

# 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: [5]

[first order, zero, rate constant,  $sp$ ,  $sp^2$ , independent, twelve, faster, alkoxylation, dependent, slower, eight, alkyl halide]

- When the concentration of the reactant in a chemical reaction is one molar, the rate of the reaction is equal to \_\_\_\_\_.
- In Williamson's synthesis, ethers are prepared by the reaction of an \_\_\_\_\_ with an \_\_\_\_\_.
- A metal crystallises in body centred cubic crystal. The co-ordination number of its atom is \_\_\_\_\_.
- The central oxygen atom in ozone is \_\_\_\_\_ hybridised.
- Nitration of toluene occurs \_\_\_\_\_ than benzene.

- (b) Complete the following statements by selecting the correct alternatives from the choices given: [5]

- Acetamide is
  - acidic
  - basic
  - neutral
  - amphoteric
- When a galvanic cell is written in an abbreviated form then
  - left electrode serves as cathode.
  - left electrode serves as anode.
  - reduction reaction occurs at anode.
  - left electrode constitutes the positive terminal.
- Glucose cannot be classified as
  - carbohydrate
  - hexose
  - oligosaccharide
  - aldose
- Which of the following 0.5 M aqueous solutions will have the lowest freezing point?
  - Urea
  - Sodium chloride
  - Aluminium sulphate
  - Cane sugar



- (v) An example of nucleophile is  
 (a)  $\text{NO}_2$  (b)  $\text{NO}_2^-$   
 (c)  $\text{NO}_2^+$  (d)  $\text{CO}$
- (c) Give the balanced equations for the following. Name the products formed. [5]
- Acetone is treated with chloroform.
  - A mixture of calcium acetate and calcium formate is heated.
  - Aniline is treated with sodium nitrite and hydrochloric acid in cold.
  - Formaldehyde is treated with concentrated sodium hydroxide.
  - Phenol is heated with zinc dust.

- (d) Explain the following in one sentence: [5]
- Ethyl alcohol is neutral to litmus but phenol is acidic.
  - Fluorine does not form oxy-acids.
  - Water and nitric acid cannot be separated completely by ordinary fractional distillation.
  - Indicators are weak organic acids or bases.
  - Half-life period of a chemical reaction is independent of concentration of the reactant molecules.

## 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

- Calculate the osmotic pressure of a solution obtained by mixing 100 mL of 2.5% solution of urea (molecular weight = 60) and 50 mL of 3.5% solution of cane sugar (molecular weight = 342) at  $27^\circ\text{C}$ .
  - Why the use of pressure cooker reduces cooking time? [3]
- At  $20^\circ\text{C}$  the vapour pressures of methyl alcohol and ethyl alcohol are 95 mm and 45 mm respectively. If 25 gm of methyl alcohol is mixed with 138 gm of ethyl alcohol, determine the total pressure of the solution. Also, calculate the mole fraction of methyl alcohol in the vapour phase.  
 [Atomic weight: C = 12, O = 16, H = 1] [4]

- For the reaction  $\text{A} + \text{B} \rightleftharpoons 3\text{C}$  at  $25^\circ\text{C}$ , a 3 litre container contains 1, 2, 4 moles of A, B and C respectively. Predict the direction of reaction if
    - $K_c$  for the reaction is 10
    - $K_c$  for the reaction is 15
    - $K_c$  for the reaction is 10.66.
  - What is the effect of temperature on the yield of ammonia? Give reason for your answer. [3]

## QUESTION 3

- Account for the following:
  - Copper sulphide precipitates when hydrogen sulphide is passed through its salt solution both in acidic and alkaline medium but zinc sulphide precipitates only in alkaline medium.
  - The freezing point of equimolal solution of sodium chloride is less than that of glucose solution.



- (iii) The rates of forward and backward reaction at 25°C of the following reaction are  $5 \times 10^{-3}$  moles  $\text{lit}^{-1} \text{sec}^{-1}$  and  $3 \times 10^2$  moles  $\text{lit}^{-1} \text{sec}^{-1}$ :



Calculate the value for free energy change. [3]

- (b) (i) Define co-ordination number of a crystalline solid.  
 (ii) Mention two differences between metallic crystals and atomic crystals.  
 (iii) What is the effect of an electric field on piezoelectric crystals? [4]
- (c) (i) What are sigma and pi-bonds?  
 (ii) Explain:  
 (1) The basis of similarities and differences between metallic and ionic crystals.  
 (2) Ionic solids are hard and brittle.  
 (iii) 'Stability of a crystal is reflected in the magnitude of its melting point'. Comment. [3]

#### QUESTION 4

- (a) (i) The molar conductance at infinite dilution for sodium acetate, hydrochloric acid and sodium chloride are 91,

426.2 and 126.5  $\text{ohm}^{-1} \text{cm}^2 \text{mole}^{-1}$  respectively at 298 K. Calculate the molar conductance of acetic acid at infinite dilution.

- (ii) What is the charge in coulombs on the  $\text{O}^{2-}$  ion?

- (iii) The rates of forward and backward reaction at 25°C of the following reaction are  $5 \times 10^{-3}$  moles  $\text{lit}^{-1} \text{sec}^{-1}$  and  $3 \times 10^2$  moles  $\text{lit}^{-1} \text{sec}^{-1}$



Calculate the value for equilibrium constant. [3]

- (b) A mixture of acetic acid and sodium acetate acts as a buffer solution. What is a buffer solution? Explain how this buffer solution resists the change of pH when small amount of base is added. [3]
- (c) (i) A buffer solution contains 0.20 mole of  $\text{NH}_4\text{OH}$  and 0.25 mole of  $\text{NH}_4\text{Cl}$  per litre, calculate the pH value of the solution. Dissociation constant of  $\text{NH}_4\text{OH}$  at room temperature is  $1.8 \times 10^{-5}$  and  $K_w = 10^{-14}$ .  
 (ii) What are solubility curves? What is indicated by a sharp break in a solubility curve? [4]

#### SECTION B

(Answer any two questions.)

#### QUESTION 5

- (a) Write the equations of the extraction of potassium dichromate from chromite ore. Mention two of its uses. [3]
- (b) Give balanced equations for the following: [2]
- (i) Bromine with dilute sodium hydroxide solution.  
 (ii) Chlorine with excess ammonia.

#### QUESTION 6

- (a) Give the balanced chemical equation for the following: [2]
- (i) Hydrogen sulphide is passed through sulphuric acid.  
 (ii) Moist iodine is treated with ozone.
- (b) How would you account for the following: [3]
- (i)  $[\text{Fe}(\text{CN})_6]^{-3}$  is weakly paramagnetic while  $[\text{Fe}(\text{CN})_6]^{-4}$  is diamagnetic.



Chemistry-XII

- (ii)  $[\text{Ni}(\text{Co})_4]$  possesses tetrahedral geometry while  $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$  is square planar and diamagnetic.
- (iii)  $[\text{Ti}(\text{H}_2\text{O})_6]^{+3}$  is coloured while  $[\text{Sc}(\text{H}_2\text{O})_6]^{+3}$  is colourless.

**QUESTION 7**

- (a) Give balanced equation for the following: [3]

(i) Silver nitrate is heated.

**SECTION C**

(Answer any two questions.)

**QUESTION 8**

- (a) (i) When steam is passed over heated coke a mixture of combustible gases is formed. How is acetone manufactured from this combustible gas mixture? Write the balanced equation for the reaction. Name another organic compound which can also be manufactured from this gas.
- (ii) What happens when acetone is treated with barium hydroxide solution? Name the product formed and write the balanced chemical equation for the reaction. [4]
- (b) Draw and name the structural isomers of  $\text{C}_5\text{H}_{10}$ . Which of them exhibits geometrical or optical isomerism? [3]
- (c) Arrange the following in increasing order of basicity and explain your order: ammonia, water and ethyl amine [3]

**QUESTION 9**

- (a) (i) Arrange the following in decreasing order of basicity:
- $\text{NH}_3$ ,  $\text{C}_2\text{H}_5\text{NH}_2$ ,  $(\text{C}_2\text{H}_5)_2\text{NH}$ ,  $(\text{C}_2\text{H}_5)_3\text{N}$

- (ii) Copper is heated with concentrated sulphuric acid.
- (iii) Ammonium hydroxide is added to copper sulphate, first little amount and then in excess.

- (b) How are  $\text{XeO}_3$  and  $\text{XeOF}_4$  prepared? Describe their molecular shape. [2]

(ii) Nitrobenzene does not undergo Friedel Crafts reaction. Explain.

(iii) Why is aniline a weaker base than aliphatic amine? [3]

- (b) Name the following reactions and give the balanced equations:

(i) Acetone with iodine and sodium hydroxide.

(ii) Formaldehyde with concentrated alkali solution.

(iii) Phenol with chloroform and alkali solution.

(iv) Benzene diazonium chloride and cuprous chloride. [3]

- (c) Give one test to distinguish between the following pair of compounds. Give the relevant chemical equations:

(i) Acetic acid and formic acid

(ii) Benzaldehyde and acetaldehyde [4]

**QUESTION 10**

- (a) An organic compound A of molecular formula  $\text{C}_3\text{H}_6\text{O}_2$  when treated with ammonia and on heating formed B of molecular formula  $\text{C}_3\text{H}_7\text{ON}$ . B when heated with phosphorous pentoxide, formed C of molecular formula  $\text{C}_3\text{H}_5\text{N}$ . C on complete acid hydrolysis formed A. C



on reduction with complex metal hydride formed a basic nitrogenous compound D of molecular formula  $C_3H_9N$ . D on treatment with nitrous acid, formed an alcohol E of molecular formula  $C_3H_8O$ . E on oxidation formed compound A. Give the structures of compound A, B, C, D and E and explain the reactions involved.

[4]

- (b) (i) What is the difference between Nylon 6 and Nylon 66? Name the monomers used to prepare these two types of polymers.
- (ii) Give the different classification of polymers

(a) on the basis of their mode of synthesis,

(b) on the basis of their structure.

[3]

(c) (i) Give the chemical equations separately when ammonia reacts with formaldehyde and acetaldehyde. Name the products formed.

(ii) What happens when methyl isocyanate is

(a) hydrolysed,

(b) reduced by  $LiAlH_4$ ?

[3]



**A COMPLETE PACKAGE FOR IIT-JEE JEECHEMISTRY**