

2022

CHEMISTRY

(Theory)

Full Marks : 70

Pass Marks : 21

Time : Three hours

All the questions are compulsory.

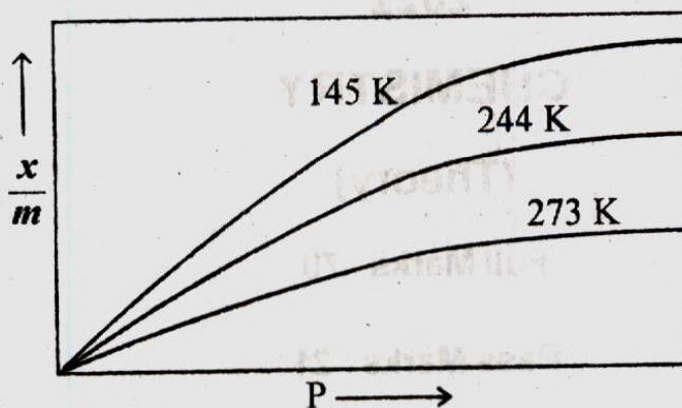
The figures in the right margin indicate full marks for the questions.

Question Nos. 1 – 10 are Very Short Answer (VSA) types of 1 mark each.

1. What is Williamson synthesis ? 1
2. Name the naturally occurring α -amino acid which is optically inactive. 1
3. What is pig iron ? 1
4. Write IUPAC name of the coordination isomer of the compound, $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$. 1
5. The rate constant of a reaction is $2 \times 10^{-2} \text{s}^{-1}$. What is the order of the reaction ? 1
6. A hydrocarbon C_5H_{10} does not react with chlorine in dark but gives a single monochloro compound $\text{C}_5\text{H}_9\text{Cl}$ in bright sunlight. Identify the hydrocarbon. 1

P.T.O.

7. Consider the adsorption isotherms given below and interpret the variation in the extent of adsorption (x/m) when temperature increases at constant pressure. 1



8. How will you convert phenol into salicylaldehyde? 1
9. How do you explain the amphoteric behavior of α -amino acids? 1
10. Why do soaps not work in hard water? 1

Questions 11–14 are Objective types carrying 1 mark each. Choose and rewrite the best answer out of the given alternatives.

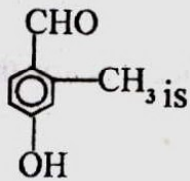
11. For the reaction $A + B \longrightarrow \text{Product}$, it is found that the reaction order with respect to A and B are 2 and 3 respectively. When the concentrations of both A and B are doubled up, the rate increases by a factor of 1
- A. 10
- B. 16
- C. 32
- D. remains unchanged

12. Hardening of leather in tanning industry is based on 1

- A. Electrophoresis
- B. electroosmosis
- C. thermosetting
- D. mutual coagulation

13. Among the following which is the strongest oxidising agent ? 1

- A. F_2
- B. Cl_2
- C. Br_2
- D. I_2

14. The IUPAC name of the compound  is 1

- A. 4-Formyl-3-methylphenol
- B. 4-Hydroxy-2-methylbenzaldehyde
- C. 2-Formyl-5-hydroxytoluene
- D. 4-Hydroxy-6-methylbenzaldehyde

Question Nos. 15 – 24 are Short Answer (SA-II) types of 2 marks each.

15. Write the two parameters used to characterise a unit in three dimensions. 2

16. The composition of a sample of Wustite is $Fe_{0.93}O_{1.00}$. Calculate the percentage of Fe^{+3} ions in this crystal of Wustite. 2

17. For a solution containing non-volatile solute, show that relative lowering of vapour pressure is equal to the mole fraction of the solute. 2
18. What are homogeneous catalysis and heterogeneous catalysis? 2
19. Make a sequence of steps for the extraction of zinc from zinc blende. 2
20. Why does O_3 act as a powerful oxidising agent? Write the equation of oxidising action of O_3 on lead sulphide. 2
21. What are transition elements? Write the general electronic configuration of transition elements. 2
22. Using Valence Bond Theory (VBT), explain the formation of the complex ion $[Ni(CN)_4]^{2-}$. 2
23. How are vitamins classified? Name the vitamin responsible for the coagulation of blood. 2
24. What are analgesics? Give an example of non-narcotic analgesics. 2

Question Nos. 25–31 are Short Answer (SA-I) types of 3 marks each.

25. The freezing point depression of 0.1 molal solution of acetic acid in benzene is 0.256K. What conclusion can you draw about the molecular state of acetic acid in benzene?
 $[K_f \text{ for benzene} = 5.12 \text{ K kg mol}^{-1}]$ 3
26. Write integrated rate equation for zero order reaction, $R \rightarrow P$. Show that half-life period of zero order reaction is directly proportional to the initial concentration of the reactant. 3

27. What is lanthanoid contraction ? What are the consequences of lanthanoid contraction ? 3
28. "For optically active haloalkanes, S_N2 reactions are accompanied by inversion of configuration while S_N1 reactions are accompanied by racemisation". Justify the statement by taking the reaction :
 2-Bromobutane + $\text{OH}^- \rightarrow$ Butan-2-ol + Br^- 3
29. What is Lucas reagent ? How can you distinguish between Butan-2-ol and 2-Methylpropan-2-ol by Lucas reagent ? 3
30. Complete the following reactions : 3
- (i) $\text{C}_6\text{H}_5\text{NH}_2 + \text{CHCl}_3 + \text{KOH}(\text{alc.}) \rightarrow$
- (ii) $\text{C}_6\text{H}_5\text{CONH}_2 + \text{Br}_2 + \text{NaOH}(\text{aq}) \rightarrow$
- (iii) $\text{C}_6\text{H}_5\text{N}_2\text{Cl} \xrightarrow{\text{Cu}_2\text{Br}_2/\text{HBr}}$
31. What is the monomer of natural rubber ? Give one example each of polyamide and polyester polymer. 3

Questions from 32 – 34 are Essay (E) types of 5 marks each.

32. State Faraday's laws of electrolysis. Two electrolytic cells A and B containing electrolytes CuSO_4 and ZnSO_4 respectively were connected in series. A steady current of 2 ampere was passed through them until 0.635g of copper were deposited at the cathode of cell A. How long did the current flow ? What mass of zinc were deposited at the cathode of cell B ?

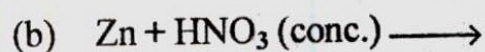
[At.wts. of Cu = 63.5, Zn = 65.3] 5

OR

Differentiate between electrolytic cell and galvanic cell. Write overall cell reaction of the cell: $\text{Zn(s)} \mid \text{Zn}^{2+}(0.1\text{M}) \parallel \text{Cu}^{2+}(1.0\text{M}) \mid \text{Cu(s)}$

If the measured emf, (E_{cell}) at 25°C for the above cell is 1.3V , find the standard emf, (E°_{cell}) for the cell. 5

33. Write the steps involved in the manufacture of nitric acid by Ostwald's process and complete the following reactions :



3+2=5

OR

Account for the following observations :

(i) Nitrogen (N_2) is a fairly inert gas.

(ii) Ammonia is a good complexing agent.

(iii) Elements of oxygen family are called chalcogens.

(iv) Inter halogen compounds are more reactive than halogens (except fluorine).

(v) Helium is used in filling balloons for meteorological observations. 5

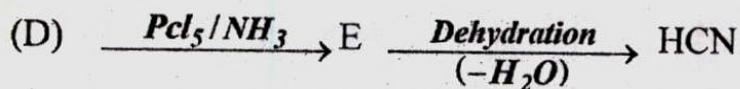
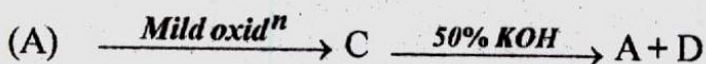
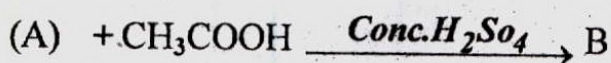
34. An organic compound A ($\text{C}_9\text{H}_{10}\text{O}$) forms an orange red precipitate B with 2,4-DNP reagent. On heating with iodine in the presence of NaOH , compound A

gives yellow precipitate C along with a colourless compound D. The compound A does not reduce Tollen's reagent or Fehling's solution and does not decolourise bromine water or Baeyer reagent. On drastic oxidation with chromic acid, compound A gives a carboxylic acid E(C₇H₆O₂). Deduce the structure of the compounds A to E.

5

OR

Identify (A) to (E) in the following sequence of reactions and write their IUPAC names.



5