

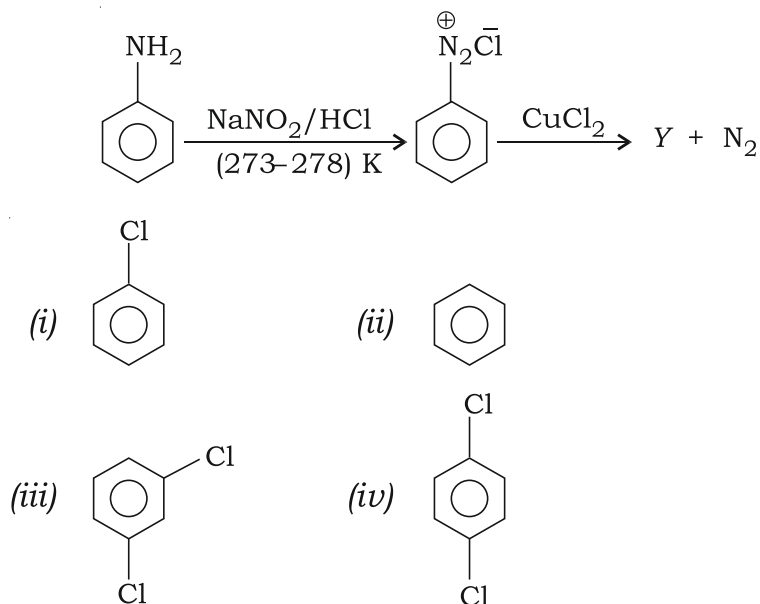
(i) Finkelstein reaction

(ii) Fittig reaction

(iii) Swarts reaction

(iv) Wurtz reaction

(h) Identify the compound Y in the following reaction :



PART—II

2. On heating a crystal of KCl in potassium vapour, the crystal starts exhibiting a violet colour. What is the colour due to?

1

3. A solid with cubic crystal is made of two elements P and Q. Atoms of Q are at the corners of the cube and P at the body-centre. What is the formula of the compound?

1

(5)

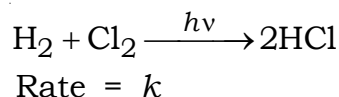
4. Convert benzene to *p*-chloronitrobenzene. 1
5. Which of the following isomers is steam volatile and why? 1
p-Nitrophenol and *o*-Nitrophenol
6. Arrange the following compounds in increasing order of their reactivity in nucleophilic addition reactions : 1
Ethanal, Propanal, Propanone, Butanone
7. Give reason why $C_6H_5NH_2$ is a weaker base than $CH_3CH_2NH_2$. 1
8. Write the equation of carbylamine reaction. 1
9. Write one difference between α -helix and β -pleated structures of proteins. 1

PART—III

10. An element with density 2.8 g cm^{-3} forms an f.c.c. unit cell with edge length $4 \times 10^{-8} \text{ cm}$. Calculate the molar mass of the element. Given, $N_A = 6.022 \times 10^{23}$. 2
11. *Either*
- (a) Define the following : 1+1=2
(i) Henry's law about dissolution of a gas in a liquid
(ii) Boiling point elevation constant for a solvent
- Or*
- (b) Define the following terms : 1+1=2
(i) Ideal solution
(ii) Azeotrope
12. When 2.56 g of sulphur was dissolved in 100 g of CS_2 , the freezing point lowered by 0.383 K. Calculate the formula of sulphur. (K_f for $CS_2 = 3.83 \text{ K kg mol}^{-1}$ and atomic mass of sulphur = 32 g mol^{-1}) 2

(6)

13. Consider the following reaction :



(a) Write the order and molecularity of this reaction. 1

(b) Write the unit of k . 1

14. Give reasons for the following features of transition metals : 1+1=2

(a) The transition metals and their compounds are usually paramagnetic.

(b) The transition metals exhibit variable oxidation states.

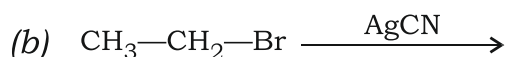
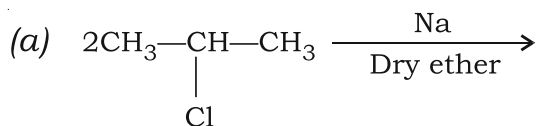
15. *Either*

(a) Explain on the basis of VBT why $[\text{Ni}(\text{CN})_4]^{-2}$ is diamagnetic, while $[\text{NiCl}_4]^{-2}$ is paramagnetic. (Atomic number of Ni is 28) 2

Or

(b) With the help of crystal field theory, predict the number of unpaired electrons in $[\text{Fe}(\text{CN})_6]^{-4}$ and $[\text{Fe}(\text{H}_2\text{O})_6]^{+2}$ complexes and hence, its magnetic character (Atomic number of Fe is 26) 2

16. Write the major products in the following reactions : 2



(7)

17. How will you convert—

- (a) nitrobenzene to aniline;
- (b) ethanoic acid to methenamine? 2

PART—IV

18. (a) For a reaction $R \rightarrow P$, half-life ($t_{1/2}$) is observed to be independent of the initial concentrations of reactants. What is the order of the reaction? 1
- (b) A first-order reaction takes 20 minutes for 25% decomposition. Calculate the time when 75% of the reaction will be completed. 2

19. *Either*

- (a) Define the following terms : 3
- (i) Electrophoresis
 - (ii) Adsorption
 - (iii) Shape-selective catalysis

Or

- (b) (i) Out of $MgCl_2$ and $AlCl_3$, which one is more effective in causing coagulation of negatively charged sol and why? 1
- (ii) Out of sulphur sol and protein, which one forms multimolecular colloids? 1
- (iii) Differentiate between adsorption and absorption. 1

(8)

20.

Either

- (a) Write the principle of vapour phase refining with the help of an example. 2
- (b) What is the role of limestone in the extraction of iron from its oxides? 1

Or

- (c) Name one chief ore each of copper and aluminium. Name the method used for the concentration of these two ores. 2
- (d) What is the role of depressant in froth floatation process? 1

21. Give reasons for the following : 1+1+1=3

- (a) Nitric oxide becomes brown when released in air.
- (b) PCl_5 is ionic in nature in the solid state.
- (c) Fluorine exhibits only -1 oxidation state, whereas other halogens exhibit $+1$, $+3$, $+5$ and $+7$ oxidation states also.

22. How would you account for the following? 3

- (a) Sc^{+3} is colourless in aqueous solution, whereas Ti^{+3} is coloured.
- (b) Atomic radii of $4d$ and $5d$ series elements are nearly same.
- (c) Mn^{+2} is more resistant than Fe^{+2} towards oxidation.

- 23.** (a) Write the mechanism of acid dehydration of ethanol to yield ether. 2
(b) How is toluene obtained from phenol? 1
- 24.** What happens when D-glucose is treated with the following reagents?
(a) HI
(b) Bromine water
(c) HNO_3
Give chemical equations. 3
- 25.** Write the names and structures of the monomers of the following polymers : 3
(a) Bakelite
(b) Buna-S
(c) PVC
- 26.** (a) Which one of the following is a food preservative? 1
Equanil, Morphine, Sodium benzoate
(b) Why is bithional added to soap? 1
(c) Which class of drug is used in sleeping pills? 1

PART—V

27.

Either

- (a) State Faraday's first law of electrolysis. How much charge in terms of faraday is required for the reduction of 1 mol of Cu^{+2} to Cu? 1+1=2

(10)

(b) Calculate the e.m.f. of the following cell at 298 K :



(Given, $E^\circ_{\text{cell}} = +2.71\text{ V}$, $1\text{ F} = 96500\text{ C mol}^{-1}$) 2

(c) What are fuel cells? 1

Or

(d) State and explain Kohlrausch's law of independent migration of ions. Why does the conductivity of a solution decrease with dilution? 2+1=3

(e) An aqueous solution of CuSO_4 was electrolyzed between platinum electrodes using a current of 0.1287 ampere for 50 minutes. (Atomic mass of $\text{Cu} = 63.5\text{ g mol}^{-1}$)

(i) Write the cathodic reaction.

(ii) Calculate—

(1) the electric charge passed during electrolysis;

(2) the mass of copper deposited at the cathode. 2

28. Either

(a) Account for the following : 3

(i) Interhalogens are more reactive than pure halogens.

(ii) N_2 is less reactive at room temperature.

(iii) Reducing character increases from NH_3 to BiH_3 .

(b) Draw the structures of the following : 1+1=2

(i) $\text{H}_4\text{P}_2\text{O}_7$ (Pyrophosphoric acid)

(ii) SF_6

(11)

Or

- (c) Write the balanced chemical equations for the following reactions : 2
- (i) Chlorine reacts with dry slaked lime.
- (ii) Carbon reacts with conc. H_2SO_4 .
- (d) Describe Ostwald's process for manufacture of nitric acid with special reference to the reaction conditions, catalysts used and the yield in the process. 3

29.

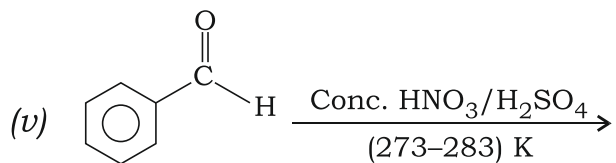
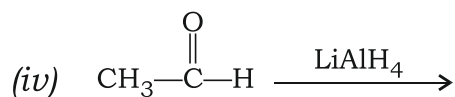
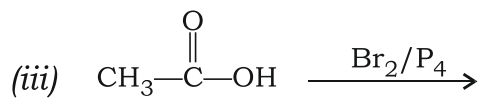
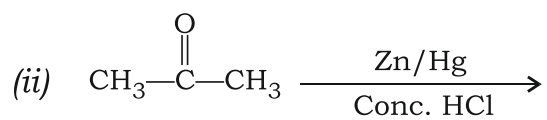
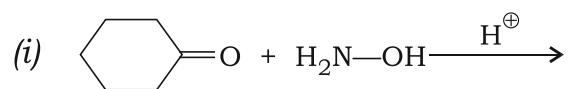
Either

- (a) Write the chemical equations to illustrate the following name reactions : 2
- (i) Rosenmund's reduction
- (ii) Cannizzaro's reaction
- (b) Out of
- $$\text{CH}_3-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_2-\text{CH}_3 \quad \text{and} \quad \text{CH}_3-\text{CH}_2-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$$
- which will give iodoform test? 1
- (c) Account for the following : 1+1=2
- (i) $\text{Cl}-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$ is a stronger acid than $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$.
- (ii) Carboxylic acids do not give reactions of carbonyl group.

(12)

Or

(d) Write the products of the following reactions : 5



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