

**2024/TDC (CBCS)/EVEN/SEM/
CHMHCC-202T/300**

TDC (CBCS) Even Semester Exam., 2024

CHEMISTRY

(2nd Semester)

Course No. : CHMHCC-202T

(Physical Chemistry)

Full Marks : 50

Pass Marks : 20

Time : 3 hours

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

UNIT—I

1. Answer any two questions : 2×2=4

- (a) Define state and path function and give one example of each.
- (b) State the first law of thermodynamics. Why is it also called the law of conservation of energy?
- (c) Define standard state of formation. Give one example.

(2)

2. Answer any one question :

6

- (a) (i) Distinguish between isothermal and adiabatic process. Derive a relation between temperature and volume in reversible adiabatic expression. 1+3=4
- (ii) One mole of an ideal gas expands against a constant external pressure of 1 atm from a volume of 10 dm³ to a volume of 30 dm³. Calculate the work done by the gas in Joules. 2
- (b) (i) Derive the expression for the work done in reversible isothermal work. 4
- (ii) The enthalpy of combustion of glucose C₆H₁₂O₆ (s) is -2816 kJ mol⁻¹ at 25 °C. Calculate ΔH_f° (C₆H₁₂O₆). The ΔH_f° values for CO₂(g) and H₂O(l) are -393.5 kJ mol⁻¹ and -285.9 kJ mol⁻¹ respectively. 2

UNIT—II

3. Answer any two questions :

2×2=4

- (a) Explain the limitation of first law of thermodynamics.

(3)

(b) Show that $\left(\frac{\delta T}{\delta V}\right)_S = -\left(\frac{\delta P}{\delta S}\right)_V$.

(c) State and explain Joule-Thomson coefficient.

4. Answer any one question :

6

- (a) (i) Derive an expression for second law of thermodynamics. 3
- (ii) Obtain an expression for change in entropy of an ideal gas with change in pressure and temperature. 3
- (b) (i) State third law of thermodynamics and explain its significance. 3
- (ii) Define the following terms : 1½×2=3
- (1) Residual entropy
- (2) Inversion temperature

UNIT—III

5. Answer any two questions :

2×2=4

- (a) Define partial molar entropy and partial molar enthalpy.
- (b) Explain the importance of chemical potential.
- (c) Derive an expression for Gibbs-Duhem equation.

(4)

6. Answer any one question : 6

(a) Derive an expression for chemical potential of ideal gas mixture in terms of pressure, concentration and mole-fraction.

(b) (i) Discuss the variation of free energy change with temperature and pressure. 4

(ii) Show that $\left(\frac{\delta\mu_i}{\delta T}\right)_{P,N} = -\bar{S}_i$. 2

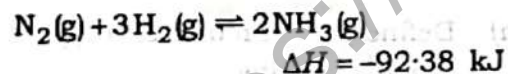
UNIT—IV

7. Answer any two questions : 2×2=4

(a) Explain the term 'fugacity'.

(b) Explain the thermodynamic condition for spontaneity of a reaction.

(c) What will be the effect of temperature on the following reaction?



8. Answer any one question : 6

(a) (i) Explain coupling of exoergic and endoergic reactions with suitable example. 4

(5)

(ii) Explain Le Chatelier's principle with a suitable example. 2

(b) (i) Derive a relation among K_p , K_x and K_c . 4

(ii) Derive van't Hoff reaction isotherm. 2

UNIT—V

9. Answer any two questions : 2×2=4

(a) State and explain Raoult's law.

(b) Explain depression of freezing point with an example.

(c) Explain reverse osmosis.

10. Answer any one question : 6

(a) Derive an expression for osmotic pressure and explain how it can be used for determining molar mass of non-volatile solute. 4+2=6

(b) Derive a relation between the depression of freezing point of a solution and the mole fraction of dissolve solute. What is molal freezing point constant of a solvent? 4+2=6
