

**General Equilibrium**

1. Elements and compounds on the right of the equation arrow are called ???
2. Elements and compounds on the left of the equation arrow are called ???
3. Equilibrium equations occur because the reactions are ????
4. A chemical reaction stops in the middle. What is the condition of the reaction?
5. Why is Equilibrium described as Dynamic Equilibrium or Active Equilibrium?
6. What type of reaction arrow is used in an equilibrium equation?
7. What two things must be equal for a system to be in equilibrium?
8. What is the only thing that can change the value for a Keq?

For the reaction:  $S_{(g)} + T_{(g)} \rightleftharpoons G_{(g)} + H_{(g)}$

9. Chemicals S and T are called the ??
10. Chemicals G and H are called the ??
11. What is the rate equation for the forward reaction?
12. What is the rate equation for the reverse reaction?
13. What is the Keq equation for this reaction?
14. What two physical states are used in the Keq equations?
15. What two physical states are not used in the Keq equations?
16. A reaction has a Keq value of 45000000. What does this mean when a system is in equilibrium?
17. A reaction has a Keq value of 0.00000000876. What does this mean when a system is in equilibrium?

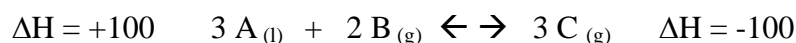
Write the Keq equations for each of the following reactions:

18.  $Ca(OH)_{2(s)} \rightleftharpoons CaO_{(s)} + O_{2(g)}$
19.  $CO_{(g)} + H_2O_{(l)} \rightleftharpoons CO_{2(g)} + H_{2(g)}$
20.  $Fe_2O_{3(s)} + 3 H_{2(g)} \rightleftharpoons 2 Fe_{(s)} + 3 H_2O_{(g)}$

**LeChatelier's Principle**

21. What is LeChatelier's Principle.
22. Which way does an equilibrium system shift if you **add reactants**?
23. Which way does an equilibrium system shift if you **add products**?
24. Which way does an equilibrium system shift if you **add heat or increase the temperature**?
25. Which way does an equilibrium system shift if you **increase pressure or decrease volume**?
26. Which way does an equilibrium system shift if you **remove reactants**?
27. Which way does an equilibrium system shift if you **remove products**?
28. Which way does an equilibrium system shift if you **remove heat or decrease the temperature**?
29. Which way does an equilibrium system shift if you **decrease pressure or increase volume**?

**For the Reaction:**



**What would you do to increase the yield (make more) of chemical C?**

30. Increase or Decrease the Pressure?
31. Increase or Decrease the Temperature?
32. Increase or Decrease the amounts of Reactants?
33. Increase or Decrease the amounts of Products?

## ANSWERS

## General Equilibrium

- |  |                                    |
|--|------------------------------------|
| 1. Elements and compounds on the right of the equation arrow are called ???        | <b>products</b>                    |
| 2. Elements and compounds on the left of the equation arrow are called ???         | <b>reactants</b>                   |
| 3. Equilibrium equations occur because the reactions are ????                      | <b>stalled in the middle</b>       |
| 4. A chemical reaction stops in the middle. What is the condition of the reaction? | <b>equilibrium</b>                 |
| 5. Why is Equilibrium described as Dynamic Equilibrium or Active Equilibrium?      | <b>Still reacting, nobody wins</b> |
| 6. What type of reaction arrow is used in an equilibrium equation?                 | <b>double arrow</b>                |
| 7. What two things must be equal for a system to be in equilibrium?                | <b>forward and reverse rates</b>   |
| 8. What is the only thing that can change the value for a Keq?                     | <b>TEMPERATURE</b>                 |

For the reaction:  $S_{(g)} + T_{(g)} \rightleftharpoons G_{(g)} + H_{(g)}$

- |  |  |
|--|--|
| 9. Chemicals S and T are called the ??   | <b>reactants</b>                                     |
| 10. Chemicals G and H are called the ??  | <b>products</b>                                      |
| 11. What is the rate equation for the forward reaction?  | <b>Rate = <math>k_{\text{forward}} [S][T]</math></b> |
| 12. What is the rate equation for the reverse reaction?  | <b>Rate = <math>k_{\text{reverse}} [G][H]</math></b> |
| 13. What is the Keq equation for this reaction?  | <b>Keq = <math>[G][H] / [S][T]</math></b>            |
| 14. What two physical states are used in the Keq equations?                                      | <b>gases and aqueous (dissolved in water)</b>        |
| 15. What two physical states are not used in the Keq equations?                                  | <b>solids and liquids</b>                            |
| 16. A reaction has a Keq value of 45000000. What does this mean when a system is in equilibrium? |  |

**P / R : mostly products in the equilibrium**

17. A reaction has a Keq value of 0.00000000876. What does this mean when a system is in equilibrium?

**P / R : mostly reactants in the equilibrium**

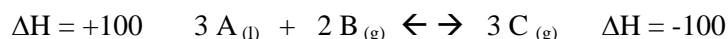
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## LeChatelier's Principle

21. What is LeChatelier's Principle. **A system in equilibrium, when disturbed, will shift to counteract the Disturbance.**
22. Which way does an equilibrium system shift if you **add reactants**? **→**
23. Which way does an equilibrium system shift if you **add products**? **←**
24. Which way does an equilibrium system shift if you **add heat or increase the temperature**? **To endo (+) side**
25. Which way does an equilibrium system shift if you **increase pressure or decrease volume**? **To side with less gas**
26. Which way does an equilibrium system shift if you **remove reactants**? **←**
27. Which way does an equilibrium system shift if you **remove products**? **→**
28. Which way does an equilibrium system shift if you **remove heat or decrease the temperature**? **To exo (-) side**
29. Which way does an equilibrium system shift if you **decrease pressure or increase volume**? **To side with more gas**

**For the Reaction:**



**What would you do to increase the yield (make more) of chemical C?**

- |  |                                 |
|--|---------------------------------|
| 30. Increase or Decrease the Pressure?             | <b>Decrease Pressure</b>        |
| 31. Increase or Decrease the Temperature?          | <b>Decrease the Temperature</b> |
| 32. Increase or Decrease the amounts of Reactants? | <b>Increase the Reactants</b>   |
| 33. Increase or Decrease the amounts of Products?  | <b>Decrease the Products</b>    |