

Name: \_\_\_\_\_

Period: \_\_\_\_\_

Seat#: \_\_\_\_\_

**Directions:** Show all work in a way that would earn you credit on the AP Test! This is always the rule! Some answers are provided at the end in italics and underlined. If you need more space, use binder paper and staple to your worksheet.

- 1) Consider the equilibrium:  $2 \text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \leftrightarrow 2 \text{SO}_3(\text{g}) \quad K_c = 4.36 \text{ M}^{-1}$   
 a) Calculate the value of "Q" for a situation in which  $[\text{SO}_2] = 2.00 \text{ M}$ ,  $[\text{O}_2] = 1.50 \text{ M}$ , and  $[\text{SO}_3] = 1.25 \text{ M}$ .  
*0.260*

b) Does this mixture shift toward the reactants or products to reach equilibrium? \_\_\_\_\_

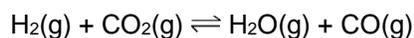
- 2) Study the discussion in your textbook about converting  $K_c$  and  $K_p$ . Write the  $K_p$  expression for the reaction in question 1 and calculate its value at  $0^\circ\text{C}$ . Remember,  $R = 0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K}$ .

- 3) 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?  
 $\text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons \text{PCl}_5(\text{g})$

- |  |       |       |       |
|--|-------|-------|-------|
| a) Addition of $\text{PCl}_3$              | _____ | _____ | _____ |
| b) Removal of $\text{Cl}_2$                | _____ | _____ | _____ |
| c) Removal of $\text{PCl}_5$               | _____ | _____ | _____ |
| d) Decrease in the volume of the container | _____ | _____ | _____ |
| e) Addition of He without change in volume | _____ | _____ | _____ |

- 4) How will each of the changes in question 3 affect the  $K_{eq}$ ? ( $\uparrow$  = increase;  $\downarrow$  = decrease;  $\text{—}$  = unchanged)  
 a \_\_\_\_\_    b \_\_\_\_\_    c \_\_\_\_\_    d \_\_\_\_\_    e \_\_\_\_\_

- 5) 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 $\text{CO}_2$               | _____ | _____ | _____ | _____ |
| b) Addition of $\text{H}_2\text{O}$        | _____ | _____ | _____ | _____ |
| c) Addition of a catalyst                  | _____ | _____ | _____ | _____ |
| d) Increase in temperature                 | _____ | _____ | _____ | _____ |
| e) Decrease in the volume of the container | _____ | _____ | _____ | _____ |

**Dougherty Valley HS Chemistry - AP**  
**Equilibrium – Chemical Equilibrium Problem Set 2**

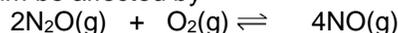
---

6) How will each of the changes in question 5 affect the equilibrium constant?

a \_\_\_\_\_ b \_\_\_\_\_ c \_\_\_\_\_ d \_\_\_\_\_ e \_\_\_\_\_

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

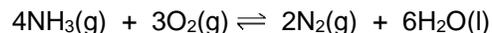
How will the amount of chemicals at equilibrium be affected by



- a) Adding  $\text{N}_2\text{O}$  \_\_\_\_\_
- b) Removing  $\text{O}_2$  \_\_\_\_\_
- c) Increasing the volume of the container \_\_\_\_\_
- d) Adding a catalyst \_\_\_\_\_

8) For the reaction,

How will the concentration of each chemical be affected by



- a) adding  $\text{O}_2$  to the system \_\_\_\_\_
- b) adding  $\text{N}_2$  to the system \_\_\_\_\_
- c) removing  $\text{H}_2\text{O}$  from the system \_\_\_\_\_
- d) decreasing the volume of the container \_\_\_\_\_

9) 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. 1.00, 0.500, 1.00

	2 $\text{N}_2\text{O}$	$\text{O}_2$	4 $\text{NO}$
<b>initial</b>			
<b>change</b>			
<b>equilibrium</b>			

Remember: The "ice" box may be used with moles, molarity, or Liters (for gaseous equilibria)... never grams.