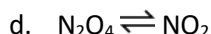
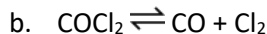
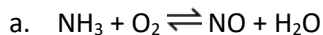


AP Worksheet 7a (Equilibrium, K, Q)

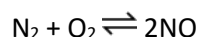
Part 1 – K_c, K_p, Q

1. Balance the equation and write the equilibrium constant expression, K_c, for each of the following reactions. All reactants and products are gases.



2. If K_c for $2\text{A} + \text{B} \rightleftharpoons 2\text{C}$ is 8.0, set up the expression used to calculate the concentration of C at equilibrium. Calculate the equilibrium concentration of C if the equilibrium conditions were 0.50 mol each of A and B in a 10.0 L container. (0.032 M)

3. At 2000 °C, nitrogen and oxygen react according to the following equation.



The equilibrium constant for this reaction at 2000 °C is 1.2×10^{-4} . At equilibrium, the concentrations of N₂ and O₂ are found to be 0.166 M and 0.145 M, respectively. What is the concentration of NO? (1.7×10^{-3} M)

4. Ammonia combines with oxygen to produce water vapor and nitrogen.
- Write a balanced equation for the equilibrium reaction.
 - Write the expression for the equilibrium constant.
 - At a certain temperature, the concentration of each substance is 1.0 M. Calculate K_c for that temperature. (1.0)
 - Calculate K_c if [NH₃] is 3.0 M, [O₂] is 2.0 M, [H₂O] is 4.0 M, and [N₂] is 2.0 M. (25)

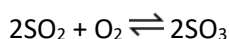
Part 2 – Interpreting K and Q

5. For the reaction $2\text{CO}(\text{g}) \rightleftharpoons \text{C}(\text{s}) + \text{CO}_2(\text{g})$, K_c = 7.7×10^{-15} . At a particular time, the following concentrations are measured: [CO] = 0.034 M, [CO₂] = 3.6×10^{-17} M. Is this reaction at equilibrium? If not which direction will the reaction proceed?

6. For the reaction $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$, $K_c = 0.2$. At a particular time, the following concentrations are measured: $[\text{N}_2\text{O}_4] = 2.0 \text{ M}$, $[\text{NO}_2] = 0.2 \text{ M}$. Is this reaction at equilibrium? If not which direction will the reaction proceed?
7. At 340°C , $K_c = 0.064$ for the reaction $\text{Fe}_2\text{O}_3(\text{s}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{Fe}(\text{s}) + 3\text{H}_2\text{O}(\text{g})$. Given that $[\text{H}_2] = 0.45 \text{ M}$ and $[\text{H}_2\text{O}] = 0.37 \text{ M}$, find Q and predict how the reaction will proceed.

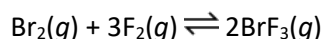
Extra problems (optional)

8. Determine the equilibrium constant of the following reaction using the data given.

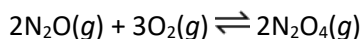


At equilibrium at 295°C , a 2.00 L flask was found to contain 0.35 mole of SO_2 , 0.70 mole of O_2 , and 1.40 moles SO_3 . (46)

9. The equilibrium constant for the reaction below, at a given temperature, is 45.6. If the equilibrium concentrations of F_2 and BrF_3 are 0.124 M and 0.199 M respectively, calculate the equilibrium concentration of Br_2 . (0.455 M)



10. An equilibrium is established in the reaction below and the concentrations of each component are determined. Calculate the value of K_c at this temperature (2.52×10^5)



Equilibrium concentrations, $\text{N}_2\text{O} = 0.0155 \text{ M}$, $\text{O}_2 = 0.0169 \text{ M}$, $\text{N}_2\text{O}_4 = 0.0171 \text{ M}$

11. For the reaction $2\text{ICl}(\text{g}) \rightleftharpoons \text{I}_2(\text{g}) + \text{Cl}_2(\text{g})$, $K_c = 0.11$. At a particular time, the following concentrations are measured: $[\text{ICl}] = 2.5 \text{ M}$, $[\text{I}_2] = 2.0 \text{ M}$, $[\text{Cl}_2] = 1.2 \text{ M}$. Is this reaction at equilibrium? If not which direction will the reaction proceed?