

**SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2015**

(CUCBCSS-UG)

Complementary Course – Chemistry

CHE 2C 02 – Complementary Course II – PHYSICAL CHEMISTRY

Three Hours

Maximum : 64 Marks

**Section A (One Word/Sentence)***Answer all questions.**Each question carries 1 mark.*

1. According to the third law of thermodynamics, the entropy of a perfect crystal is zero at \_\_\_\_\_.
2. The average velocity of a gas varies directly as the square root of \_\_\_\_\_.
3. Name the most unsymmetrical crystal system.
4. \_\_\_\_\_ solids are anisotropic.
5. The maximum number of Bravais lattices possible for crystals is \_\_\_\_\_.
6. Write the S.I. unit of surface tension.
7. Viscosity of a liquid \_\_\_\_\_ with increase in temperature.
8. Specific conductance is the reciprocal of \_\_\_\_\_.
9. When  $\text{Na}_2\text{CO}_3$  is dissolved in water the pH of the solution will \_\_\_\_\_.
10. For  $\text{Al}_2(\text{SO}_4)_3$  solution, the equivalent conductance  $\lambda_{\text{eq}}$  and molar conductance  $\lambda_{\text{m}}$  are related as \_\_\_\_\_.

(10 × 1 = 10 marks)

**Section B (Short Answer)***Answer any seven questions.**Each question carries 2 marks.*

11. State the first law of thermodynamics.
12. What are open and closed systems? Give one example each.
13. Write the vander Waal's equation for 'n' moles of a gas and explain the terms.
14. Calculate the RMS velocity of hydrogen molecule at 300 K.
15. Calculate the Miller indices of a plane whose intercepts are 2a, 3b and 2c.
16. State Henry's law.

**Turn over**

17. Write any *two* factors that affect the vapourisation of a liquid.
18. Write any *four* advantages of conductometric titrations.
19. The molar conductance of infinite dilution of  $\text{CH}_3\text{COONa}$ ,  $\text{HCl}$  and  $\text{NaCl}$  in  $\text{S cm}^2 \text{ mol}^{-1}$  are 91, 426.2 and 126.5 respectively. Calculate the  $\lambda_m^\infty$  value of  $\text{CH}_3\text{COOH}$ .
20. The resistance of a  $10^{-2} \text{ N}$  solution of a weak acid is  $5 \times 10^3$  ohms, in a conductivity cell of length constant  $0.5 \text{ cm}^{-1}$ . Calculate the equivalent conductance of the solution at this concentration.

(7 × 2 = 14 marks)

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

21. (i) Derive an equation to relate the enthalpy change and internal energy change of a reaction.
- (ii) The enthalpy change for the reaction  $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$  is  $-890.5 \text{ kJ mol}^{-1}$  at  $300 \text{ K}$ . Calculate the value of internal energy change at the same temperature.
22. (i) State the second law of thermodynamics based on entropy.
- (ii) The enthalpy of vapourisation of water is  $40.6 \text{ kJ mol}^{-1}$  at  $100^\circ \text{ C}$ . Calculate the entropy change of vapourisation at  $100^\circ \text{ C}$ .
23. What are the features of Maxwell's distribution curve? Explain the effect of temperature on the distribution.
24. Explain reverse osmosis. Write any *two* applications of reverse osmosis.
25. What are reference electrodes? Explain the construction and working of a standard Hydrogen Electrode.
26. Explain the effect of dilution in the specific conductance and molar conductance of a strong electrolyte.

(4 × 5 = 20 marks)

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

27. (i) What is the physical significance of Gibbs free energy? Explain the effect of temperature on the spontaneity of a reaction.
- (ii) The enthalpy change and entropy change for the decomposition of  $\text{H}_2\text{O}_2$ , are  $-196 \text{ kJ mol}^{-1}$  and  $132 \text{ J mol}^{-1}$  respectively. Predict the feasibility of the process at  $300 \text{ K}$ .
28. (i) What are liquid crystals? Name the different types of liquid crystals. Mention any two applications of liquid crystals.
- (ii) Explain the different types of stoichiometric defects.

(6 + 4 = 10 marks)

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29. (i) From the laws of osmotic pressure, derive an equation for the molecular mass of a solute.
- (ii) Write the cell reaction taking place in the electrochemical cell  $\text{Zn}/\text{Zn}^{2+} (10^{-3} \text{ m}) \parallel \text{Ag}^+ (10^{-1} \text{ m}) \mid \text{Ag}$  and calculate the EMF of the cell at  $25^\circ \text{C}$ . Given  $E^0_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$  and  $E^0_{\text{Ag}^+/\text{Ag}} = 0.80 \text{ V}$ .
30. (i) What are buffer solutions? How are they classified? Derive an equation for the pH for a buffer.
- (ii) Explain the working of a  $\text{H}_2\text{-O}_2$  fuel cell.

(6 + 4 = 10 marks)

[2 × 10 = 20 marks]