Roll No. ..... Total Printed Pages-12

F- 1371

C.B.S. (Second Semester)

EXAMINATION, May - June, 2022

CHEMISTRY - II

(C - 201)

Time : Three Hours] *[Maximum. Marks:40*

Note: Attempt all sections as directed.

Section - A

(Objective/Multiple Choice Questions)

(½ Marks each)

Note: Attempt all questions. Choose the most appropriate answer.

1. For exothermic reactions. ΔH is_____while for endothermic reactions it is_____
   (A) Positive, Negative
   (B) Positive, Positive
   (C) Negative, Negative
   (D) Negative, Positive

2. The Kirchoff's equation is:
   (A) $\Delta H_2 - \Delta H_1 = \Delta C_p \ (T_2 - T_1)$
   (B) $\Delta E_2 - \Delta E_1 = \Delta C_v \ (T_2 - T_1)$
   (C) Both
   (D) Neither (A) nor (B)
3. The heat of neutralization of a strong acid and a strong base is always:
   (A) Zero
   (B) Constant
   (C) Positive
   (D) Changing
4. The heat change in equations
   $H^+_{(aq)} + OH^-_{(aq)} = H_2O_{(l)}$ $\Delta H = -13.7$ kcal represents
   (A) Heat of neutralization
   (B) Heat of formation of water
   (C) Heat of dissociation of water
   (D) Heat of solution

5. The Gibb's Helmholtz equation is applicable to

   (A) All processes, chemical or physical

   (B) All processes, chemical or physical but in a closed system

   (C) All chemical processes in a closed system

   (D) All physical processes in a closed system

6. For a spontaneous process

   (A) $\Delta G > 0$

   (B) $\Delta G = 0$

   (C) $\Delta G < 0$

   (D) None of these

7. The change in free energy is measure of:

   (A) Net work done

   (B) Net change in entropy

   (C) Net change in enthalpy

   (D) Net change in internal energy

8. Which of the following equation is used to calculate the heat of reaction when ΔG at two temperatures are given?

   (A) Clapeyron equation

   (B) Gibb's Helmholtz equation

   (C) Kirchoff's equation

   (D) None of the above

9. A mixture of two miscible liquids (ethanol and water) has the number of phases equal to

   (A) Zero

   (B) Three

   (C) Two

   (D) One

10. For one component system the phase rule is

    (A) F = 3 - P

    (B) F = 2 - P

    (C) F = 1 - P

    (D) None of these

11. The equation $\frac{dP}{dT} = \frac{\Delta H}{T(V_2 - V_1)}$ is called

(A) Gibb's Helmholtz equation

(B) Kirchoff's equation

(C) Clapeyron equation

(D) Clausius Clapeyron equation

12. At a triple point

(A) Both the temperature and pressure are fixed

(B) Only the temperature is fixed

(C) Only the pressure is fixed

(D) Sometimes pressure and sometimes temperature is fixed

13. A colligative property depends upon

(A) Chemical nature of the particles

(B) Number of the particles

(C) Size of the particles

(D) Temperature of the solution

14. The elevation in boiling point is given by the formula

$$\Delta T = K_b \times \frac{w}{m} \times \frac{1}{W}$$

Where K_b is called

(A) Boling point constant

(B) Ebulioscopic constant

(C) Molal elevation constant

(D) All of these

15. Freezing point depression is measured by

(A) Beckmann's method

(B) Rast's camphor method

(C) Both

(D) None of these

16. The law of relative lowering vapour pressure was given by

(A) Van't Hoff

(B) Raoult

(C) Ostwald

(D) Henery

17. Which of the following will change the equilibrium constant for a reaction mixture?

(A) Changing temperature

(B) Adding inert gas

(C) Increasing pressure by decreasing volume

(D) All the these

18. For a reaction involving only gases at 25^0C, the equilibrium constant can be expressed in terms of molarity Kc or partial pressure Kp. Which is true about the numerical value of Kp?

(A) Kc is generally greater than Kp

(B) Kc is generally less than Kp

(C) Kc is generally equal to Kp

(D) Kc is equal to Kp if the total moles of reactants and products are equal

19. A chemical system is at equilibrium

(A) When the rate of the forward reaction becomes zero

(B) When the rate of the forward reaction and the reverse reaction are equal

(C) All of the reactants have been used up

(D) When the rates of the forward reaction and the reverse reaction are both zero

20. For the reaction:

$2Ag^{+} + Zn \rightarrow 2Ag + Zn^{2+}$

E°_{cell} = 1.56V. What is the corresponding value of $\triangle G^{o}$?

(A) $301\ k\text{J mol}^{-1}$

(B) $-301\ \text{J mol}^{-1}$

(C) $-301\ k\text{J mol}^{-1}$

(D) $301\ \text{J mol}^{-1}$

Section - B

(Very Short Answer Type Question)

(0.75 Marks each)

Note: Attempt all questions.

1. What is the difference between Bond Energy and Bond Dissociation Energy?
2. Define third law of thermodynamics.
3. What are Partial molar properties?
4. What is the relationship between spontaneity and equilibrium?
5. Explain Phase, component and degree of freedom.
6. How many phases are present in a piece of molten ice placed in a beaker covered with a watch glass?
7. What is the importance of vant's Hoff equation in colligative properties?
8. What is azeotrophic mixture? Can it be considered as ideal solution?
9. What are the conditions necessary for chemical equilibrium?

10. What is the basic difference between galvanic and electrolytic cell.

Section - C

(Short Answer Type Questions)

(1.25 Marks each)

Note: Attempt all questions.

1. Explain the entropy change in a phase transition.
2. What is Trouton's rule? Why does Trouton's rule work?
3. Explain Gibb's - Duhem equation.
4. At what temperature would the following reaction occur spontaneously? $(\Delta H^\circ = 1256.4\ kJ\ \Delta S^\circ = 587\ J/K)$

   $A + B \rightarrow C$.
5. How Phase Rule determined thermodynamically?
6. Write the applications of Clausius Clapeyron equation?
7. An aqueous solution boils at 100.50^0C. Calculate the Freezing point of the solution. (given that K_b of water = 0.50^0C/m and K_f of water = 1.86 ^{0}C/m)
8. How molecular weight is determined from osmotic pressure?

9. Derive Nernst equation.

10. The standard potentials of the $Cu^{2+}./Cu$ and Cu^{+}/Cu couples are +0.340 V and 0.522 V, respectively. Calculate E^0 for $Cu^{2+}./Cu^{+}$.

Section - D

(Long Answer Type Questions)

(2 Marks each)

Note: Attempt all questions.

1. What is the effect of temperature on heat of reaction? Derive the Kirchoff's equation.

OR

State and explain Hess's law of constant heat summation. Discuss the application of this law.

2. Discuss the significance of Gibb's Helmholtz equation. Derive various forms of Gibbs-Helmholtz equation.

OR

What is Chemical potential? Derive the expression for the effect of temperature and pressure on chemical potential.

3. Draw and discuss the phase diagram for the carbon dioxide system. In what respects does this system differ from the water system?

OR

Discuss the salient features and phase diagram of the sulphur system.

4. State and derive Raoult's law for vapour pressure lowering. How it is used for determining the molar mass of a nonvolatile compound?

OR

Explain the term osmosis and osmotic pressure. Derive the van't Hoff equation for the osmotic pressure of a dilute solution.

5. What is standard free energy change? Derive a relationship between standard free energy change and equilibrium constant of a reaction.

OR

Explain Le Chatelier's principle. Discuss briefly the effect of change in concentration, pressure and temperature on a chemical reaction.