

**UNIT- 8 – PHYSICAL AND CHEMICAL EQUILIBRIUM****I. Answer in brief (2/3 marks)**

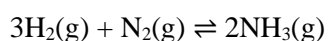
1. State Le-Chatelier principle.
2. State law of mass action.
3. When the numerical value of the reaction quotient (Q) is greater than the equilibrium constant (K), in which direction does the reaction proceed to reach equilibrium?
4. If there is no change in concentration, why is the equilibrium state considered dynamic?
5. What is homogeneous and heterogeneous equilibrium?
6. Consider the following reactions,
  - a)  $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2 \text{HI}(\text{g})$
  - b)  $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$
  - c)  $\text{S}(\text{s}) + 3\text{F}_2(\text{g}) \rightleftharpoons \text{SF}_6(\text{g})$

In each of the above reaction find out whether you have to increase (or) decrease the volume to increase the yield of the product.

7. Explain how will you predict the direction of an equilibrium reaction.

**II. Answer in a paragraph (5 marks)**

1. Derive a general expression for the equilibrium constant  $K_P$  and  $K_C$  for the reaction



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2. Derive the relation between  $K_P$  and  $K_C$ .
3. One mole of  $\text{PCl}_5$  is heated in one litre closed container. If 0.6 mole of chlorine is found at equilibrium, calculate the value of equilibrium constant.
4. For the reaction  $\text{SrCO}_3(\text{s}) \rightleftharpoons \text{SrO}(\text{s}) + \text{CO}_2(\text{g})$ , the value of equilibrium constant  $K_P = 2.2 \times 10^{-4}$  at 1002 K. Calculate  $K_C$  for the reaction.
5. Deduce the Vant Hoff equation.
6. The partial pressure of carbon dioxide in the reaction  $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$  is  $1.017 \times 10^{-3}$  atm at 500° C. Calculate  $K_P$  at 600° C for the reaction.  $\Delta H$  for the reaction is 181 KJ mol<sup>-1</sup> and does not change in the given range of temperature.
7. Derive  $K_P$  and  $K_C$  for the formation equilibrium of HI.
8. Derive  $K_P$  and  $K_C$  for the dissociation of  $\text{PCl}_5$ .