Name _____ Date _____ Class _____

CHAPTER 18 STUDY GUIDE FOR CONTENT MASTERY

Chemical Equilibrium

Section 18.1 Equilibrium: A State of Dynamic Balance

In your textbook, read about chemical equilibrium.

Complete each statement.

1. When a reaction results in almost complete conversion of reactants to products, chemists say the reaction goes to **completion**.
2. A reaction that can occur in both the forward and the reverse directions is called a(n) **reversible reaction**.
3. **Chemical equilibrium** is a state in which the forward and reverse reactions balance each other because they take place at equal rates.
4. At equilibrium, the concentrations of reactants and products are **constant**, but that does not mean that the amounts or concentrations are **equal**.
5. Equilibrium is a state of **action**, not one of **inaction**.

In your textbook, read about equilibrium expressions and constants.

For each statement below, write *true* or *false*.

false 6. The law of chemical equilibrium states that at a given pressure, a chemical system may reach a state in which a particular ratio of reactant to product concentrations has a constant value.

true 7. The equation $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ is an example of a homogeneous equilibrium.

true 8. If an equilibrium constant has a value less than one, the reactants are favored at equilibrium.

false 9. The value for K_{eq} is constant only at a specific volume.

false 10. If the equilibrium constant for a reaction at 300 K is 49.7, the concentration of the reactants will be greater than the concentration of the products.

true 11. A heterogeneous equilibrium means that reactants and products are present in more than one state.

true 12. The product of the forward chemical reaction is HI, for the equilibrium expression:

$$K_{eq} = \frac{[HI]^2}{[H_2][I_2]}$$

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Section 18.1 *continued*

In your textbook, read about determining equilibrium constants.

A chemist did two experiments to determine the equilibrium constant for the reaction of sulfur dioxide with oxygen to form sulfur trioxide. Use the table showing the results of the experiments to answer the following questions.

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ at 873 K			
Experiment 1		**Experiment 2**	
Initial concentrations	Equilibrium concentrations	Initial concentrations	Equilibrium concentration
$[SO_2] = 2.00M$	$[SO_2] = 1.50M$	$[SO_2] = 0.500M$	$[SO_2] = 0.590M$
$[O_2] = 1.50M$	$[O_2] = 1.26M$	$[O_2] = 0M$	$[O_2] = 0.0450M$
$[SO_3] = 3.00M$	$[SO_3] = 3.50M$	$[SO_3] = 0.350M$	$[SO_3] = 0.260M$

13. Write the equation to calculate the equilibrium constant for the reaction.
$K_{eq} = [SO_3]^2/[SO_2]^2[O_2]$

14. Is this reaction an example of a homogeneous or heterogeneous equilibrium?
homogeneous

15. Calculate the equilibrium constant from the data obtained in experiment 1.
$K_{eq} = 4.32$
Solution: $[3.50]^2/[1.50]^2[1.26] = 4.32098 = 4.32$

16. What is the equilibrium constant for the reaction in experiment 2?
$K_{eq} = 4.32$
Solution: $[0.260]^2/[0.590]^2[0.0450] = 4.31549 = 4.32$

17. Was it necessary to calculate both equilibrium constants? Why or why not?
No; because both experiments were done at the same temperature, the equilibrium constant would be the same.

18. What does this experiment show about the initial concentrations of products and reactants in a reversible reaction?
This experiment shows that it does not matter what the initial concentrations of products and reactants are in a reversible reaction. When the reaction is at equilibrium, they will have the same ratio to one another.