

CHEMISTRY FOR IIT-JEE

Conducted by:

G.D. VARMA

Model Test Paper

PART-I

(Answer all questions.)

QUESTION 1

- (a) Fill in the blanks choosing words from the following:
[twelve, positional, gem, condensation, amino acids, decreases, increases, less, indicate, vicinal, more, white, different, same, functional] [5]
- (i) Proteins are _____ polymers of _____.
 - (ii) The half-life of a first order reaction _____ with increase of temperature.
 - (iii) An element crystallizes in closed packed hexagonal crystals. The coordination number of its atom is _____.
 - (iv) _____ isomerism is not shown by aliphatic aldehydes.
 - (v) A _____ diol has two hydroxyl groups on _____ carbon atom.
- (b) State whether the following statements are true or false. If false correct them. [5]
- (i) Hydrolysis of ester in presence of a dilute acid is known as saponification.
 - (ii) The basicity of NH_2^- group is more than that of Cl^- group, therefore, amides are more reactive than acid chlorides.
 - (iii) Ozone is a compound of oxygen.
 - (iv) For a dilute solution, Raoult's law states that the lowering of vapour pressure is equal to the mole fraction of the non-volatile solute.
 - (v) The electric charge for electrode deposition of one gram equivalent of substance is charge on one mole of electrons.
- (c) Explain the following in one sentence: [5]
- (i) The second and third transition series elements have very similar atomic radii.
 - (ii) Sodium metal can be used for drying diethyl ether but not ethyl alcohol.
 - (iii) Boiling point of water is more than hydrogen sulphide.
 - (iv) pH of ammonium hydroxide decreases with addition of ammonium chloride to it.
 - (v) Electrode potential of anode of a galvanic cell decreases when electrolyte concentration in anode chamber increases.
- (d) Give the balanced equations for the following reactions. Name the products formed. [5]

- (i) Ethanol is treated with acetic acid in presence of concentrated sulphuric acid.
- (ii) Phenol is heated with carbon dioxide at 125°C under a pressure of six atmospheres.
- (iii) Ethyl amine is treated with alkaline chloroform solution.
- (iv) Benzamide is treated with sodium hypobromite solution.
- (v) Iodine is added to a solution of potassium iodide.

PART-II

(Answer six questions choosing two from Section A, two from Section B and two from Section C.)

SECTION A

(Answer any two questions.)

QUESTION 2

- (a) (i) Dissociation of N_2O_4 to NO_2 is a reversible endothermic reaction.
 - (1) State whether the amount of NO_2 in the equilibrium mixture is increased or decreased when the temperature is raised.
 - (2) What is the effect of pressure on the equilibrium mixture?
- (ii) What is the number of tetrahedral void in a unit cell of a cubic close packed structure?
- (iii) What is the Brönsted definition of acids and bases? [3]
- (b) 3 moles of an ideal gas at 10 atm pressure is placed in a vessel of volume 50 litres. The gas absorbed 32.65 kilocalories of heat when it expanded to 100 litres at 5 atm pressure. Calculate the work done and the change in internal energy of the gas. [4]
- (c) (i) The vapour pressure of dilute aqueous solution of cane sugar ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$) is 750 mm of mercury at 373 K. Calculate the mole fraction of the solute.
- (ii) Derive qualitatively, the relation between osmotic pressure and the molecular weight of the solute. [3]

QUESTION 3

- (a) (i) Outline the main characteristics of a crystalline solid and an amorphous solid.
- (ii) Why is the co-ordination number 12 not found in ionic crystal?
- (iii) How would you prove that the number of atoms/molecules per unit cell is one, four for the simple cube and face centred unit cell respectively.
- (iv) What is the co-ordination number of carbon atoms in graphite? [4]
- (b) (i) What is the difference between molecularity and order of a reaction?
- (ii) The specific reaction rate of a chemical reaction at 273 K and 303 K are respectively 2.45×10^{-5} and 1.62×10^{-4} . Calculate the energy of activation of this reaction. [3]
- (c) (i) State law of mass action.
- (ii) When a graph is plotted between $\log K$ versus $1/T$ for a first order reaction, a straight line is formed. What is the slope of the line? [3]

QUESTION 4

- (a) Explain the following:
 - (i) A 0.01 M acetic acid has higher pH value than a 0.01 M hydrochloric acid.

- (ii) Suspension of calcium oxalate dissolves on addition of hydrochloric acid.
- (iii) The strength of weak acid increases with dilution. [3]
- (b) (i) Calculate the e.m.f. of the following cell:
 $\text{Al}/\text{Al}^{+3} (0.1 \text{ M}) \parallel \text{Al}^{+3} (0.2 \text{ M}) \mid \text{Al}$
- (ii) Certain standard reduction potentials are listed below:
 $\text{A}^{+2}/\text{A} = -0.763 \text{ V}$, $\text{B}^{+2}/\text{B} = -0.440 \text{ V}$
 $\text{H}^{+}/\text{H}_2(\text{g})/\text{Pt} = 0.0 \text{ V}$, $\text{C}^{+2}/\text{C} = +0.337 \text{ V}$

- (a) By combining which two electrodes given above, you will get a cell with largest e.m.f. Give the e.m.f. of the cell.
- (b) What happens when powder B is added in a solution containing C^{+2} and H^{+} ions? [3]
- (c) A buffer solution with pH 9 is to be prepared by mixing NH_4Cl and NH_4OH . Calculate the number of moles of NH_4Cl that should be added to one litre of 0.1 M NH_4OH solution. [$K_b = 1.8 \times 10^{-5}$] [4]

SECTION B

(Answer any two questions.)

QUESTION 5

- (a) Write balanced chemical equations involved in the extraction of copper. What is blister copper? [3]
- (b) What happens when copper is heated with [2]
- (i) dil. HCl (ii) dil. HNO_3
 (iii) aqueous AgNO_3 solution
 (iv) iron is added to aq. CuSO_4 solution?

QUESTION 6

- (a) Give reasons for each of the following: [2]
- (i) Among the hydride of halogens, HF is least volatile, whereas HCl is most volatile.

- (ii) Zinc is used to obtain silver from sodium argentocyanide.

- (b) Describe the preparation of potassium permanganate from pyrolusite ore. [3]

QUESTION 7

- (a) Give balanced chemical equation for the following reactions:
- (i) Sodium nitrite with acidified potassium permanganate.
 (ii) Acidified potassium dichromate is heated with sodium chloride.
 (iii) Steam is passed over heated iron. [3]
- (b) Write balanced chemical equations involved in the extraction of silver by cyanide process. [2]

SECTION C

(Answer any two questions.)

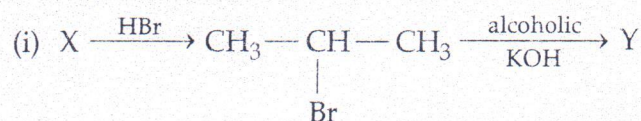
QUESTION 8

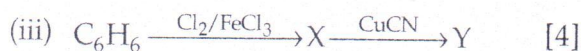
- (a) How will you obtain
- (i) ethyl acetate from acetic acid
 (ii) nitrobenzene from benzene
 (iii) iodoform from ethanol
 (iv) urea from cyanamide? [4]
- (b) Draw and name the different isomers of $\text{C}_3\text{H}_6\text{O}_3$. Which of them exhibit (s) geometrical or optical isomerism? [3]

- (c) Give one test to distinguish between glucose and fructose. Give the relevant equations. [3]

QUESTION 9

- (a) Predict X and Y in the following sequence:





- (b) (i) Name the product obtained when nitrobenzene is reduced in acid, neutral and alkaline media.
- (ii) What is the product obtained when formaldehyde is treated with calcium hydroxide? Give the balanced equation for the reaction.
- (iii) What happens when glucose is fermented with yeast? [3]
- (c) A compound (A) with molecular formula $\text{C}_4\text{H}_{10}\text{O}$ on oxidation yields compound (B). The compound (B) gives positive iodoform test. Compound (B) on reaction with CH_3MgI followed by hydrolysis gives (C). Identify (A), (B) and (C) and give the sequence of reactions. [3]

QUESTION 10

- (a) (i) What deductions are to be made with regard to the observation that the

same osazone is obtained from D-glucose and D-fructose?

- (ii) What is the significance of the letter D and the sign (+) in the name D(+) glucose?
- (iii) What is invert sugar? [3]
- (b) (i) How will you prepare alkyl isocyanide from
- (a) Primary amine
- (b) Alkyl halides?
- (ii) How would you separate primary, secondary and tertiary amines by Hinsberg's method? [3]
- (c) An organic compound A contains 69.42% C, 5.78% H and 11.57% N and has vapour density 60.5. A gives ammonia on boiling with caustic soda. On heating with phosphorous pentoxide A gives B. On reduction with sodium/alcohol B forms a base which reacts with nitrous acid giving off nitrogen and yielding alcohol C. The alcohol can be oxidised to benzoic acid. Give the structures of A, B and C and give the reaction sequence. [4]

A COMPLETE PACKAGE FOR IIT-JEE CHEMISTRY