

Reg. No. :

Name :

Second Semester B.Sc. Degree Examination, September 2022

First Degree Programme Under CBCSS

Chemistry

Complementary Course for Physics and Geology

CH 1231.1/CH 1231.2 : PHYSICAL CHEMISTRY I

(2017-2019 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions. Answer in one word to maximum of two sentences. Each question carries **1** mark.

1. What is internal energy?
2. Give the mathematical representation of first law of thermodynamics.
3. Define pH of a solution.
4. What is meant by heat capacity of a system?
5. Why is a higher temperature not used in the Haber process?
6. Define equilibrium constant in terms of partial pressures. (K_p).
7. Give one example for basic buffer.

P.T.O.

8. What are reversible reactions?
9. Define enthalpy of solution.
10. What are Bronsted acids?

(10 × 1 = 10 Marks)

SECTION – B

Short answer type. Answer **any eight** questions from the following. Each question carries **2** marks.

11. Mention the limitations of first law of thermodynamics.
12. Show that in an isothermal expansion of an ideal gas $\Delta U = 0$.
13. What are the entropy criteria for spontaneity and equilibrium?
14. What is bond dissociation energy?
15. Define enthalpy of formation.
16. State Kirchhoff equation.
17. Explain common ion effect with an example.
18. For the reaction $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$; Prove that $K_p = K_c$.
19. State second law of thermodynamics.
20. Mention the factors influencing the value of equilibrium constants.
21. Give two examples each for neutral Lewis acids and bases.
22. Calculate the hydrolysis constant of 0.1M solution of KCN. Dissociation constant of KCN = 7.2×10^{-10} at 25°C and $K_w = 1.0 \times 10^{-14}$.

(8 × 2 = 16 Marks)

SECTION – C

Short essay type. Answer **any six** questions from the following. Each question carries 4 marks.

23. Differentiate isothermal and isochoric processes.
24. Deduce the relationship between q_p and q_v for an ideal gas.
25. Write Gibbs-Helmholtz equation and discuss the conditions for a process to be spontaneous.
26. Discuss the applications of Hess's law.
27. Define K_x of a reaction and deduce the relation between K_x and K_p .
28. Calculate the K_p of the reaction
 $A(g) + B(g) \rightleftharpoons C(g) + D(g)$ if ΔG° of the reaction at 25°C is $-3.435 \text{ kJmol}^{-1}$.
29. Explain the effect of pressure in the decomposition of PCl_5 .
30. What is levelling effect?
31. Discuss the hydrolysis of salts of strong acid and weak base.

(6 × 4 = 24 Marks)

SECTION – D

Long essay. Answer **any two** questions. Each question carries 15 marks.

32. Define heat capacities at constant volume and pressure. Prove that $C_p - C_v = R$.
33. Write short notes on the followings
 - (a) Enthalpy of hydration
 - (b) Enthalpy of reaction and its calculation
 - (c) Variation of heat of reaction with temperature

34. (a) Derive van't Hoff reaction isotherm. 7

(b) The equilibrium constant of a reaction doubles on rising the temperature from 25°C to 35°C. Calculate the standard enthalpy change of the reaction. 4

(c) Calculate the K_c for the reaction

$2\text{SO}_3(g) \rightleftharpoons 2\text{SO}_2(g) + \text{O}_2(g)$ for which $K_p = 3.5 \times 10^{-23}$ atm at 27°C. 4

35. (a) What are buffer solutions and buffer capacity? 4

(b) How will you calculate the pH of different buffer solutions? 6

(c) Calculate the pH of a solution obtained by mixing 50ml of 0.2M HCl with 50ml of 0.1M NaOH. 5

(2 × 15 = 30 Marks)