V/CHEM (vii)

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(5th Semester)

CHEMISTRY

SEVENTH PAPER (CHEM–353)

(Physical Chemistry—II)

Full Marks : 55

Time : 2½ hours

(PART : B—DESCRIPTIVE)

(*Marks* : 35)

*The figures in the margin indicate full marks
for the questions*

1. *(a)* Define the following :   2

   (i) Most probable velocity

   (ii) Mean free path

  (b) Give an account of Maxwell's distribution of molecular velocities.   3

  (c) Calculate the temperature at which the hydrogen molecules will have an average speed of $176400 \ cm \ s^{-1}$.   2

(2)

OR

2. *(a)* State and explain the law of equipartition of energy.   3

  (b) What is meant by degree of freedom of a molecule?   1

  (c) Calculate various degrees of freedom for *(a)* H_2O, *(b)* CO_2 and *(c)* C_2H_2.   3

3. *(a)* Describe Nernst heat theorem.   3

  (b) What is residual entropy?   1

  (c) Derive Gibbs-Duhem equation and give its significance.   3

OR

4. *(a)* What do you understand by partial molar quantities? Write the expression for partial molar quantity of a component in a mixture.   3

  (b) Define chemical potential.   1

  (c) Derive an expression for the variation of chemical potential with temperature.   3

5. *(a)* What is viscometer? Describe Ostwald's viscometer method for the determination of viscosity of liquid.   1+2=3

  (b) What is parachor?   1

(c) The parachors of ethane and propane are 110·5 and 150·8 respectively. What values of parachor do you expect for hexane? 3

OR

6. (a) What is enzyme catalysis? Describe some characteristics of enzyme catalysis. 1+2=3

(b) What are liquid crystals? 1

(c) Discuss the Lindemann's theory for unimolecular reaction. 3

7. (a) What is meant by space lattice and unit cell? 1+1=2

(b) Describe investigation of internal structure of a solid by X-ray diffraction (Bragg's method). 3

(c) Calculate the Miller indices of a crystal plane which cut through the crystal axis at ($2a$, $3b$, c) and ($6a$, $3b$, $3c$). 2

OR

8. (a) Define the following : 1×3=3
   (i) Centre of symmetry
   (ii) Plane of symmetry
   (iii) Axis of symmetry

(b) The second-order reflection for X-rays from (100) planes of NaCl occurs at 29·3°. If the wavelength used is 1·54 A, calculate the distance between two successive planes in NaCl. 2

(c) Define Miller indices and law of rational indices. 2

9. (a) Define the terms specific conductance and equivalent conductance of a solution. 2

(b) What is Ostwald dilution law? 2

(c) If the molar conductivities at infinite dilution of NaCl, HCl and CH_3COONa are 126·4, 426·1 and 91·0 ohm^{-1} cm^2 mol^{-1} respectively, then what will be that of acetic acid? 3

OR

10. (a) State and explain Kohlrausch law. 2

(b) Discuss asymmetry effect. 2

(c) During the electrolysis of a solution of potassium chloride between platinum electrodes, 0·0137 g of the chloride was lost from the anodic compartment and 0·0857 g of silver was deposited in a silver coulometer connected in series with the cell. Determine the transport number of K^+ and Cl^- ions. 3

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Subject Code : $\mathbf{V}/$ CHEM (vii)

Booklet No. A

To be filled in by the Candidate

DEGREE 5th Semester
(Arts / Science / Commerce /
........................) Exam., **2016**

Subject ....

Paper ....

Date Stamp ....

....

INSTRUCTIONS TO CANDIDATES

1. The Booklet No. of this script should be quoted in the answer script meant for descriptive type questions and vice versa.

2. This paper should be ANSWERED FIRST and submitted within *45 minutes* of the commencement of the Examination.

3. While answering the questions of this booklet, any cutting, erasing, over-writing or furnishing more than one answer is prohibited. Any rough work, if required, should be done only on the main Answer Book. Instructions given in each question should be followed for answering that question only.

Signature of
Scrutiniser(s)

Signature of
Examiner(s)

Signature of
Invigilator(s)

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2 0 1 6

(5th Semester)

CHEMISTRY

SEVENTH PAPER (CHEM–353)

(Physical Chemistry—II)

(PART : A—OBJECTIVE)

(*Marks* : 20)

The figures in the margin indicate full marks for the questions

SECTION—A

(*Marks* : 5)

Put a Tick (✓) mark against the correct answer in the brackets provided :   1×5=5

1. The numbers of translational, rotational, vibrational degrees of freedom respectively for CO_2 molecules are

    (a) 3, 3, 3   (   )

    (b) 3, 2, 4   (   )

    (c) 1, 2, 3   (   )

    (d) 2, 2, 3   (   )

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2. The SI unit of equivalent conductance is

(a) $S\,m^2$ ( )

(b) $S\,m^{-1}$ ( )

(c) $S^{-1}\,m^{-1}$ ( )

(d) $S^2\,m^{-1}$ ( )

3. Upon dilution equivalent conduction of a solution

(a) remains unchanged   ( )

(b) decreases   ( )

(c) increases then decreases   ( )

(d) increases   ( )

4. Nernst heat theorem is applicable to

(a) pure solids only   (   )

(b) pure gases only   (   )

(c) solids and liquids   (   )

(d) pure liquids only   (   )

5. The number of molecular collisions occurring per unit time per unit volume of the gas is

(a) collision frequency   (   )

(b) mean free path   (   )

(c) collision diameter   (   )

(d) collision number   (   )

SECTION—B

(*Marks* : 15)

Answer the following questions :   3×5=15

   1. Describe briefly the effect of temperature on Maxwell's distribution of molecular velocities.

2. Calculate the root-mean-square velocity, average velocity and most probable velocity of SO_2 at 427 °C.

3. The first-order reflection from 100, 110, 111 planes of a given cubic crystal were found to occur at angles 5·9°, 8·4° and 5·2° respectively. Determine the type of cubic lattice to which the crystal belongs.

4. What is meant by transport number of an ion? Show that the sum of transport numbers of cation and anion is unity.

5. Describe the Wien effect.

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