Chemical Equilibrium Video 1 Review Sheet

Description of Chemical Equilibrium Video 1:

This essential review material will focus on how to describe and define an equilibrium state, followed by an introduction to the law of mass action, predicting shifts in equilibrium, and expressing the change by examining the reaction quotient, Q.

1) There are two ways to state that a chemical reaction is at equilibrium, what are they?

2) The Law of Mass Action indicates the extent of an equilibrium and often one is able to predict if the equilibrium lies toward reactants or products if given the equilibrium constant. How is this possible?

3) The Haber reaction is an equilibrium when hydrogen gas reacts with nitrogen gas to afford ammonia gas. At a certain temperature the equilibrium concentrations were measured and found to be $[H_2] = 0.763$ *M*, $[N_2] = 0.921$ *M*, and $[NH_3] = 0.157$ *M*. What is the equilibrium constant at this temperature?

4) The Haber reaction is an equilibrium when hydrogen gas reacts with nitrogen gas to afford ammonia gas. At 300^0C the equilibrium constant was found to be K = 9.60. Please convert this to a K_p value at 300^0C.

5) The Haber reaction is an equilibrium when hydrogen gas reacts with nitrogen gas to afford ammonia gas. At 472^0C the equilibrium partial pressures were measured and found to be $[H_2] = 7.38$ atm, $[N_2] = 2.46$ atm, and $[NH_3] = 0.166$ atm. What is the K_p and K at this temperature?

6) Please explain what the reaction quotient, Q, is equal to, and explain shift in equilibrium if Q = K, Q > K, and if Q < K.

7) Gaseous hydrogen and gaseous iodine are in equilibrium with gaseous hydrogen iodide (also known as hydroiodic acid). The equilibrium constant was measured and found to be 50.5 at 448^0C. Random amounts of reactants and product ($[H_2] = 1.00\text{x}10^{-2}$ mol, $[I_2] = 3.00\text{x}10^{-2}$ mol, and $[HI] = 2.0\text{x}10^{-2}$ mol) were placed into a 2.00L reaction vessel and allowed to obtain an equilibrium state at 448^0C. Please predict if the given initial quantities will increase or decrease at equilibrium.

8) Please indicate if shift will be to left or right and express the change for the Haber reaction at 773 ^{0}C (K=0.0602) given the following concentrations.

a) $[H_2] = 0.38$ *M*, $[N_2] = 2.4$ *M*, and $[NH_3] = 0.0$ *M*

b) $[H_2] = 0.0$ *M*, $[N_2] = 3.8$ *M*, and $[NH_3] = 9.3$ *M*

c) $[H_2] = 1.20$ *M*, $[N_2] = 0.40$ *M*, and $[NH_3] = 0.20$ *M*