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Reg. No. :

Code No. : 30479 E Sub. Code : CMCH 52

B.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2024.

Fifth Semester

Chemistry — Core

PHYSICAL CHEMISTRY - II

(For those who joined in July 2021 & 2022 only)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

- Identify the intensive property from the following
(a) Enthalpy (b) Temperature
(c) Volume (d) Heat capacity
- A gas expands from 10 lit to 20 lit against a constant pressure of 5 atm. The pressure – volume work done by the system is
(a) -50 lit atm (b) 50 lit atm
(c) -100 lit atm (d) 100 lit atm

3. In which of the following case entropy decreases?

- (a) $I_{2(s)} \longrightarrow I_{2(g)}$ (b) $H_2O_{(l)} \longrightarrow H_2O_{(g)}$
(c) $H_2O_{(s)} \longrightarrow H_2O_{(l)}$ (d) $H_2O_{(g)} \longrightarrow H_2O_{(l)}$

4. Gibbs free energy equation is

- (a) $\Delta G = \Delta H - T\Delta S$ (b) $\Delta G = \Delta E - T\Delta S$
(c) $\Delta G = -T\Delta S$ (d) $\Delta G = T\Delta S$

5. The number of phases in a mixture of three gases enclosed in a container is

- (a) 0 (b) 1
(c) 2 (d) 3

6. If x is the solubility of $KAl(SO_4)_2$, then its solubility product is

- (a) x^3 (b) x^4
(c) $4x^3$ (d) $4x^4$

7. Which chemical is used in moving boundary method for the determination of transport number?

- (a) $Cd(OH)_2$ (b) CdS
(c) $CdCl_2$ (d) $CdSO_4$

8. Which of the following is based on Arrhenius theory?

- (a) Degree of dissociation
- (b) Solubility product
- (c) Ostwald's dilution law
- (d) All of these

9. For a vibration to be IR active, the molecule should have

- (a) permanent dipole moment
- (b) change in dipole moment
- (c) change in polarisability
- (d) none of the above

10. UV radiation causes

- (a) vibration in the molecule
- (b) rotation in the molecule
- (c) nuclear excitation
- (d) electronic excitation in the molecule

PART B — (5 × 5 = 25 marks)

Answer ALL questions choosing either (a) or (b).
Each answer should not exceed 250 words.

11. (a) 2 moles of an ideal gas expands reversibly and isothermally at 20°C from a volume of 2 litres to 20 litres. Calculate the work done by the gas.

Or

(b) Derive thermodynamically the relationship between C_p and C_v .

12. (a) Explain the physical significance of entropy.

Or

(b) Define Helmholtz free energy and Gibbs free energy. Write the differences between them.

13. (a) Explain the phase diagram of Pb - Ag system.

Or

(b) What is a buffer solution? Explain the buffer action of an acid buffer.

14. (a) How is the solubility of a sparingly soluble salt determined by conductance measurements?

Or

(b) Explain Debye - Huckel limiting law.

15. (a) How is the bond length of a diatomic molecule determined from its rotational spectrum?

Or

- (b) State and explain the rule of mutual exclusion principle in Raman spectroscopy.

PART C — (5 × 8 = 40 marks)

Answer ALL questions choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) (i) Explain state and path functions with examples.
(ii) State the first law of thermodynamics.

Or

- (b) (i) What is inversion temperature? Explain.
(ii) State Hess's law of constant heat summation. Illustrate one of its applications with an example.

17. (a) Explain how the absolute entropy of a gas at 25°C is determined with the help of third law of thermodynamics.

Or

- (b) (i) Explain partial molar properties.
(ii) Explain how chemical potential changes with change in temperature and pressure.

18. (a) Derive Clapeyron – Clausius equation and write its uses.

Or

- (b) What are the analytical applications of common ion effect and solubility product?

19. (a) Discuss about Kohlrausch's law and its applications.

Or

- (b) Draw and explain the conductometric titration curves of

(i) $\text{HCl} \times \text{NaOH}$

(ii) $\text{CH}_3\text{COOH} \times \text{NaOH}$

(iii) a mixture of HCl and $\text{CH}_3\text{COOH} \times \text{NaOH}$.

20. (a) Discuss the theory of vibrational spectroscopy.

Or

- (b) Explain the various types of electronic transitions.