

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2016

(CUCBCSS—UG)

Complementary Course

CHE 2C 02—PHYSICAL CHEMISTRY

Time : Three Hours

Maximum : 64 Marks

Section A (One word/sentence)

*Answer all questions.**Each question carries 1 mark.*

1. A sealed thermosflask containing hot tea is an example of _____ system.
2. According to _____ law, the volume of a fixed mass of gas varies directly as the absolute temperature.
3. _____ solids are isotropic.
4. The unit cell of a crystal resembled a matchbox in its shape. The crystal belongs to _____ crystal system.
5. There are _____ Bravais lattices in a cubic crystal.
6. What is the SI unit of viscosity ?
7. At the normal B.P. of liquid its _____ becomes equal to atmospheric pressure.
8. The hydronium ion concentration, in an aqueous solution of CH_3COOH , in terms of dissociation constant K_a and concentration 'C' can be expressed as $[\text{H}_3\text{O}^+] = \text{_____}$.
9. When NH_4Cl is dissolved in water, the pH will _____.
10. For $\text{Fe}_2(\text{SO}_4)_3$ solution, the equivalent conductance λ_{eq} and molar conductance λ_{m} are related as _____.

(10 × 1 = 10 marks)

Section B (Short Answer)

*Answer any seven questions.**Each question carries 2 marks.*

11. Write the Mathematical formulation of the first law of thermodynamics.
12. What is the physical significance of Gibb's free energy ?
13. What are the faulty assumptions in kinetic molecular model ?
14. Calculate the most probable velocity of N_2 molecule at 300 K.
15. Derive the Miller indices of a crystal plane having intercepts $2a$, $2b$ and $3c$.

Turn over

16. Explain the effect of temperature in the surface tension of a liquid.
17. What is reverse osmosis ?
18. Write the principle of conductometric titrations.
19. The molar conductance of 10^{-3} M aqueous solution of weak acid HA is $60 \text{ S cm}^2 \text{ mol}^{-1}$. If the molar conductance at infinite dilution of H^+ and $\bar{\text{A}}$ are 250 and $150 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$, respectively. Calculate the degree of dissociation of the acid at this concentration.
20. The resistance of 0.01 M solution of a weak acid is 5×10^3 ohms, when taken in a conductivity cell of cell constant 0.5 cm^{-1} . Calculate the molar conductance of the solution.

(7 × 2 = 14 marks)

Section C (Paragraph)*Answer any four questions.**Each question carries 5 marks.*

21. Using Gibbs-Helmholtz equation, illustrate the effect of temperature on the spontaneity of a reaction.
22. (a) Giving any *one* statement of the second law of thermodynamics.
(b) The standard molar enthalpy fusion of ice is 6.00 kJ mol^{-1} at 0°C . Calculate the entropy of fusion of ice.
23. What are liquid crystals ? How are they classified ? Explain.
24. What are colligative properties ? Explain the determination of molecular mass of a solute from colligative property values.
25. Explain the construction and working of a calomel electrode.
26. Write the cell reaction and calculate the EMF at 25°C ., of the cell $\text{Fe} | \text{Fe}_{(0.1\text{M})}^{2+} || \text{Ni}_{(0.01\text{M})}^{2+} | \text{Ni}$; Given $E^\circ \text{Fe}^{2+}/\text{Fe} = -0.44 \text{ V}$ and $E^\circ \text{Ni}^{2+}/\text{Ni} = -0.25 \text{ V}$.

(4 × 5 = 20 marks)

Section D (Essay)*Answer any two questions.**Each question carries 10 marks.*

27. (a) Derive the relation between Enthalpy change and Internal energy change of a reaction. (4 marks)
- (b) The internal energy change for the reaction :

$$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$$
 is -87 kJ at 300 K .
 Calculate the value of ΔH at 300 K . (3 marks)
- (c) State and explain Third law of thermodynamics. (3 marks)

28. (a) What are the features of the kinetic molecular model of gases ?
(b) Write briefly on the different types of defects in crystals.
29. (a) State and explain Henry's law. Mention any *two* applications of the law.
(b) Derive an equation for the pH of an acidic buffer.
30. (a) Explain the effect of dilution in the conductance of weak and strong electrolytes
(b) Discuss the construction and working of H_2-O_2 fuel cell.

(2 × 10)