T – 3200

Reg. No. : ....

Name : ....

Second Semester B.Sc. Degree Examination, August 2024

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. Each question carries **1** mark.

1. Define bond dissociation energy.

2. Write one application of common ion effect.

3. What is meant by a spontaneous reaction?

4. What is relation connecting free energy, enthalpy and entropy?

5. Define enthalpy of hydration.

6. Write one example for basic buffer.

7. What is Arrhenius concept of acids and bases?

8. Write one application of Hess's law.

9. Define Le-Chatlier principle.

10. Calculate the pH of 0.001 M HCl.

(10 × 1 = 10 Marks)

SECTION – B

Answer **any eight** questions. Each question carries **2** marks.

11. Define van't Hoff reaction isotherm.

12. What are the limitations of first law of thermodynamics?

13. The enthalpy change for the conversion of a liquid to its vapour is 80 kJ /mol. Calculate the entropy change if the boiling point of the liquid is 150°C.

14. Define enthalpy of neutralisation.

15. Write the significance of bond dissociation energy.

16. Write the Henderson equation and explain the terms.

17. Define isochoric process.

18. What is ionic product of water?

19. One mole of an ideal gas at 28°C is allowed to expand isothermally and reversibly form a volume of 5 litres to 10 litres. Calculate the work done by the gas.

20. What are the characteristics of equilibrium constant?

21. Define Lewis acid with an example.

22. Explain Helmholtz free energy.

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions. Each question carries **4** marks.

23. Derive relation between heat of reaction at constant volume and constant pressure.

24. Calculate the equilibrium constant for a reaction at 25°c. $\Delta G° = 35$ kcal.

25. Predict the effect of pressure on the dissociation of PCls.

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26. Discuss in detail second law of thermodynamics.

27. Calculate the enthalpy of hydrogenation, $C_2H_4(g) + H_2(g) = C_2H_6(g)$. Given that bond energy of $H-H-430\,kJ$, $C=C=610\,kJ$ and $C-C=340\,kJ$ and $C-H=443\,kJ$.

28. Explain determination of pH by potentiometric method.

29. What happens if pressure is increased for the reversible reaction

$$2SO_2 + O_2 \rightleftharpoons 2SO_3.$$

30. Derivation of relation between Kw and Kh for salts of weak acid - weak base.

31. Discuss the conditions for spontaneity using free energy concept.

(6 × 4 = 24 Marks)

SECTION – D

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

32. (a) Derive the relation between Kp and Kc.   7

     (b) Calculate the heat of formation of a CO_2. Given $CH_4 + 2O_2 \rightleftharpoons CO_2 + 2H_2O$. Given that $\Delta H = 0.8$ kcal/mol (of the reaction). Heat of formation of H_2O, CH_4 (g) and O_2 are 12.4, –78.3 and 23.4 kcal/mol respectively.   8

33. (a) State Kirchhoff's equation. Indicate how it can be used to evaluate ΔH of a reaction from heat capacity data of reactants and products.   8

     (b) Define

         (i) Gibbs Helmholtz functions

         (ii) Enthalpy

         (iii) Entropy.   7

34. Explain in detail the different concepts of acids and bases with suitable examples. **15**

35. (a) Calculate the enthalpy change for the combustion of methane given the formation of methane, carbondioxide and water are -74.8kJ/mol, -393.5kJ/mol and -286.2 kJ/mol respectively. **8**

(b) Explain buffer action taking suitable example. **7**

(2 × 15 = 30 Marks)

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