

2018

(CBCS)

(5th Semester)

CHEMISTRY

SEVENTH PAPER

(Physical Chemistry—II)

Full Marks : 75

Time : 3 hours

(PART : A—OBJECTIVE)

(Marks : 25)

The figures in the margin indicate full marks for the questions

SECTION—A

(Marks : 10)

Tick (✓) the correct answer in the brackets provided :

1×10=10

1. The numbers of translational, rotational, vibrational degrees of freedom respectively for CO₂ molecules are

(a) 3, 3, 3 ()

(b) 3, 2, 4 ()

(c) 2, 2, 3 ()

(d) 2, 3, 4 ()

2. The root-mean-square velocity of gas molecules is given by the relation

(a) $\sqrt{\frac{RT}{M}}$ ()

(b) $\sqrt{\frac{2RT}{M}}$ ()

(c) $\sqrt{\frac{3RT}{M}}$ ()

(d) $\sqrt{\frac{8RT}{M}}$ ()

3. Bragg's equation for diffraction of X-rays is

(a) $n \quad 2d \sin \quad ()$

(b) $n \quad 2 \sin \quad ()$

(c) $\sin \quad n \quad ()$

(d) $n \quad 2d \sin^2 \quad ()$

4. For an orthorhombic crystal system, which is correct?
 (a) $a \neq b \neq c$ () (b) $a = b \neq c$ ()
 (c) $a = b = c$ () (d) $a \neq b = c$ ()
5. As temperature of a reaction is increased, the rate of the reaction increases because the
 (a) reactant molecules collide with greater energy ()
 (b) reactant molecules collide less frequently ()
 (c) more molecules overcome threshold energy ()
 (d) reactant molecules collide less frequently and with greater energy ()
6. A catalyst is a substance which
 (a) increases the equilibrium concentration of the products ()
 (b) shortens the time to reach the equilibrium ()
 (c) changes the equilibrium constant of the reaction ()
 (d) supplies the energy to the reactions ()
7. Which of the following equations is used to calculate the heats of reaction when ΔG at two temperatures are given?
 (a) Gibbs-Helmholtz equation ()
 (b) Clapeyron equation ()
 (c) Kirchhoff's equation ()
 (d) Debye T^3 law ()
8. According to the third law of thermodynamics, at absolute zero for a perfect crystal, entropy change is
 (a) positive () (b) negative ()
 (c) zero () (d) None of the above ()
9. The unit of specific conductance is
 (a) ohm cm () (b) ohm cm⁻¹ ()
 (c) ohm⁻¹ cm () (d) ohm⁻¹ cm⁻¹ ()
10. The sum of the transport numbers of cation and anion is equal to
 (a) 0 () (b) 1 ()
 (c) 0.5 () (d) ()

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.

OR

What is most probable velocity? Derive its expression from Maxwell distribution of molecular velocities.

2. Explain the law of symmetry.

OR

What are the different kinds of Bravais lattices in a cubic unit cell?

3. Write the difference between order and molecularity.

OR

What is meant by temperature coefficient of a reaction?

4. Explain residual entropy.

OR

Discuss the variation of chemical potential with pressure.

5. Describe the Wien effect.

OR

What are equivalent conductance and molar conductance?

(PART : B—DESCRIPTIVE)

(Marks : 50)

The figures in the margin indicate full marks for the questions

1. (a) Give an account of Maxwell's distribution of molecular velocities. 5
(b) What is meant by 'degrees of freedom' of a molecule? 5

OR

(a) State and explain the law of equipartition of energy. 5

(b) Calculate the various degrees of freedom of the following molecules : 5

(i) HCl

(ii) H₂

(iii) H₂O

(iv) C₂H₂

(v) C₆H₆

2. (a) Explain the law of rational indices. 4
(b) Explain Debye-Scherrer powder method for crystal analysis. 6

OR

- (a) Derive Bragg's equation for X-ray crystallography. 4
(b) Explain the following terms with examples : 2×3=6
(i) Element of symmetry
(ii) Plane of symmetry
(iii) Centre of symmetry

3. (a) What is meant by activation energy? Explain how energy of activation is determined with the help of Arrhenius equation. 5
(b) What is enzyme catalysis? Describe some characteristics of enzyme catalysis. 5

OR

- (a) Discuss the mechanism of enzyme catalysis and derive Michaelis-Menten equation for an enzyme substrate reaction. 7
(b) Discuss the collision theory of reaction rates. 3

4. (a) Define chemical potential. Derive Gibbs-Duhem equation. 1+4=5
(b) Explain Nernst heat theorem. 5

OR

- (a) Discuss the variation of chemical potential with temperature. 5
(b) How does free energy vary with temperature and pressure? 5

5. (a) Derive the expression for Ostwald's dilution law. 5
(b) Describe the determination of transport number by moving boundary method. 5

OR

- (a) State and explain Kohlrausch's law of independent migration of ions. Describe its one application. 3+2=5
(b) Explain the following : 2½×2=5
(i) Asymmetry effect
(ii) Electrophoretic effect

★ ★ ★