

B.SC 2nd Semester (CBCS) Home Assignment

Subject: Chemistry (HC)

Paper: Physical Chemistry (CHE-HC-2026)

Last date of submission: 07/08/2020

Total Marks: 50

Q1. Answer the following questions

1x10 = 10

- From thermodynamic point of view, to which system animals and plants belong?
- State third law of thermodynamics.
- Which colligative property is used for determining the molar mass of macromolecules?
- What is the maximum value of van't Hoff factor (i) $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$?
- What is reverse osmosis? Give one large scale use of it.
- Define reaction quotient
- Write the expression for equilibrium constant K_P for the reaction



- If $Q_C > K_C$ then what would be the type of reaction?
- Can a catalyst change the position of equilibrium in a reaction?
- What will happen to internal energy if work is done by the system?

Q2. Answer the following questions

2x5 = 10

- Entropy is not a convenient criterion for predicting the spontaneity of a process. Why?
- With the help of first law of thermodynamics and $H=U+PV$, prove $\Delta H=q_p$
- Give reason for the following
 - Aquatic species are more comfortable in cold water than in hot water.
 - Cold drinks bottles are sealed under high pressure of CO_2 .
- 6 moles of an ideal gas expand isothermally and reversibly from a volume of 1 dm^3 to a volume of 10 dm^3 at 27°C . What is the maximum work done? Express the result in joules.
- Calculate ΔG accompanying the vaporization of one mole of liquid water at 100°C and 76 torr pressure. Will the process be spontaneous?

Q3. Answer the following questions

3x5=15

- For a van der Waals gas, express the fugacity as a function of V , T , R and van der Waals constant.

b) State Le Chatelier's principle and apply it to discuss the optimum conditions for the manufacture of ammonia.

c) Show that work done in a reversible process is greater than the work done in an irreversible process.

d) The vapour pressure of benzene is 53.3kPa at 60.6°C, but it lowers to 51.5 kPa when 19g of a non-volatile organic compound is dissolved in 500g benzene. Calculate the molar mass of the organic compound, taking the molar mass of benzene as 78g.

e) For a gas phase reaction, pressure does not affect the value of equilibrium constant at constant temperature. Explain with reason.

Q4. Derive Gibbs - Duhem equation for a mixture system at constant pressure and temperature. **5**

Q5. Show that in an isothermal expansion of an ideal gas (a) $\Delta U=0$ and (b) $\Delta H=0$. Calculate the final volume of one mole of an ideal gas initially at 0°C and 1 atm pressure if it absorbs 1000 cal of heat during a reversible isothermal expansion. **3+2=5**

Q6. Helium gas at 500K expands adiabatically and reversibly to double its volume. Find the final temperature of the gas in degree Celsius. (assume that He gas behaves ideally). **5**