Total No. of Printed Pages—14

HS/XII/Sc/Ch/14

2014

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.

PART—I

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

(a) In physical adsorption gas molecules are bound on the solid surface by

(i) chemical forces

(ii) electrostatic forces

(iii) van der Waals forces

(iv) gravitational forces

(b) The *p-p-p* angle in white phosphorus (P_4) is

(i) 120°

(ii) 60°

(iii) 90°

(iv) 109 28

(c) The letter D in carbohydrates signifies

(i) dextrorotatory

(ii) its relative configuration

(iii) mode of synthesis

(iv) laevorotatory

(d) The hormone released when there is stress or danger is

(i) estrogen

(ii) progesterone

(iii) oxytocin

(iv) adrenaline

(e) Peptization is the process of

(i) passing of freshly prepared precipitates into colloidal state

(ii) depositing colloidal particles as precipitates

(iii) formation of peptide bonds

(iv) breaking of peptide bonds

(f) Bleaching action of

$$\underset{\text{(bleaching powder)}}{Ca(OCl_2)_2\ CaCl_2\ Ca(OH)_2\ 2H_2O}$$

is due to

(i) reduction and is permanent

(ii) oxidation and is permanent

(iii) substitution and is temporary

(iv) oxidation and is temporary

(g) Antipyretics are medicine which

(i) lower body temperature

(ii) relieve pain

(iii) control malaria

(iv) can kill harmful organism in the body

(h) Which of the following is an example of aldohexose?

(i) Ribose

(ii) Fructose

(iii) Sucrose

(iv) Glucose

PART—II

2. What is the relationship between the edge length (a) of the unit cell and the radius (r) of an atom in a face-centred unit cell? 1

3. What are emulsions? 1

4. Write the IUPAC name of $[Co(NH_3)_5ONO]Cl_2$. 1

5. Arrange the following halides in order of increasing S_N2 reactivity : 1

$(CH_3)_3CCl$, CH_3Cl, CH_3Br, CH_3CH_2Cl, $(CH_3)_2CHCl$

6. How will you distinguish between propan-1-ol and 2-methyl propan-2-ol? 1

7. Arrange the following in the increasing order of their acid strengths : 1

Benzoic acid, 4-nitrobenzoic acid, 3,4-dinitrobenzoic acid, 4-methoxybenzoic acid

8. Write down the classification of polymers on the basis of intermolecular forces. 1

9. What is carbylamine reaction? 1

PART—III

10. Find the equilibrium constant of the following reaction at 298 K :

Cu (s) 2Ag (aq) Cu^2 (aq) 2Ag (s) ;

E_{cell} 0 46 V

Identify the cathode and anode in the cell. 2

11. Prove that the time taken to complete 50% of a first-order reaction is independent of the initial concentration. 2

12. *(a)* What do x and m represent in the adsorption isotherm expression $x / m \quad kP^{1/n}$? 1

(b) What happens, when $Fe(OH)_3$ sol and As_2O_3 sol are mixed with each other? 1

13. *Either*

(a) Write the balanced chemical equation for the reaction of Cl_2 with hot concentrated NaOH. Is this reaction a disproportionation reaction? Justify. 2

Or

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

(ii) Identify X in the following reaction : 1

$Cl_2 \quad 2X \qquad 2Cl \qquad X_2$

14. Why do Zr and Hf exhibit similar properties? What is the outermost electronic configuration of these elements? 2

15. *Either*

(a) Explain on the basis of valence bond theory, why $[Ni(CN)_4]^{2}$ is square planar and diamagnetic. [At. No. of Ni = 28] 2

Or

(b) Explain with the help of crystal field theory, why $[Ti(H_2O)_6]^{3}$ is coloured while $[Sc(H_2O)_6]^{3}$ is colourless. [Atomic No. of Ti = 22 and Sc = 21] Calculate the spin only magnetic moment of these two complex ions. 2

16. *(a)* Write equations for the synthesis of PVC. 1

(b) Write down the structure of the monomers present in unbreakable plastic crockery. 1

17. Match items of *Column—A* and *Column—B* : ½×4=2

Column—A	*Column—B*
Antioxidant	Dopamine
Dyes	Butylated hydroxyl toluene (BHT)
Analgesic	Malachite green
Neurotransmitters	Paracetamol

PART—IV

18. *(a)* An iron oxide crystallizes in hcp array of oxygen with two out of three vacant octahedral voids occupied by iron. Give the formula of iron oxide. 2

(b) Frenkel defect is not found in pure alkali metal halide. Why? 1

19. *(a)* Three electrolytic cells containing $ZnSO_4$, $AgNO_3$ and $CuSO_4$ were connected in series. A steady current of 1 5 A was allowed to pass through them till 1 45 g of Ag is deposited. How long did the current flow? What weight of Cu and Zn were deposited? (Atomic mass of Ag = 108, Cu 63 5 and Zn 65 3) 2

(b) Can we keep $AgNO_3$ solution in a copper container? 1

[$E_{Cu^{2}\ /Cu}$ 0 34 V, $E_{Ag\ /Ag}$ 0 80 V]

20. *(a)* Find the order of the reaction if the units of rate constant k is mol $^{1/2}$ L $^{1/2}$ s ^{1}. 1

(b) The rate constant of a reaction is 1 5 10^{7} s ^{1} at 50 °C and 4 5 10^{7} s ^{1} at 100 °C. Calculate the activation energy, E_a for the reaction. [R 8 314 J K ^{1} mol ^{1}] 2

21. *Either*

(a) What are calcination and roasting? In which type of ores are these processes used? 1+1=2

(b) Which metals are generally extracted by electrolytic processes? What position these metals occupy in the periodic table? 1

Or

(c) What types of metals are likely to exist in native state in nature? Give examples. 1

(d) Write the chemical reactions involved in the blast furnace during the extraction of iron from haematite. 2

22. *Either*

(a) Sc^3 is more stable than Sc^2 . Why?
[At. No. of Sc = 21] 1

(b) Write the chemical reaction of hydrogen sulphide with acidified potassium dichromate. Draw the structure of dichromate ion. 2

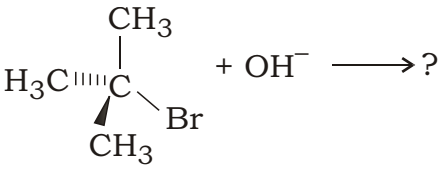
Or

(c) How is potassium permanganate obtained from pyrolusite ore? Write the structure of MnO_4 ion. 2+1

23. *(a)* Identify all possible alkenes that would be formed on dehydrohalogenation of 2-chloropentane with alcoholic KOH. Also identify the major alkene : 1½

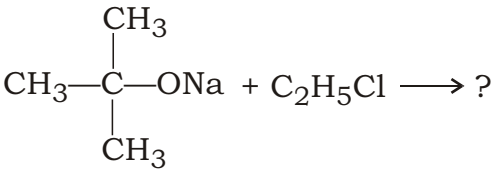
$$CH_3—CH_2—\underset{\displaystyle H}{\underset{|}{CH}}—\underset{\displaystyle Cl}{\underset{|}{CH}}—\underset{\displaystyle H}{\underset{|}{CH_2}} \xrightarrow{\text{Alcoholic KOH}} ?$$

(b) Write the products of the following reaction which is a first-order reaction giving the steps involved : 1½

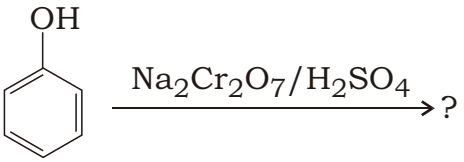


24. Complete the following reactions : 1+1+1

(i)



(ii)

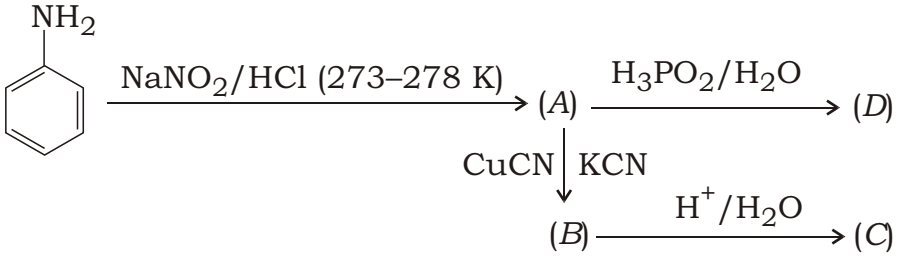


(iii) $C_6H_5OCH_3 \xrightarrow{HI} ?$

25. *Either*

(a) Explain why aniline does not undergo Friedel-Crafts reaction? 1

(b) Identify the compounds *(A)* and *(B)* in the following sequence of reactions : ½×4=2



Or

(c) Why are aliphatic amines more basic than aromatic amines? 1

(d) Why aromatic primary amines cannot be prepared by Gabriel phthalimide synthesis? 1

(e) Complete the following reaction : 1

$$C_6H_5NH_2 \quad C_6H_5OH \xrightarrow{NaNO_2/HCl\ (273\ \ 278\ K)} \ ?$$

26. *Either*

(a) Write the names of anomers of glucose. 1

(b) What are essential amino acids? 1

(c) Name the two types of heterocyclic nitrogenous base present in nucleotide. 1

Or

(d) What are reducing sugars? 1

(e) Which linkage is present between the two units of monosaccharides in disaccharides? Name the disaccharide present in milk. 2

PART—V

27. *Either*

(a) A solution of NaOH is made by dissolving 0 8 g of it in 100 ml of its solution. Calculate the molarity of the solution. 1

(b) What is the effect of addition of non-volatile solute to the vapour pressure of a pure liquid? Give reasons for your answer. 2

(c) Calculate the molar mass of a substance 1 3 g of which when dissolved in 169 g of water gave the solution which will boil at 100 025 °C at 1 atm. (K_b 0 52 Km ^{1}) 2

Or

(d) Calculate the molarity and molality of a 15% solution (by weight) of H_2SO_4 of density 1 020 g cm ^{3}. 2

(e) State Henry's law on solubility of gases in liquid. Why do we see effervescence when a cold drink bottle is opened? 2

(f) Molar mass of CH_3COOH in aqueous solution as determined by the use of colligative properties is approximately double of the expected value. Why? 1

28. *Either*

(a) Write down the steps involved in the manufacture of HNO_3 by Ostwald process. 2

(b) Draw the structure of $HClO_4$. What is the oxidation number of Cl in this compound? Write the formula of oxyacid of Cl in its +5 oxidation state. 2

(c) Write the reaction of XeF_4 with H_2O. 1

Or

(d) Write down the preparation of ozone from oxygen. Mention the conditions required to maximize the yield of ozone. 2

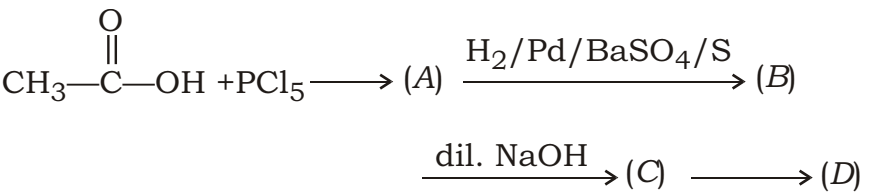
(e) Write the structural formula of PCl_5 in solid state and also indicate the hybridisation of phosphorus atoms. 2

(f) What happens, when sulphur is treated with conc. HNO_3? 1

29. *(a)* Explain why aromatic aldehydes and ketones are less reactive than aliphatic aldehydes and ketones towards nucleophilic reagents. 1

(b) Why are carboxylic acids more acidic than phenols? Explain on the basis of resonance. 2

(c) Identify the compounds *(A)* to *(D)* in the following sequence of reactions : ½×4=2



$$CH_3-\overset{\overset{O}{\|}}{C}-OH + PCl_5 \longrightarrow (A) \xrightarrow{H_2/Pd/BaSO_4/S} (B)$$

$$\xrightarrow{\text{dil. NaOH}} (C) \longrightarrow (D)$$

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