Total No. of Printed Pages—15

HS/XII/Sc/Ch/15

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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.

(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.

(xii) General students are not allowed to attempt questions meant for Elementary School Teacher Candidates.

PART—I

1. Choose and write the correct answers for the following in the Answer Script : ½×8=4

(a) On doping germanium metal with a little of indium, one gets

(i) *p*-type semiconductor

(ii) *n*-type semiconductor

(iii) insulator

(iv) rectifier

(b) The empty space in the h.c.p. unit cell is

(i) 74%

(ii) 68%

(iii) 32%

(iv) 26%

(c) The colligative properties of a dilute solution depend upon the

(i) nature of the solute

(ii) nature of the solvent

(iii) number of particles of solute

(iv) number of particles of solvent

(d) In which mode of expression, the concentration of a solution remains independent of temperature?

(i) Molarity

(ii) Normality

(iii) Formality

(iv) Molality

(e) At high concentration of soap in water, soap behaves as

(i) molecular colloid

(ii) associated colloid

(iii) macromolecular colloid

(iv) lyophillic colloid

(f) Adsorption of gases on solid surface is generally exothermic because

(i) enthalpy is positive

(ii) entropy decreases

(iii) entropy increases

(iv) free energy increases

(g) The correct IUPAC name of $[Pt(NH_3)_2Cl_2]$ is

(i) diamminedichloridoplatinum(II)

(ii) diamminedichloridoplatinum(IV)

(iii) diamminedichloridoplatinum(0)

(iv) dichloridodiammineplatinate(IV)

(h) What kind of isomerism exists between $[Cr(H_2O)_6]Cl_3$ and $[Cr(H_2O)_5Cl]Cl_2\ H_2O$?

(i) Linkage isomerism

(ii) Solvate isomerism

(iii) Ionization isomerism

(iv) Coordination isomerism

PART—II

2. How many atoms are there in a unit cell of a metal crystallizing in f.c.c. structure? 1

3. What is the condition to be satisfied for a compound to be chiral? 1

4. Under what conditions, 2-methylpropene can be converted into isobutyl bromide (1-bromo-2-methylpropane) by hydrogen bromide? Write the correct reaction involved. 1

Or

(For Elementary School Teacher Candidates only)

Write the names of the reagent used when an unsymmetrical alkene reacts with hypohalous acid through *(i)* Markownikoff's rule and *(ii)* Anti-Markownikoff's rule. ½+½=1

5. What happens when phenol is warmed with CO_2 in presence of aqueous NaOH? 1

6. Why is the melting point of benzoic acid more than that of formic acid? 1

Or

(For Elementary School Teacher Candidates only)

Write the formula of any dicarboxylic acid and give its name. ½+½=1

7. What happens, when alkyl cyanides are completely hydrolyzed in presence of mineral acids? 1

Or

(For Elementary School Teacher Candidates only)

Complete the reaction : 1

$$CH_3 — CH_2 — C \equiv N \xrightarrow{Sn/HCl} ?$$

8. What happens, when benzenediazonium chloride solution is added slowly to boiling dil. mineral acid? 1

9. Name the vitamin whose deficiency causes pernicious anaemia. 1

PART—III

10. Explain why the molecular mass of NaCl determined by the elevation of boiling point method is half its actual molecular mass. 2

11. *Either*

(a) Give reason for "Addition of 1 mole of any volatile substance like methyl alcohol to 1 litre of water decreases the boiling point of the solution in comparison to pure water". 2

Or

(b) On addition of 0 643 g of a non-volatile compound to 50 ml of benzene (density = 0 879 g cm ^{3}) the freezing point is lowered from 5 51 C to 5 03 C. If K_f for benzene is 5 12, find the molar mass of the non-volatile compound. 2

Or

(For Elementary School Teacher Candidates only)

What is meant by lowering of vapour pressure? How does relative lowering of vapour pressure depend on number of moles of solute in a solution? 2

12. The unit cell of an element of atomic mass 96 has density 10 3 g cm ^{3} having cell edge 314 pm. Determine the type of crystal lattice (simple, cubic, b.c.c. or f.c.c.). 2

Or

(For Elementary School Teacher Candidates only)

Show that a body-centred cubic unit cell has two atoms per unit cell. 2

13. *Either*

(a) Derive the general expression for the rate constant *k* for a first-order reaction. 2

Or

(b) The initial concentration of N_2O_5 in the following first-order reaction

$$N_2O_5\ (g) \quad 2NO_2\ (g) \quad \frac{1}{2}\ O_2\ (g)$$

was 1 24 10 ^{2} mol L ^{1} at 318 K. The concentration of N_2O_5 after 60 minutes was 0 20 10 ^{2} mol L ^{1}. Calculate the rate constant of the reaction at 318 K. 2

14. *(a)* Name the *d*-block element which is known in liquid state under ordinary conditions and write its outermost electronic configuration. 1

(b) What is the highest oxidation state possible for the element with atomic number 23? 1

15. Explain why tetrahedral Ni(II) complexes are paramagnetic but square planar Ni(II) complexes are diamagnetic. 2

Or

(For Elementary School Teacher Candidates only)

What is a ligand? Give an example of a bidentate and an ambidentate ligand. 1+½+½=2

16. How will you carry the following conversion? 2

$$C_6H_5Cl \longrightarrow p\text{-}C_6H_4\begin{matrix}NO_2\\OH\end{matrix}$$

17. *(a)* Acetamide is a weaker base than ethylamine. Explain. 1

(b) Complete the following reaction : 1

$$C_6H_5NH_2 \quad CHCl_3 \quad 3KOH\ (alc) \qquad ?$$

PART—IV

18. *(a)* Define pseudo first-order reaction. Give an example. 1

(b) The time required for 10% completion of a first-order reaction at 298 K is equal to that required for its 25% completion at 308 K. Calculate the energy of activation. 2

Or

(For Elementary School Teacher Candidates only)

What is meant by half-life period of a chemical reaction? Give the expression for half-life of a first-order reaction. 1+1=2

19. *Either*

(a) State Hardy-Schulze law. 1

(b) What are the differences between physisorption and chemisorption? (Mention at least two differences.) 1

(c) How does bleeding from a wound stop by applying alum? 1

Or

(d) What is Brownian movement? Mention one of its applications. 1½+½=2

(e) Why is the colour of the sky blue? 1

20. How can you extract blister copper from copper pyrites? Give the chemical reactions involved in the process. 3

Or

(For Elementary School Teacher Candidates only)

Write the names and formulae of two ores of copper. How can you obtain pure copper from blister copper? 2+1=3

21. *Either*

(a) How does permanganate solution react with Fe(II) ions? Write balanced ionic equation for the reaction. 2

(b) Why transition metals and many of their compounds act as good catalyst? 1

Or

(c) What are lanthanoids? Give their general electronic configurations. What is lanthanoid contraction? 3

22. *Either*

(a) Arrange the following compounds in increasing order of acidity : 1

H_2O, C_2H_5OH and phenol

(b) How can the following pair be chemically distinguished? 2

Phenol and Ethyl alcohol

Or

(c) Write the structural formulae of all possible ethers having the molecular formula $C_4H_{10}O$ and give their IUPAC names. 2

(d) Why are boiling points of ethers lower than those of alcohols? 1

23. *(a)* What is glycosidic linkage? 1

(b) What are nucleic acids? Mention their two important biological functions. 2

Or

(For Elementary School Teacher Candidates only)

Write the full form of DNA and RNA. Name the specific nitrogenous bases present in DNA and RNA.

½+½+1+1=3

24. *(a)* What are the monomer units of the polymer Nylon-2-Nylon-6? Is this polymer biodegradable? 2

(b) What are elastomers? Give one example. 1

Or

(For Elementary School Teacher Candidates only)

What is the difference between 'addition' and 'condensation' polymers? Give one example of each type. 1+1+½+½=3

25. *(a)* What is antibiotic? Write the name of first anitibiotic discoverd. 1

(b) Give one example of an artificial sweetener used by diabatic patients. 1

(c) What are antioxidants? 1

26. *(a)* H_2S is less acidic than H_2Te, why? 1

(b) What happens, when—

(i) conc. H_2SO_4 is added to calcium fluoride;

(ii) SO_3 is passed through water? 1+1=2

PART—V

27. *Either*

(a) Define specific conductivity and molar conductivity for the solution of an electrolyte. How do they vary with dilution? 3

(b) Calculate $_m$ for NH_4OH, given that values of $_m$ for $Ba(OH)_2$, $BaCl_2$ and NH_4Cl are 523·28, 280·0 and 129·8 S cm^2 mol ^{1} respectively. 2

Or

(c) What is corrosion? Give the mechanism of rusting of iron. 3

(d) In the button cell commonly used in electronic gadgets, the following reaction takes place :

$$Zn\ (s)\quad Ag_2O\ (s)\quad H_2O\ (l)$$
$$Zn^2\ (aq)\quad 2Ag\ (s)\quad 2OH\ (aq)$$

where,

$E_{Zn\ ^2/Zn}$ 0 76 V and $E_{Ag\ /Ag}$ 0 80 V

Write the cell representation and calculate the value of E and G for the reaction. 2

28. *Either*

(a) Although electron gain enthalpy of fluorine is less negative as compared to chlorine, fluorine is stronger oxidizing agent than chlorine. Why? 2

(b) Dry chlorine does not act as a bleaching agent. Why? 1

(c) Why is H_3PO_4 tribasic and H_3PO_3 dibasic? Explain with the help of structures. 2

Or

(d) Why is ICl more reactive than I_2? 1

(e) Nitrogen exists as diatomic molecule N_2 and phosphorus as P_4. Why? 1

(f) Write the principle and conditions involved giving stepwise reactions in the manufacture of H_2SO_4 by contact process. 3

29. *(a)* An organic compound with molecular formula $C_9H_{10}O$ forms 2,4-DNP derivative, reduces Tollen's reagent and undergoes Cannizaro's reaction. On vigorous oxidation it gives 1,2-benzene dicarboxylic acid. Identify the compound. 3

(b) How will you bring about the following conversions in not more than two steps? 1+1=2

(i) Propanone to propene

(ii) Benzoic acid to benzaldehyde

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