

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2015

(UG—CCSS)

Core Course—Chemistry

CH 5B 11—PHYSICAL CHEMISTRY—II

Time : Three Hours

Maximum : 30 Weightage

I. Answer all the *twelve* questions. Each question carries a **weightage** of $\frac{1}{4}$.

1 In a f.c.c. arrangement the number of atoms in the unit cell is :

(a) 8.

(b) 2.

(c) 1.

(d) 4.

2 The unit cell with crystallographic dimension $a = b \neq c$, $\alpha = \beta = \gamma = 90^\circ$ is :

(a) Cubic.

(b) Tetragonal.

(c) Monoclinic.

(d) Hexagonal.

3 SO_2 belongs to which point group ?(a) C_{2v} .(b) C_{2h} .(c) D_{2h} .(d) $D_{\infty h}$.

4 Which of the following molecule has an inversion centre (centre of symmetry) ?

(a) SF_6 .(b) SiH_4 .(c) CH_4 .(d) PF_5 .5 What would be the splitting of the protons on the CH_2 groups of butane ?

(a) Doublet.

(b) Sextet.

(c) Triplet.

(d) Singlet.

6 Which of the following bonds will, show an absorption band at the highest wave number ?

(a) $\text{C}=\text{O}$.(b) $\text{C}=\text{C}$.(c) $\text{O}-\text{H}$.(d) $\text{C}-\text{H}$.

Turn over

7 0.5 M solution of urea is isotonic with :

- (a) 0.5 M solution of NaCl .
- (b) 0.5 M solution of sugar.
- (c) 0.5 M solution of benzoic acid in benzene.
- (d) 0.5 M solution of BaCl_2 .

8 At high altitude the boiling point of water lowers because :

- (a) Atmospheric pressure is low. (b) Temperature is low.
- (c) Atmospheric pressure is high. (d) None of these.

9 For the study of distribution law the two solvents should be :

- (a) Miscible. (b) Non-miscible.
- (c) Volatile. (d) Reacting with each other.

10 For a three-phase system with one component, the degrees of freedom is :

- (a) Zero. (b) One.
- (c) Three. (d) Two.

11 In which of the following Tyndall effect is not observed :

- (a) Suspension. (b) Emulsion.
- (c) Sugar solution. (d) Gold sol.

12 Fog is a colloidal system in which the dispersed phase and dispersion medium respectively are :

- (a) Gas, Liquid. (b) Liquid, Gas.
- (c) Liquid, Liquid. (d) Solid, Liquid.

(12 x $\frac{1}{4}$ = 3 weightage)

II. Answer all the *nine* questions. Each question carries *one* weightage :

13 What is the law of rational indices ?

14 Differentiate between isotropy and anisotropy.

15 Define centre of symmetry of a crystal.

16 What are the selection rules for the vibrational transition in a diatomic molecule ?

- 17 Differentiate between stokes and anti-stokes lines in Raman spectrum.
- 18 What do you mean by Van't Hoff factor ?
- 19 With the help of Clapeyron-Clausius equation predict the effect of pressure on the melting point of ice.
- 20 What do you mean by incongruent melting point ?
- 21 Write the B.E.T. equation and explain the terms involved in the equation.

(9 x 1 = 9 weightage)

III. Answer any *five* questions. Each question carries *two* weightage :

- 22 Describe powder method used for the determination of structure of crystals.
- 23 Calculate the number of atoms contained in a primitive cubic unit cell, a body centred cube and a face centred cube.
- 24 Construct the group multiplication table for water molecule.
- 25 The force constant of CO is 1840 Nm^{-1} . Calculate the vibrational frequency in cm^{-1} . The atomic masses are $^{12}\text{C} = 19.9 \times 10^{-27} \text{ kg}$; $^{16}\text{O} = 26.6 \times 10^{-27} \text{ kg}$.
- 26 Which colligative property we will use to calculate the molecular mass of polymers ? Why ?
- 27 Draw phase diagram for two-component system in which the two components form a compound with congruent melting point. Apply phase rule to this diagram.
- 28 How will you prepare the colloidal solution of gold ?

(5 x 2 = 10 weightage)

IV. Answer any *two* questions. Each question carries *four* weightage :

- 29 (a) Explain phenol-water system.
(b) Derive Gibb's adsorption isotherm.
- 30 (a) Show that in a rigid diatomic rotator the moment of inertia is given by $I = \mu r^2$.
(b) Acetic acid (CH_3COOH) associates in benzene to form a dimer. 1.65 g of acetic acid when dissolved in 100g of benzene raised the boiling point by 0.36°C . Calculate the Van't Hoff factor ($K_b = 2.57 \text{ K kg mol}^{-1}$).
- 31 Explain intrinsic and extrinsic semiconductors with examples.

(2 x 4 = 8 weightage)