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 ←→ C + D

A + B → **C + D** (forward/reverse) reaction
C + D → **A + B** (forward/reverse) reaction

EQUILIBRIUM CONSTANT EXPRESSION (Keq)

n A + m B ←→ e C + f D

lowercase letters (n, m, e, f) represent _____

CAPITAL LETTERS (A, B, C, D) represent _____

Keq = [ ][ ]
[ ] [ ]

[ ] means "_____ of"

Keq = [side]
[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.

1.) $N_{2\,(g)} + H_{2\,(g)} \leftrightarrow NH_{3\,(g)}$

2.) $KClO_{3\,(s)} \leftrightarrow KCl_{\,(s)} + O_{2\,(g)}$

3.) $H_2O_{\,(l)} \leftrightarrow H^{+1}{}_{(aq)} + OH^{-1}{}_{(aq)}$

4.) $CO_{\,(g)} + O_{2\,(g)} \leftrightarrow CO_{2\,(g)}$

5.) $Li_2CO_{3\,(s)} \leftrightarrow Li^{+1}{}_{(aq)} + CO3^{-2}{}_{(aq)}$

LE CHATELIER'S PRINCIPLE

When a system in equilibrium is stressed the system_____

~ Changes in PRESSURE ** only affect _____ **

6. $N_{2\,(g)} + 3\,H_{2\,(g)} \leftrightarrow 2\,NH_{3\,(g)}$

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 [NH3] is removed, equilibrium shift will be towards _____ side.

10. $4\,HCl_{\,(g)} + O_{2\,(g)} \leftrightarrow 2\,H_2O_{\,(g)} + 2\,Cl_{2\,(g)}$

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

6: $2\ H_2O_{(g)} \leftrightarrow 2\ H_{2(g)} + O_{2(g)}$ +16 kcal heat

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

7: $NO_{(g)} + Cl_{2(g)} \leftrightarrow 2\ NOCl_{(g)}$ -77 kJ energy

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.