Quiz B3: Le Chatelier’s Principle

Name: 
Block: 

1. Consider the following reaction: \(2\text{SO}_2(g) + \text{O}_2(g) \rightleftharpoons 2\text{SO}_3(g) \quad \Delta H = -197 \text{ kJ/mol}\)
Which of the following will not shift the equilibrium to the right?
A. Adding more \(\text{O}_2\)
B. **Adding a catalyst**
C. Increasing the pressure
D. Lowering the temperature

2. Consider the following equilibrium system: \(\text{CaCO}_3(s) \rightleftharpoons \text{CaO}(s) + \text{CO}_2(g)\)
Which one of the following changes would cause the above system to shift left?
A. Add more \(\text{CaO}\)
B. Remove \(\text{CaCO}_3\)
C. **Decrease volume**
D. Increase surface area of \(\text{CaO}\)

3. Consider the following equilibrium: \(\text{SO}_2\text{Cl}_2(g) + \text{energy} \rightleftharpoons \text{SO}_2(g) + \text{Cl}_2(g)\)
When the temperature is decreased, the equilibrium shifts
A. **Left and [SO}_2\text{Cl}_2\text{] increases**
B. Left and [SO}_2\text{Cl}_2\text{] decreases
C. Right and [SO}_2\text{Cl}_2\text{] increases
D. Right and [SO}_2\text{Cl}_2\text{] decreases

4. Consider the following equilibrium: \(2\text{SO}_3(g) \rightleftharpoons 2\text{SO}_2(g) + \text{O}_2(g)\)
The volume of the system is decreased at a constant temperature. A new state of equilibrium is established by a shift of the original equilibrium to the:
A. **Left and [SO}_3\text{] increases**
B. Right and [SO}_3\text{] decreases
C. Left and [SO}_3\text{] remains unchanged
D. Right and [SO}_3\text{] remains unchanged

5. Consider the following equilibrium system: \(\text{CO}_2(g) + \text{H}_2(g) \rightleftharpoons \text{CO}(g) + \text{H}_2\text{O}(g)\)
Which of the following, when added to the system above, would result in a net decrease in [H\(_2\)O]?
A. \(\text{CO}_2\)
B. \(\text{H}_2\)
C. **\(\text{CO}\)**
D. \(\text{H}_2\)

6. Consider the following equilibrium: \(\text{C}(s) + 2\text{H}_2(g) \rightleftharpoons \text{CH}_4(g) + 74 \text{ kJ}\)
When a small amount of solid C is added to the system
A. [H\(_2\)] decreases
B. [CH\(_4\)] increases
C. The temperature increases
D. **All concentrations remain constant**
7. Consider the following equilibrium: \(2\text{NO}_2(g) + \text{Cl}_2(g) \rightleftharpoons 2\text{NOCl}(g)\)
At constant temperature and volume, \(\text{Cl}_2\) is added to the above equilibrium system.
As equilibrium re-establishes, the
A. [NOCl] will decrease
B. The temperature increases
C. [NO] will increase
D. [NOCl] will increase

8. Consider the following equilibrium: \(\text{Cl}_2\text{O}_7(g) + 8\text{H}_2(g) \rightleftharpoons 2\text{HCl}(g) + 7\text{H}_2\text{O}(g)\)
Which of the following would increase the number of moles of HCl?
A. Increase [H\(_2\text{O}\)]
B. Increase [Cl\(_2\text{O}_7\)]
C. Increase total pressure
D. Increase volume of the system

9. Consider the following equilibrium: \(2\text{HI}(g) \rightleftharpoons \text{H}_2(g) + \text{I}_2(g)\) \(\Delta H = -68\text{kJ}\)
Which of the following would cause the equilibrium to shift right?
A. Increasing the volume
B. Decreasing the volume
C. Increasing the temperature
D. Decreasing the temperature

10. A 1.00 L flask contains a gaseous equilibrium system. The addition of reactants to this flask results in a
A. Shift to the left and decrease in the concentration of products
B. Shift to the left and increase in the concentration of products
C. Shift to the right and decrease in the concentration of products
D. Shift to the right and increase in the concentration of products

11. When the temperature of an equilibrium system is increased, the equilibrium always shifts to favor the
A. Exothermic reaction
B. Endothermic reaction
C. Formation of products
D. Formation of reactants

12. An equilibrium system shifts left when the
A. Rate of the forward reaction is equal to the rate of the reverse reaction
B. Rate of the forward reaction is less than the rate of the reverse reaction
C. Rate of the forward reaction is greater than the rate of the reverse reaction
A. Rate of the forward reaction and the rate of the reverse reaction are constant
13. Consider the following equilibrium: \(2\text{SO}_2(g) + \text{O}_2(g) \rightleftharpoons 2\text{SO}_3(g)\) \(\Delta H = -198\) kJ

There will be no shift in the equilibrium when
A. More \(\text{O}_2\) is added
B. **Catalyst is added**
C. The volume is increased
D. The temperature is increased

14. Consider the following equilibrium: \(2\text{NOCl}_{(g)} \rightleftharpoons 2\text{NO}_{(g)} + \text{Cl}_2(g)\)

In a 1.0 L container at equilibrium there are 1.0 mol NOCl, 0.70 mol NO and 0.40 mol \(\text{Cl}_2\). At constant temperature and volume, 0.10 mol NOCl is added. The concentrations in the “new” equilibrium in comparison to the concentrations in the “old” equilibrium are:

<table>
<thead>
<tr>
<th></th>
<th>[NOCl]</th>
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<tbody>
<tr>
<td>A.</td>
<td>new = old</td>
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15. Consider the following equilibrium: \(\text{N}_2\text{O}_4(g) + 58\) kJ \(\rightleftharpoons 2\text{NO}_2(g)\)

The equilibrium shifts right when
A. \(\text{NO}_2\) is added
B. \(\text{N}_2\text{O}_4\) is removed
C. The temperature is decreased
D. **The volume of the system is increased**

16. Consider the following equilibrium: \(2\text{SO}_2(g) + \text{O}_2(g) \rightleftharpoons 2\text{SO}_3(g)\)

Which of the following will shift the equilibrium to the right?

<table>
<thead>
<tr>
<th>I. Adding more (\text{O}_2)</th>
<th>II. Adding more (\text{SO}_3)</th>
<th>III. Adding a catalyst</th>
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</table>

A. **I only**
B. III only
C. I and II only
D. II and III only
17. Consider the following equilibrium: \( \text{energy} + 2\text{NaClO}_3(s) \rightleftharpoons 2\text{NaCl}_3(s) + 3\text{O}_2(g) \)
Which of the following will cause a shift to the left?
A. **adding more \( \text{O}_2 \)**
B. adding more \( \text{NaCl} \)
C. removing some \( \text{NaClO}_3 \)
D. increasing the temperature

18. Consider the following equilibrium: \( \text{CO}(g) + 2\text{H}_2(g) \rightleftharpoons \text{CH}_3\text{OH}(g) + \text{energy} \)
Which of the factors below would decrease the concentration of \( \text{CH}_3\text{OH} \) at equilibrium?
A. an addition of \( \text{CO} \)
B. an increase in \( \text{H}_2 \)
C. a decrease in the temperature
D. an increase in the temperature

19. Consider the following equilibrium: \( \text{energy} + 2\text{NaClO}_3(s) \rightleftharpoons 2\text{NaCl}_3(s) + 3\text{O}_2(g) \)
Which of the following will cause a shift to the right?
A. adding more \( \text{O}_2 \)
B. adding more \( \text{NaCl} \)
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20. Consider the following equilibrium: \( 2\text{SO}_2(g) + \text{O}_2(g) \rightleftharpoons 2\text{SO}_3(g) \)
Which of the following will shift the equilibrium to the left?

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A. I only
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**Learning Goal**

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1. Consider the following equilibrium system: \( \text{CO}_2(g) + \text{H}_2(g) \rightleftharpoons \text{CO}(g) + \text{H}_2\text{O}(g) \)
Which of the following, when removed from the system above, would result in a net increase in \([\text{H}_2\text{O}]\)?
A. \(\text{CO}_2\)
B. \(\text{H}_2\)
C. \(\text{CO}\)
D. \(\text{H}_2\)

2. Consider the following equilibrium: \( \text{C(s)} + 2\text{H}_2(g) \rightleftharpoons \text{CH}_4(g) \ + 74 \text{ kJ} \)
When a small amount of solid \(\text{C}\) is added to the system
A. \([\text{H}_2]\) decreases
B. \([\text{CH}_4]\) increases
C. The temperature increases
D. All concentrations remain constant

3. Consider the following reaction: \( 2\text{SO}_2(g) + \text{O}_2(g) \rightleftharpoons 2\text{SO}_3(g) \ \Delta \text{H} = -197 \text{ kJ/mol} \)
Which of the following will not shift the equilibrium to the left?
A. removing \(\text{O}_2\)
B. adding a catalyst
C. decreasing the pressure
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4. Consider the following equilibrium system: \( \text{CaCO}_3(s) \rightleftharpoons \text{CaO(s)} + \text{CO}_2(g) \)
Which one of the following changes would cause the above system to shift right?
A. Remove \(\text{CaO}\)
B. Add more \(\text{CaCO}_3\)
C. increase volume
D. Increase surface area of \(\text{CaO}\)

5. Consider the following equilibrium: \( \text{SO}_2\text{Cl}_2(g) + \text{energy} \rightleftharpoons \text{SO}_2(g) + \text{Cl}_2(g) \)
When the temperature is increased, the equilibrium shifts
A. Left and \([\text{SO}_2\text{Cl}_2]\) increases
B. Left and \([\text{SO}_2\text{Cl}_2]\) decreases
C. Right and \([\text{SO}_2\text{Cl}_2]\) increases
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6. Consider the following equilibrium: \( 2\text{SO}_3(g) \rightleftharpoons 2\text{SO}_2(g) + \text{O}_2(g) \)
The volume of the system is increased at a constant temperature. A new state of equilibrium is established by a shift of the original equilibrium to the:
A. Left and \([\text{SO}_3]\) increases
B. Right and \([\text{SO}_3]\) decreases
C. Left and \([\text{SO}_3]\) remains unchanged
D. Right and \([\text{SO}_3]\) remains unchanged
7. Consider the following equilibrium: \(2\text{NO}(g) + \text{Cl}_2(g) \rightleftharpoons 2\text{NOCl}(g)\)
   At constant temperature and volume, \(\text{Cl}_2\) is added to the above equilibrium system. As equilibrium re-establishes, the
   A. \([\text{NOCl}]\) will increase
   B. The temperature decreases
   C. \([\text{NO}]\) will increase
   D. \([\text{NOCl}]\) will remain constant

8. A 1.00 L flask contains a gaseous equilibrium system. The addition of reactants to this flask results in
   A. Shift to the left and decrease in the concentration of products
   B. Shift to the left and increase in the concentration of products
   C. Shift to the right and decrease in the concentration of products
   D. **Shift to the right and increase in the concentration of products**

9. When the temperature of an equilibrium system is increased, the equilibrium always shifts to favor the
   A. Exothermic reaction
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    Which of the following would increase the number of moles of HCl?
    A. decrease total pressure
    B. **increase \([\text{Cl}_2\text{O}_7]\)\)**
    C. increase \([\text{H}_2\text{O}]\)
    D. decrease volume of the system

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There will be no shift in the equilibrium when
A. The temperature is increased
B. The volume is increased
C. **Catalyst is added**
D. More \( \text{O}_2 \) is added

14. Consider the following equilibrium: \( 2\text{NOCl}(g) \rightleftharpoons 2\text{NO}(g) + \text{Cl}_2(g) \)
In a 1.0 L container at equilibrium there are 1.0 mol \( \text{NOCl} \), 0.70 mol \( \text{NO} \) and 0.40 mol \( \text{Cl}_2 \). At constant temperature and volume, 0.10 mol \( \text{NO} \) is added. The concentrations in the “new” equilibrium in comparison to the concentrations in the “old” equilibrium are:

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A. **II only**
B. III only
C. I and II only
D. II and III only

16. Consider the following equilibrium: \( \text{N}_2\text{O}_4(g) + 58 \text{ kJ} \rightleftharpoons 2\text{NO}_2(g) \)
The equilibrium shifts left when
A. \( \text{NO}_2 \) is added
B. \( \text{N}_2\text{O}_4 \) is removed
C. The temperature is increased
D. The volume of the system is increased
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Which of the following will cause a shift to the left?
A. **adding more \( \text{O}_2 \)**
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19. Consider the following equilibrium: \( \text{CO}(g) + 2\text{H}_2(g) \rightleftharpoons \text{CH}_3\text{OH}(g) + \text{energy} \)
Which of the factors below would increase the concentration of \( \text{CH}_3\text{OH} \) at equilibrium?
A. **an addition of \( \text{CO} \)**
B. a decrease in \( \text{H}_2 \)
C. an increase in the temperature
D. increase in volume

20. Consider the following equilibrium: \( 2\text{SO}_2(g) + \text{O}_2(g) \rightleftharpoons 2\text{SO}_3(g) \)
Which of the following will shift the equilibrium to the left?

| I. Adding more \( \text{SO}_3 \) | II. Adding a catalyst | III. Removing \( \text{O}_2 \) |

A. I only
B. III only
C. **I and III only**
D. III and III only

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