

## REVIEW: EQUILIBRIUM, Keq, Reaction rates

**REVERSIBLE REACTION:** a reaction where the reactants form the products, then the products re-form the reactants

- can proceed in \_\_\_\_\_
- \* represented by \_\_\_\_\_ in the equation

**GENERALIZED EQUILIBRIUM RXN:  $A + B \leftrightarrow C + D$**

$A + B \rightarrow C + D$  (forward/reverse) reaction

$C + D \rightarrow A + B$  (forward/reverse) reaction

**EQUILIBRIUM CONSTANT EXPRESSION (Keq)**

$n A + m B \leftrightarrow e C + f D$

lowercase letters (n, m, e, f) represent \_\_\_\_\_

CAPITAL LETTERS (A, B, C, D) represent \_\_\_\_\_

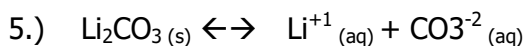
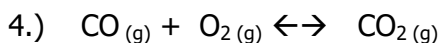
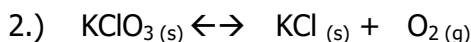
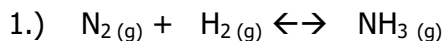
Keq =  $\frac{[C]^e [D]^f}{[A]^n [B]^m}$

[ ] means "\_\_\_\_\_ of"

Keq =  $\frac{[\text{right side}]}{[\text{left side}]}$

**Be careful when writing the Keq :** \*Do NOT include \_\_\_\_\_ or \_\_\_\_\_ in Keq expressions.

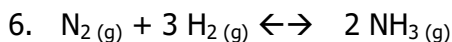
**EQUILIBRIUM CONSTANT** Write the Keq expressions for the reactions below. **NOTE:** Balance the equations first.



### LE CHATELIER'S PRINCIPLE

When a system in equilibrium is stressed the system \_\_\_\_\_

~ Changes in PRESSURE \*\* only affect \_\_\_\_\_ \*\*

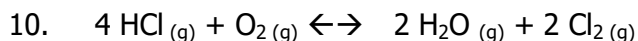


If the pressure on this system increases, the shift in equilibrium will be towards the \_\_\_\_\_ side because \_\_\_\_\_

a. If the pressure on this system decreases, the shift in equilibrium will be towards the \_\_\_\_\_ side because \_\_\_\_\_

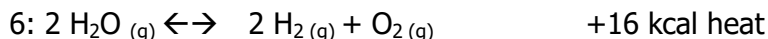
b. If  $[N_2]$  increases, equilibrium shift will be towards \_\_\_\_\_ side. If  $[NH_3]$  increases, equilibrium shift will be towards \_\_\_\_\_ side.

c. If  $[H_2]$  decreases, equilibrium shift will be towards \_\_\_\_\_ side. If  $[NH_3]$  is removed, equilibrium shift will be towards \_\_\_\_\_ side.



a. If  $[O_2]$  decreases, equilibrium shift will be towards \_\_\_\_\_ side.  $[HCl]$  inc/dec  $[H_2O]$  inc/dec  $[Cl_2]$  inc/dec

b. If  $[H_2O]$  increases, equilibrium shift will be towards \_\_\_\_\_ side.  $[HCl]$  inc/dec  $[O_2]$  inc/dec  $[Cl_2]$  inc/dec



If the temperature is increased, equilibrium shift will be towards \_\_\_\_\_ side.



If the temperature on this system is increased, the equilibrium will shift towards the \_\_\_\_\_ side.

### Changes in Keq VALUE

8a. Only changes in \_\_\_\_\_ affect the Keq value. If heat is added to start a reaction... The energy will be (+/-) it is located on the \_\_\_\_\_ side of the equation. it is an (endothermic/exothermic) reaction. So, If the temperature increases, the value of Keq will \_\_\_\_\_.

8b. If heat is given off by a reaction... The energy will be (+/-) it is located on the \_\_\_\_\_ side of the equation. it is an (endothermic/exothermic) reaction. If the temperature increases, the value of Keq will \_\_\_\_\_.

### Reaction rates

1. When 2 molecules collide what circumstances need to occur for the molecules to react?
2. What does the activation energy of the reactants tell you?

### Use the collision theory to explain 3-6:

3. Increasing the concentration of the reactant usually increases the rate of the reaction.
4. Increasing the temperature usually increase the rate of the reaction.
5. Increasing the surface area of the reactants increases the reaction rate.
6. Pressure on gaseous reactants can increase the reaction rate.
7. Adding a catalyst affects the activation energy and increases the rate of the reaction. (true/false)
8. On the diagram identify the reactants ( A/B/C)  
The products (A/B/C) The activation energy (A/B/C)
9. How much energy do the reactants have? (in kJ)
10. How much energy do the products have?
11. How much energy is required to activate the reaction?
12. Is the reaction exothermic or endothermic? ( +/- energy)
13. Draw what the graph would look like if a catalyst was added.

