

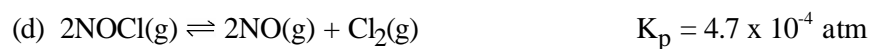
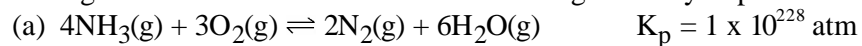
16 • Chemical Equilibria

PROBLEM SET # 1

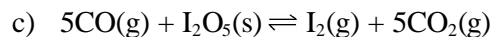
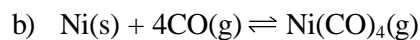
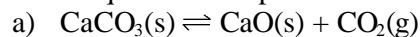
1. What general information can be gathered by observing the magnitude of the equilibrium constant?

2. Write the equilibrium expression (K_p) for each of the following reactions.

Arrange the reactions in order of their increasing tendency to proceed toward completion: ___ ___ ___ ___

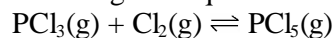


3. Write equilibrium expressions for each of the following reactions:



4. Consider the equilibrium $\text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons \text{PCl}_5(\text{g})$.

How would the following changes affect the partial pressures of each gas at equilibrium?

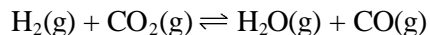


- | | | | |
|--|-------|-------|-------|
| a) addition of PCl_3 | _____ | _____ | _____ |
| b) removal of Cl_2 | _____ | _____ | _____ |
| c) removal of PCl_5 | _____ | _____ | _____ |
| d) decrease in the volume of the container | _____ | _____ | _____ |
| e) addition of He without change in volume | _____ | _____ | _____ |

5. Which if any of the changes in question 4 will change the value of the equilibrium constant for the reaction?

- a b c d e

6. Indicate how each of the following changes affects the amount of each gas in the system below, for which $\Delta H_{\text{reaction}} = +9.9 \text{ kcal}$.



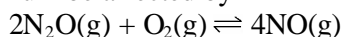
- | | | | | |
|--|-------|-------|-------|-------|
| a) addition of CO_2 | _____ | _____ | _____ | _____ |
| b) addition of H_2O | _____ | _____ | _____ | _____ |
| c) addition of a catalyst | _____ | _____ | _____ | _____ |
| d) increase in temperature | _____ | _____ | _____ | _____ |
| e) decrease in the volume of the container | _____ | _____ | _____ | _____ |

7. How will each of the changes in question 6 affect the equilibrium constant?

- a _____ b _____ c _____ d _____ e _____

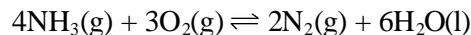
8. Consider the equilibrium: $2\text{N}_2\text{O}(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 4\text{NO}(\text{g})$

How will the amount of chemicals at equilibrium be affected by



- | | | | |
|---|-------|-------|-------|
| a) adding N_2O | _____ | _____ | _____ |
| b) removing O_2 | _____ | _____ | _____ |
| c) increasing the volume of the container | _____ | _____ | _____ |
| d) adding a catalyst | _____ | _____ | _____ |

9. For the reaction,



How will the concentration of each chemical be affected by

- | | | | | |
|--|-------|-------|-------|-------|
| a) adding O_2 to the system | _____ | _____ | _____ | _____ |
| b) adding N_2 to the system | _____ | _____ | _____ | _____ |
| c) removing H_2O from the system | _____ | _____ | _____ | _____ |
| d) decreasing the volume of the container | _____ | _____ | _____ | _____ |

10. Consider the equilibrium: $2\text{N}_2\text{O}(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 4\text{NO}(\text{g})$

3.00 moles of $\text{NO}(\text{g})$ are introduced into a 1.00-Liter evacuated flask. When the system comes to equilibrium, 1.00 mole of $\text{N}_2\text{O}(\text{g})$ has formed. Determine the equilibrium concentrations of each substance. Calculate the K_c for the reaction based on these data.