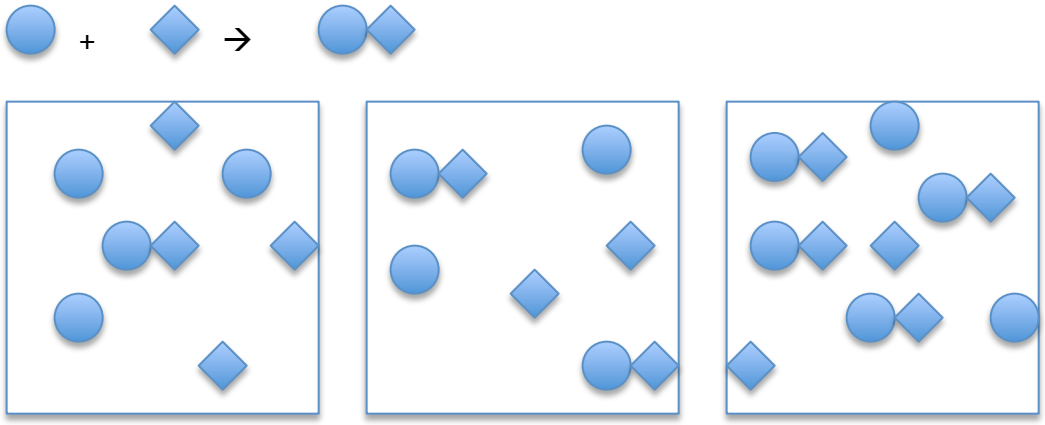
Worksheet 2

1. If the starting concentration of water is 0.5 M in the reaction HCl + NaOH → H_2O, what is the value of the equilibrium constant K?
    a. 1
    b. 2
    c. 0.25
    d. 0.5
    e. Not enough information
2. Rank the following in terms of increasing equilibrium constant for the reaction



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3. Hydrogen gas reacts with oxygen to produce water vapor. If the equilibrium composition is defined by 4 waters, 3 oxygen molecules, and 3 hydrogen molecules, what is the equilibrium constant? Which reaction is favored, the forward or reverse?

4. The equilibrium constant for the reaction N2O4(g)⇌2NO2 at 2 ∘C is Kc = 4.0. If there are 9 moles of N2O4(g) how many moles of NO2 are required to reach equilibrium at 2 ∘C?

5. If a constant Q were calculated for the reaction HCl → H^+ + Cl^-, in the same way as calculating K but before equilibrium is reached, would you expect it to be:
    a. Equal to K
    b. Less than K
    c. Greater than K

Part 2

6. The following reaction was carried out in a 3.25 L reaction vessel at 1100 K:
   $C(s)+H_2O(g) \rightleftharpoons CO(g)+H_2(g)$
   If during the course of the reaction, the vessel is found to contain 8.75 mol of C, 14.8 mol of H_2O, 3.10 mol of CO, and 10.60 mol of H_2, what is the reaction quotient Q?

7. If the reaction from Question 6 has an equilibrium constant of 0.154:
   a. The reaction will proceed to the left to establish equilibrium
   b. The reaction will proceed to the right to establish equilibrium
   c. The reaction is at equilibrium

8. The value of K_c for the reaction $2\ AB(g)+B_2(g) \rightleftharpoons 2\ AB_2(g)$ must be less than the value of K_c for the reaction $2\ AB_2(g) \rightleftharpoons 2\ AB(g)+B_2(g)$
   a. True
   b. False
9. Carbonyl fluoride, COF_2, is an important intermediate used in the production of fluorine-containing compounds. For instance, it is used to make the refrigerant carbon tetrafluoride, CF_4 via the reaction
   $2COF_2(g) \rightleftharpoons CO_2(g)+CF_4(g), \quad Kc=8.10$
   If only COF_2 is present initially at a concentration of 2.00 M, what concentration of COF_2 remains at equilibrium?

10. When 9.2 g of frozen N_2O_4 is added to a 0.20 L reaction vessel and the vessel is heated to 400 K and allowed to come to equilibrium, the concentration of N_2O_4 is determined to be 0.057 M. Given this information, what is the value of Kc for the reaction below at 400 K?
    $N_2O_4(g) \rightleftharpoons 2\ NO_2(g)$