Total No. of Printed Pages—12

HS/XII/Sc/Ch/OC/21

2021

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 ½ 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.

(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) There is no overall choice. However, an internal choice has been provided in two questions of *2* marks, three questions of *3* marks and two questions of *5* marks weightage. Students have to attend only one of the choices in such questions.

(xi) Use of non-programmable ordinary Scientific Calculators and Log Tables is allowed.

(xii) 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 : ½×8=4

(a) The number of atoms in b.c.c. arrangement is

(i) 1

(ii) 2

(iii) 3

(iv) 4

(b) To get *n*-type semiconductor, impurity to be added to silicon should have which of the following numbers of valence electrons?

(i) 2

(ii) 3

(iii) 1

(iv) 5

(c) The colloidal system in which the dispersed phase and the dispersion medium are both liquids is known as

(i) a gel

(ii) an aerosol

(iii) an emulsion

(iv) a foam

(d) The process of separation of dissolved impurities from colloids by passing through a suitable membrane is called

(i) filtration

(ii) electrophoresis

(iii) dialysis

(iv) ultrafiltration

(e) Which of the following is an example of unidentate and monodentate ligand?

(i) $H_2N—CH_2—CH_2—NH_2$

(ii) $C_2O_4^{-2}$

(iii) Cl^-

(iv) $H_2NCH_2COO^-$

(f) The coordination number of Pt in $[PtCl_6]^{2-}$ is

(i) 2

(ii) 6

(iii) 4

(iv) 8

(g) The deficiency of which of the following vitamins in our body causes night-blindness?

(i) Vitamin C

(ii) Vitamin D

(iii) Vitamin K

(iv) Vitamin A

(h) The coagulation of egg-white on boiling is a common example of

(i) denaturation of proteins

(ii) hydrolysis of proteins

(iii) solubility of proteins

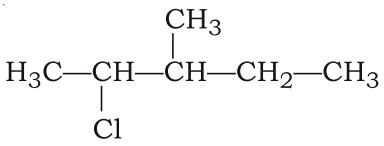
(iv) formation of proteins

PART—II

2. What are 'point defects' in crystalline substances? 1

3. In crystalline solids, what is a space lattice? 1

4. Write the IUPAC name of



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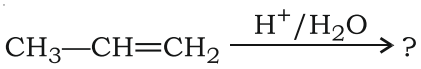
5. Arrange the following compounds in increasing order of their boiling points : 1

Bromomethane, Bromoform, Chloromethane, Dibromomethane

6. Write the structure of the major product of



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7. Write the structures of the functional groups in aldehydes and ketones. 1

8. Classify the following amines as primary or secondary :

CH_3NH_2 and $(CH_3)_2NH$ 1

9. Give one reaction to show the basic character of primary amines. 1

PART—III

10. Silver crystallises in f.c.c. lattice. If edge length of the cell is $4{\cdot}07 \times 10^{-8}$ cm and density is $10{\cdot}5$ gcm^{-3}, calculate the atomic mass of silver. (Given $N_A = 6{\cdot}022 \times 10^{23}\ mol^{-1}$). 2

11. Define the term 'solution'. Give one example of liquid solution. 2

12. *Either*

(a) Calculate the molarity of a solution containing 5 g of NaOH in 450 ml solution. (Mol. wt. of NaOH=40 $g\ mol^{-1}$) 2

Or

(b) Calculate the molality of $2{\cdot}5$ g of ethanoic acid ($C_2H_4O_2$) in 75 g of benzene (molar mass of $C_2H_4O_2$ = 60 $g\ mol^{-1}$). 2

13. Define speed/rate of a reaction. Give any one specific way of expressing the rate of a reaction. 2

14. *(a)* Name an element in the 3*d*-series of transition metals which is usually not regarded as a transition metal and write its electronic configuration. 1

(b) Which transition metal of the 3*d*-series exhibits the largest number of oxidation states and why? 1

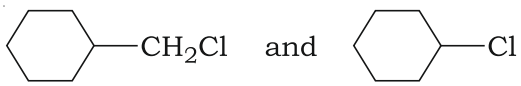
15. What are homoleptic and heteroleptic complexes? Give one example of each. 2

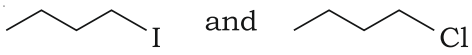
16. *Either*

(a) Why is chloroform ($CHCl_3$) stored in dark coloured bottles? 2

Or

(b) In the following pairs of halogen compounds, which would undergo S_N2 reaction faster and why?

(i)  1

(ii)  1

17. Why have primary amines (RNH_2) higher boiling point than tertiary amines (R_3N) of comparable molecular mass? 2

PART—IV

18. *(a)* Calculate the overall order of a reaction, which has the rate expression :

(i) Rate = $k[A]^{3/2}[B]^{1/2}$ 1

(ii) Rate = $k[A]^{3/2}[B]^{-1}$ 1

(b) The reaction $R \rightarrow P$ has zero order. Write the rate equation for this reaction. 1

19. *(a)* What are lyophilic and lyophobic sols? Write one example of each type. 2

(b) Write one difference between Homogeneous catalysis and heterogeneous catalysis. 1

20. *Either*

(a) What types of ores are roasted? 1

(b) Name the method used for refining of nickel. 1

(c) Why is pine-oil used in froth-floatation method? 1

Or

(d) Write the chemical reaction involved in the extraction of zinc from zinc oxide. How is it collected? 2

(e) Write one difference between 'pig iron' and 'cast iron'. 1

21. *Either*

(a) In the manufacture of H_2SO_4 by contact process, giving step-wise reactions, write the principle and conditions involved. 3

Or

(b) Why is dinitrogen less reactive at room temperature? 1

(c) In the manufacture of ammonia by Haber's process, give the equation involved and mention the optimum conditions required to maximise the yield of ammonia. 2

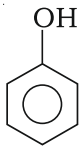
22. The magnetic moments of Sc^{3+} and Fe^{2+} are 0·00 BM and 4·90 BM. Which of these ions—

(a) has the maximum number of unpaired electrons and why;

(b) forms colourless aqueous solutions and why? 3

23. Write the structures of the products in the following reactions : 1+1+1=3

(a) $C_2H_5OH \xrightarrow[443\ K]{H_2SO_4} ?$

(b)  + Zn $\xrightarrow{Heat}$?

(c) $CH_3CH_2OCH_2CH_3 + HI \xrightarrow{373\ K} ?$

24. How are vitamins classified? Name the vitamin responsible for the coagulation of blood. 3

25. *Either*

(a) Explain the terms 'polymer' and 'monomer' with an example of each. 3

Or

(b) Write the names and structures of the monomers used for synthesizing the following polymers : 1+1+1

(i) Polythene

(ii) Teflon

(iii) Polyacrylonitrile

26. *(a)* What are soaps? 1

(b) Why do soaps not work in hard water? 2

PART—V

27. In the Daniel cell, the following redox reaction occurs :

$$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$$

Answer the following : 1×5=5

(a) Write the reduction half-cell reaction.

(b) Write the oxidation half-cell reaction.

(c) Write the half-cell reaction which acts as the anode.

(d) Write the half-cell reaction which acts as the cathode.

(e) Define galvanic cell.

28. *Either*

(a) Account for the following : 2+1+2=5

(i) Moist chlorine is a powerful bleaching agent for vegetable or organic matter

(ii) Formation of a black residue occurs when concentrated H_2SO_4 is added to a test tube containing cane sugar (a carbohydrate)

(iii) Anomalous behaviour of fluorine

Or

(b) *(i)* Which substances deplete the ozone layer in the upper atmosphere? 1

(ii) How is SO_2 responsible in producing acid rain? 1

(iii) Which gas is used in oxyacetylene welding? 1

(iv) Write the name and ratios of the two acids used for dissolving noble metals like Au, Pt, etc. 1

(v) Name the Gr 17 element used in sterilising drinking water. 1

29. *Either*

(a) Arrange the following compounds in the increasing order of their boiling points : 1

CH_3CHO, CH_3CH_2OH, CH_3OCH_3, $CH_3CH_2CH_3$

(b) What happens when (give equations only)— 1×4=4

(i) acetaldehyde (CH_3CHO) reacts with HCN;

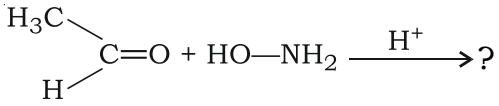
(ii) propanone reacts with CH_3MgI in the presence of H_2O/H^+;

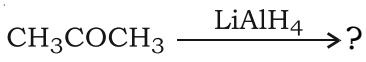
(iii) acetic acid (CH_3COOH) is heated in the presence of strong dehydrating agent such as P_2O_5;

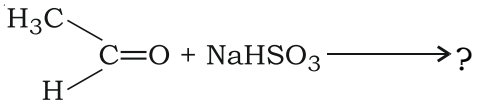
(iv) two moles of acetaldehyde (CH_3CHO) condense in the presence of NaOH.

Or

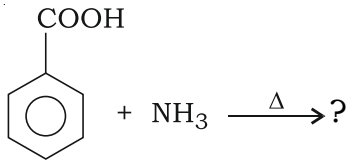
(c) Write the products of the following reactions : 1×5=5

(i) 

(ii) 

(iii) 

(iv) 

(v) 

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