**Kinetics**- the measure of reaction rates

\* **“Collision Theory”**- in order for a reaction to occur the reacting particles must “collide” with proper speed/energy and orientation/direction. If both the effectiveness and frequency increase the rate of the reaction also increases.

Factors that increase or decrease the rates of a reaction:

1. **Nature of Reactants**

- ionic compounds react faster

- covalent compounds react slower

2. **Temperature** (temp = average kinetic energy)

- increase temp = increased rate

- decrease temp = decreased rate

3. **Concentration**

- increase concentration = increased rate

- decrease concentration = decreased rate

4. **Pressure** (only effects gas)

 \* if a solid or liquid has a change in pressure = NO EFFECT!

- increase pressure = decreased volume = increased rate

- decrease pressure = increase volume = decreased rate

5. **Surface area**

 \* powder has the greatest surface area

- increase surface area = increased rate

- decrease surface area = decreased rate

6. **Catalyst**

- increase rate of reaction by offering an alternate pathway with a lower activation energy



 \* Releases energy

 A. Activation energy forward

 B. Potential energy reactants

 C. ΔH

 D. Activated complex

 E. Activation energy reverse

 F. Potential energy of products

Hints for exothermic

1. The potential energy of reactants is greater then the potential energy of products

2. ΔH= heat of reaction is negative (-)

3. Activation energy forward is less then the activation energy reverse

4. Heat as a product

reactants🡺products + heat/energy (KJ)



\*Energy absorbed

 A. Activation energy forward

 B. Potential energy of reactants

 C. ΔH

 D. Activated complex

 E. Activation energy reverse

 F. Potential energy of products

Hints for endothermic reactions

1. Potential energy of reactants is less the potential energy of products

2. ΔH= positive(+)

3. Activation energy forward is greater then activation energy reverse

4. Uses energy

reactant + heat/energy(KJ)🡺products

ΔH = Heat of Reaction (table I)

ΔH= heat of products- heat of reactants

If ΔH is:

negative= exothermic

positive= endothermic

**Equilibrium**

1. Rate of forward reaction is equal to the rate of the reverse reaction

example: A + B ← AB + heat

forward reaction= synthesis and exothermic

reverse reaction= decomposition and endothermic

2. Concentrations are constant= remain the same

3. Chemical equilibrium

reactants← products

**Types of equilibrium**

1. Phase equilibriums- occurs during a phase change at constant temperature



a) s ← l

b) l ← g

c) s ←g

2. Solution equilibrium- rate of dissolving is equal to the rate of precipitate being formed NaCl(s) ← NaCl(aq)

 H20

\*Saturated solutions are considered to be in equilibrium( solid on bottom)

crystal that doesn’t dissolve

**Le Challer’s Principle**

**-** explains what occurs when a “stress” is added to a reaction at equilibrium

examples of a stress

1. Increase/decrease the concentration [ ]

[H20]= concentration of water

2. Increase/decrease the temperature

3. Increase/decrease the pressure (if a gas is present (g) and the moles of reactants and procedures after)

4. A catalyst is added- which has no effect on equilibrium because a catalyst increases the rate of both the forward and reverse reactions

When a reaction at equilibrium is stressed it “shifts” to reduce that stress and re-establishes a new equilibrium

shift right= favor the forward reaction Terms of

shift left= favor the reverse reaction LeChatliers

Hints

increase= away

decrease= forward

shift right=reactants decrease and products increase

shift left= reactants increase and products decrease

 For pressure= count the total number of moles on the reactant side and the products

- if they are the same= no effect

- if they are different:

increase in pressure= shift to smaller #of moles

decrease in pressure= shift to larger #of moles

Entropy

Entropy is a measure of randomness or disorder.

solid 🡪liquid->gas = an increase in entropy

gas->liquid-> solid = a decrease in entropy

Systems in nature tend to go to or favor LOWER ENGERY (EXOTHERMIC) and HIGHER ENTROPY (RANDOMNESS)