

Total No. of Printed Pages—7

**2 SEM TDC CHMH (CBCS) C 4**

**2026**

( May/June )

**CHEMISTRY**

( Core )

Paper : C-4

( **Physical Chemistry** )

Full Marks : 53

Pass Marks : 21

Time : 3 hours

*The figures in the margin indicate full marks  
for the questions.*

1. Choose the correct option from the following :

1×6=6

(a) The adiabatic process is

(i) isochoric

(ii) isobaric

(iii) isenthalpic

(iv) isentropic

( 2 )

(b) The variation of enthalpy of reaction with temperature is given by

(i) Hess' law

(ii) Henry's law

(iii) Raoult's law

(iv) Kirchhoff's equation

(c) Entropy of the universe

(i) continuously increases

(ii) continuously decreases

(iii) remains constant

(iv) is zero

(d)  $K_p = K_c(RT)^{\Delta n_g}$ . In this expression,

$\Delta n_g$  denotes

(i) sum of all the gaseous molecules

(ii) sum of molecules of gaseous reactants minus sum of molecules of gaseous products

( 3 )

(iii) sum of molecules of gaseous products minus sum of molecules of gaseous reactants

(iv) It is one for reactions of liquid solutions

(e)  $\text{CaCO}_3(\text{g}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$

The pressure of  $\text{CO}_2(\text{g})$  in the above equilibrium increases when

(i) a catalyst is added

(ii)  $T$  is increased

(iii)  $T$  is decreased

(iv) an inert gas is introduced, keeping  $T$  constant

(f) The correct equation relating rise in boiling point of a solution with concentration is

(i)  $\Delta T = \frac{k_b}{m}$

(ii)  $\Delta T = m \times k_b$

(iii)  $\Delta T = \frac{k_b}{M}$

(iv)  $\Delta T = M \times k_b$

( 4 )

2. Answer the following questions :  $2 \times 7 = 14$

- (a) What are extensive and intensive properties?  $1+1=2$
- (b) What do you mean by free expansion? What is the work done during such an expansion?  $1+1=2$
- (c) The internal energy of an isolated system is constant. Explain.
- (d) State and explain Hess' law of constant heat summation.
- (e) Write the physical significance of chemical potential.
- (f) What do you mean by partial molar properties of an open system?
- (g) Define molal elevation constant. Write its unit.

### UNIT—I

3. Answer any *four* of the following questions :

$3 \times 4 = 12$

- (a) Explain zeroth law of thermodynamics. State the first law of thermodynamics in two ways.  $1\frac{1}{2} \times 2 = 3$

( 5 )

- (b) Give the mathematical derivation of Kirchhoff's equation. What is adiabatic flame temperature?  $2+1=3$
- (c) Describe the efficiency of a heat engine. Write a few lines on the term 'entropy'. What is its unit?  $1+1\frac{1}{2}+1\frac{1}{2}=3$
- (d) State third law of thermodynamics. What is residual entropy?  $2+1=3$
- (e) Derive Gibbs-Helmholtz equation. What is inversion temperature?  $2+1=3$
- (f) Derive thermodynamic equation of state.
- (g) Derive the following relation :

$$\left(\frac{\partial S}{\partial P}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_P$$

### UNIT—II

4. Answer any *one* of the following questions : 4

- (a) Give a brief account of partial molar quantities. Write about the significance of partial molar quantities.  $3+1=4$

( 6 )

- (b) Derive Gibbs-Duhem equation. What is chemical potential?  $3+1=4$

### UNIT—III

5. Answer any *three* of the following questions :

$3 \times 3 = 9$

- (a) What is meant by degree of advancement of a chemical reaction? Write a note on fugacity.  $1\frac{1}{2} + 1\frac{1}{2} = 3$
- (b) State Le Chatelier principle. Write a note on thermodynamic equilibria.  $2+1=3$
- (c) Describe the relationship among  $k_c$ ,  $k_p$  and  $k_x$ .
- (d) What do you mean by free energy of mixing? Explain.

### UNIT—IV

6. Answer any *two* of the following questions :

$4 \times 2 = 8$

- (a) State and explain Raoult's law. Explain how the law can be used for determining molar mass of a dissolved substance.  $2+2=4$

( 7 )

- (b) Why are colligative properties called so? Name the various colligative properties.  $2+2=4$
- (c) What is Henry's law? Define osmotic pressure.  $2+2=4$

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