

(b) Hess's law and its applications

(c) Criteria of Spontaneity

(d) Solubility Principle and its applications

(e) Bond energy and Bond dissociation Energy

(5×3)

(500)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1493

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Unique Paper Code : 2172583501

Name of the Paper : DSC-A5: Physical Chemistry

Name of the Course : **Agrochemical and Pest
Management**

Semester : V

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt 4 questions in all.

1. Answer the following questions in brief:

P.T.O.

- (a) Define the common ion effect with an example.

Discuss the application of the common ion effect in qualitative analysis, particularly in the separation of Group II and Group III cations.

- (b) Define extensive properties and intensive properties. Give one examples for each.

- (c) Prove that $C_p - C_v = R$ for one mole of an ideal gas. Why C_p is always greater than C_v .

- (d) 2.0 mole of an ideal gas expands isothermally and reversibly at 300 K from a volume of 10 dm³ to a final volume of 30 dm³. Calculate the work done, ΔE , ΔH , and δq . ($R=8.314 \text{ Jmol}^{-1}\text{K}^{-1}$).

- (e) Calculate the degree of dissociation & pH of 0.1 M CH_3COOH . The dissociation constant of acetic acid is 1.8×10^{-5} . (4,3,3,3,2)

- (d) Calculate the pH of (i) 0.005 M HCl solution and (ii) 0.001M KOH solution. (5,4,4,2)

5. (a) Explain the buffer action of an acidic and a basic buffer solution with suitable examples.

- (b) Calculate the solubility of silver chromate Ag_2CrO_4 in a 0.100M solution of AgNO_3 . (K_{sp} for $\text{Ag}_2\text{CrO}_4 = 9.0 \times 10^{-12}$).

- (b) Define degree of ionization. What are the factors affecting the degree of ionization?

- (d) Calculate the pH of 0.75 M CH_3COOH solution. (5,4,4,2)

6. Write short notes on the following :

- (a) State function and Path functions

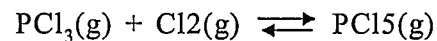
- (d) Calculate the pH of a buffer solution containing 0.25 M NH_4Cl and 0.05M of NH_4OH . (K_b for NH_4OH is 1.8×10^{-5}). (4,4,4,3)

4. (a) Derive the relationship between K_p and K_c . Under what conditions K_p and K_c are found equal?

For the reaction $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$ $K_p = 0.1 \text{ atm}^{-1}$ at 300 K. Find K_c .

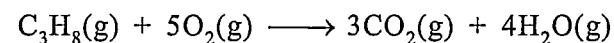
- (b) Define molar conductance and specific conductance. How are they related? Explain why the conductivity of a solution decreases with dilution, but molar conductance increases.

- (c) The equilibrium constant (K_p) for the reaction



is 3.4×10^{17} at 25°C . Calculate the standard free energy change for the reaction.

2. (a) Propane has the structure $\text{CH}_3\text{-CH}_2\text{-CH}_3$. Calculate the change in the enthalpy for the following reaction :



Given that average bond enthalpies (KJ/mol) are:

C-C	C-H	C=O	O=O	O-H
347	414	741	498	464

- (b) State Kohlrausch's Law of independent migration of ions. If molar conductivities at infinite dilution of KCl , HCl and CH_3COOK are 149.9, 426.1 and $114.4 \text{ ohm}^{-1}\text{cm}^2\text{mol}^{-1}$ respectively. What will be the molar conductivity of acetic acid at infinite dilution.

(c) State Third law of thermodynamics. Write the complete expression for the entropy calculation of any substance in the gaseous state at temperature T starting from 0 K and assuming that a solid undergoes a polymorphic transition.

(f) Define Enthalpy of hydration. Explain with the help of an example. (4,4,4,3)

3. (a) Calculate the heat of formation of HCl at 348K from the following data :

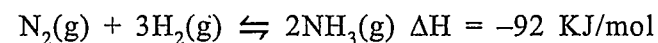
$\frac{1}{2} \text{H}_2(\text{g}) + \frac{1}{2} \text{Cl}_2(\text{g}) \longrightarrow \text{HCl}(\text{g})$. The heat of formation at 25°C at constant pressure is -92300J. The mean heat capacities over this temperature range are :

$\text{H}_2(\text{g}); C_p = 28.53 \text{ J/K/mol}$

$\text{Cl}_2(\text{g}); C_p = 32.26 \text{ J/k/mol}$

$\text{HCl}(\text{g}); C_p = 28.49 \text{ J/K/mol}$

(b) State Le Chatelier's principle. For the equilibrium:



What effect will be on equilibrium direction if :

(i) The pressure is decreased.

(ii) The temperature is increased

(ii) $\text{NH}_3(\text{g})$ is removed from system.

(c) Define hydrolysis constant & degree of hydrolysis.

Calculate the pH of 0.20 M solution of ammonium chloride, $K_b = 1.8 \times 10^{-5}$.