Total No. of Printed Pages—12

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CHEMISTRY

Full Marks : 70

Time : 3 hours

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, 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.

(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.

(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.

(2)

(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.

(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 answers for the following in the Answer Script :   ½×8=4

(a) To get *p*-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

(b) In a face-centred cubic unit cell, the edge length is

(i) $\dfrac{4}{\sqrt{3}}r$

(ii) $\dfrac{4}{\sqrt{2}}r$

(iii) $2r$

(iv) $\dfrac{\sqrt{3}}{2}r$

(c) What is the oxidation state of Fe in $K_3[Fe(CN)_6]$?

    (i)   2

    (ii)   3

    (iii)   4

    (iv)   1

(d) Which of the following is not a complex compound?

    (i)   Potassium ferrocyanide

    (ii)   Potassium ferricyanide

    (iii)   Ferrous ammonium sulphate

    (iv)   Cuprammonium sulphate

(e) How many chiral compounds are possible on monochlorination of 2-methyl butane?

    (i)   2

    (ii)   4

    (iii)   6

    (iv)   8

(f) S_N2 mechanism proceeds through the intervention of

    (i)   carbonium ion

    (ii)   transition state

    (iii)   free radical

    (iv)   carbanion

(4)

(g) Gabriel phthalimide reaction is used for the preparation of

   (i) primary aromatic amines

   (ii) secondary amines

   (iii) aliphatic primary amines

   (iv) tertiary amines

(h) Which of the following compounds gives dye test?

   (i) Aniline

   (ii) Methylamine

   (iii) Diphenylamine

   (iv) Ethylamine

PART—II

2. Why is Frenkel defect not found in pure alkali metal halides?   1

3. What will happen if a patient is given hypertonic solution of glucose?   1

4. Give one example each of oil in water emulsion and water in oil emulsion.   ½+½=1

5. Arrange the following alkyl halides in order of increasing reactivity towards the nucleophilic substitution (S_N2) :   1

$$CH_3Cl, \quad (CH_3)_3CCl, \quad (CH_3)_2CHCl$$

6. Give the name with chemical formula of the reagent used for the distinction between primary, secondary and tertiary alcohols. ½+½=1

7. Write the structure of 5-chloro-4-methoxy-2-nitrobenzoic acid. 1

8. Primary amines have higher boiling points than tertiary amines. Why? 1

9. Which -amino acid is not optically active? 1

PART—III

10. *(a)* Aluminium crystallizes in a cubic close-packed structure. Its metallic radius is 125 pm. What is the length of the side of the unit cell? 1

(b) Why is potassium chloride sometimes violet instead of pure white? 1

11. What is reverse osmosis? Mention one of its applications. 1+1=2

12. *Either*

(a) The freezing point of 0·1 molal solution of CH_3COOH in benzene is 0·256 K (K_f 5·12 K m^{-1}). What conclusion will you draw about molecular state of CH_3COOH in C_6H_6? 2

Or

(b) A solution containing 18 g of a non-volatile solute in 200 g of H_2O freezes at 272·07 K. Find the molecular mass of the solute. (K_f 1·86 K m^{-1})   2

13. (a) Calculate the overall order of a reaction which has the rate expression

$$\text{Rate} = k[A]^{1/2}[B]^{3/2}$$ 1

(b) What is the rate determining step of a reaction?   1
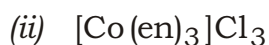
14.   *Either*

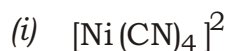(a) Explain why Ce^{4} is a good oxidizing agent whereas Sm^{2} is a good reducing agent.   2

Or

(b) You are supplied with a concentrated solution of Na_2CrO_4. How will you obtain $K_2Cr_2O_7$ from this? Write the equation involved.   2

15. (a) What do you mean by crystal field splitting?   1

(b) Write the IUPAC names of the following :   ½+½=1

   (i) $[Ni(CN)_4]^{2}$

   (ii) $[Co(en)_3]Cl_3$

16. *(a)* Explain why thionyl chloride $(SOCl_2)$ method is preferred for preparing alkyl chlorides from alcohols.   1

(b) For isomeric haloalkanes, the boiling point decreases with branching of chain. Why?   1
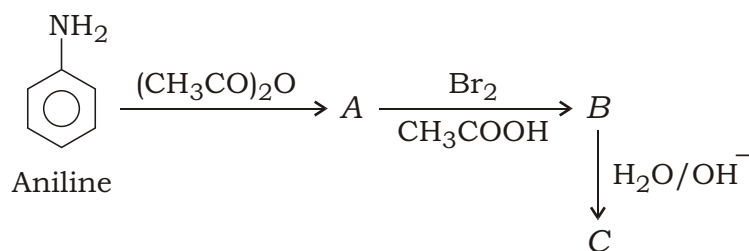
17.   *Either*

(a) Explain, with the help of chemical equations, how the following compounds would be obtained from benzene diazonium chloride :   1+1=2

    (i) Iodobenzene

    (ii) 4-Aminoazobenzene

               Or

(b) Complete the following reaction :

What will happen if aniline is treated with aqueous bromine? $1\frac{1}{2}+\frac{1}{2}=2$

(8)

PART—IV

18. *(a)* What is the order of reaction whose rate constant has the same unit as the rate of reaction?   1

    (b) Thermal decomposition of a compound is of first order. 50% decomposes in 120 minutes. How long will it take for 90% to decompose?   2

19. *(a)* Indicate a chemical reaction involving homogeneous catalyst.   1

    (b) What is Brownian movement?   1

    (c) Comment on the following statement :   1

     Colloid is not a substance but a state of substance.

20.   *Either*

    (a) What is the principle of zone refining?   1

    (b) What is flux? Give one example each of an acidic flux and a basic flux.   2

            Or

    (c) Why are metallic ores converted into oxide usually?   1

    (d) Discuss the process of leaching with reference to the extraction of aluminium.   2

(9)

21. *Either*

(a) N_2 is known whereas P_2 is not known. Why? 1

(b) Bleaching of flowers by chlorine is permanent while that by sulphur dioxide is temporary. Explain. 2

Or

(c) OF_2 should be called oxygen difluoride and not fluorine oxide. Why? 1

(d) H_2S acts only as a reducing agent but SO_2 acts both as a reducing agent as well as an oxidizing agent. Why? 2

22. (a) Why are Zn^2 salts white while Cu^2 salts are blue? 1

(b) What is meant by 'disproportionation'? Write the disproportionation reaction of Cu in aqueous solution. 2

23. (a) Give the chemical equation for the reaction of ethanol with conc. H_2SO_4 at 440 K. 1

(b) Convert phenol to salicylic acid (2-hydroxy-benzoic acid). 2

24. *(a)* Name one fibrous protein and one globular protein. 1

(b) What are the products obtained on hydrolysis of sucrose? 1

(c) What is the structural feature characterizing reducing sugars? 1

25.   *Either*

(a) Give the common and IUPAC name of the monomer of natural rubber. 1

(b) How is high density polythene obtained? What structural difference it has from low density polythene? 2

Or

(c) Name a copolymer which is used for making non-breakable plastic crockery. 1

(d) Write the names and give the structures of the monomers of Nylon-66. 2

26. *(a)* What is an antiseptic? Give one example. 1

(b) Name one narcotic and one non-narcotic analgesic. 1

(c) Name any two main categories of food additives. 1

PART—V

27. *(a)* Why limiting molar conductivity of CH_3COOH cannot be determined experimentally?   1

(b) How many coulombs of charge are required to produce 20·0 g of calcium from calcium chloride?   2

(c) What is a salt bridge? Give two functions of salt bridge.   1+1=2

28.   *Either*

(a) F-atom is more electronegative than I-atom, yet HF has lower acid strength than HI. Why?   1

(b) Explain why oxygen is a gas while other members of the same group are solids.   2

(c) For interhalogens of the type AX_n (*A*, *X* = halogen atoms; *n*   1 or 3 or 5 or 7), what relation exists between *A* and *X* ? How does their reactivity vary with individual halogens?   1+1=2

                Or

(d) Why does NO_2 dimerize?   1

(e) Draw the structure of $H_2S_2O_7$. What is the oxidation state of sulphur in it?   1+1=2

(f) Write the balanced chemical equations of the following :   1+1=2

   (i)   Excess of ammonia with chlorine

   (ii) Conc. H_2SO_4 with calcium fluoride

29.   *Either*

(a) Name one reagent used to distinguish acetaldehyde from acetone.   1

(b) Bring out the following conversions :   1+1=2

  (i) But-2-ene to ethanal
  (ii) Acetic acid to ethanal

(c) Why carboxylic acids do not give the characteristic reactions of carbonyl group?   2

Or

(d) What type of aldehydes and ketones undergo aldol condensation?   1

(e) Why does benzoic acid not undergo Friedel-Crafts reaction?   1

(f) Convert toluene to 3-nitrobenzoic acid.   1

(g) Identify the products *A*, *B*, *C* and *D* from the following reactions :   ½×4=2

  (i) $CH_3COCl \xrightarrow[\text{Boiling xylene}]{\text{Pd/BaSO}_4\text{/S}} A \xrightarrow{\text{K}_2\text{Cr}_2\text{O}_7\text{/H}^+} B$

  (ii) $CHCHO + NH_2NH_2 \longrightarrow C$
  $\qquad\qquad\qquad KOH \Big| \text{Glycol}$
  $\qquad\qquad\qquad\qquad \downarrow$
  $\qquad\qquad\qquad\qquad D$

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