

**Problem of the Day 23      CHEM 1252**

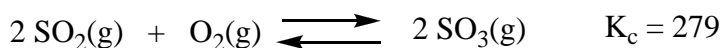
1. At high temperatures,  $\text{PCl}_5$  dissociates as illustrated below.



At 300 °C, the equilibrium constant for this reaction is  $K_c = 11.5$ . The concentrations of  $\text{PCl}_3$  and  $\text{Cl}_2$  at equilibrium are both 0.0100 M. Calculate the equilibrium concentration of  $\text{PCl}_5$ .

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2. A mixture of  $\text{SO}_2$ ,  $\text{O}_2$ , and  $\text{SO}_3$ , at 1000 K contains the gases at the following concentrations:  $[\text{SO}_2] = 0.00500 \text{ M}$ ,  $[\text{O}_2] = 0.00190 \text{ M}$ , and  $[\text{SO}_3] = 0.00690 \text{ M}$ . Is the reaction at equilibrium? If not, which way will the reaction proceed to reach equilibrium?



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3. The following reaction occurs at high temperatures

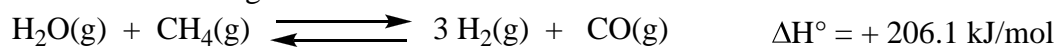


(a) Given that the initial concentration of  $\text{CH}_2\text{Cl}_2$  is 0.0206 M, fill in the table with appropriate concentrations and/or variables.

$2 \text{CH}_2\text{Cl}_2(\text{g}) \rightleftharpoons \text{CH}_4(\text{g}) + \text{CCl}_4(\text{g})$				
initial	1		1	1
change	1		1	1
final	1		1	1

(b) Calculate the equilibrium concentration of  $\text{CH}_4$ .

4. Consider the following reaction:



Which direction will the reaction shift after the following changes occur? In each case, circle one response.

Change	Direction of shift			
	right	left	no effect	
Add H <sub>2</sub> O	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	3
Remove CH <sub>4</sub>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	3
Add H <sub>2</sub>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	3
Add a catalyst	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	3
Decrease the temperature	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	3

4. Consider the following reaction:  $\text{H}_2\text{O}(\text{g}) + \text{CO}(\text{g}) \rightleftharpoons \text{H}_2(\text{g}) + \text{CO}_2(\text{g})$

In one experiment 1.0 mole H<sub>2</sub>O(g) and 1.0 mol CO(g) are put into a flask and heater to 350°C. In a second experiment 1.0 mol H<sub>2</sub>(g) and 1.0 mol CO<sub>2</sub>(g) are put into another flask with the same volume as the first. This mixture is also heater to 350°C. After equilibrium is reached, will there be any difference in the composition of the mixtures in the two flasks? *You must justify your answer.*

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