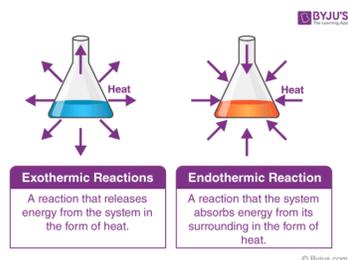


# Chemistry Study Guide

## Chapters 16-18

### 1. Exothermic vs Endothermic Reactions (difference)

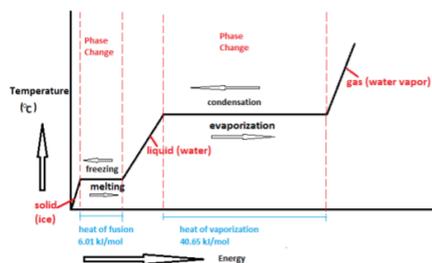


### 2. What is a thermochemical equation? What does it mean when change in H is negative vs when it is positive?

**Thermochemical equations**

- A typical chemical equation is  $S + O_2 \rightarrow SO_2$
- It is called a "thermochemical equation" when we add information about  $\Delta H$  ...  
 $S + O_2 \rightarrow SO_2 \quad \Delta H = -296.9 \text{ kJ}$
- If we change the equation, then the  $\Delta H$  also changes ...  
 $SO_2 \rightarrow S + O_2 \quad \Delta H = +296.9 \text{ kJ}$
- If the reaction is reversed the sign is reversed
- Also, if numbers in the equation change, so will the amount of energy produced/absorbed:  
 $2S + 2O_2 \rightarrow 2SO_2 \quad \Delta H = -593.8 \text{ kJ}$

### 3. What is the definition for molar heat of vaporization, condensation and fusion. Be able to calculate heat absorbed or released if given the molar heat and the moles of a substance.

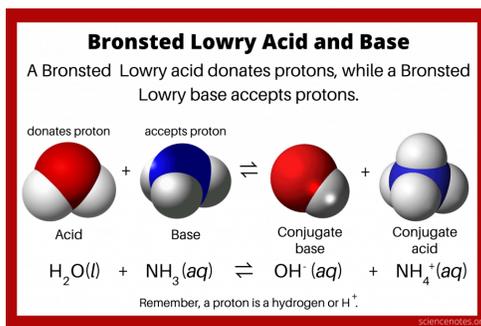


Molar heat of vaporization: heat required to vaporize one mole of a liquid (- heat of condensation)

Molar heat of fusion: heat required to melt one mole of a solid substance (- heat of solid)

### 4. What are the properties of acids and bases? Where do they fall on the pH scale? What's the difference between the Arrhenius Model of acids and bases, the Bronsted-Lowry Model, and the Lewis Model.

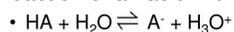
5. Be able to identify acid/base pairs according to the Bronsted-Lowry Model.



6. What makes an acid/base weak or strong? What does it mean when the acid/base ionization constant is high vs low?

#### Acid Ionization Constant

- **Acid Ionization Constant** ( $K_a$ ): the equilibrium constant for the ionization reaction of an acid with water

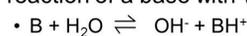


$$K_a = \frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]}$$

- Large  $K_a$  = Strong acid
- Small  $K_a$  = Weak acid

#### Base Ionization Constant

- **Base Ionization Constant** ( $K_b$ ): the equilibrium constant for the ionization reaction of a base with water



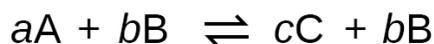
$$K_b = \frac{[\text{BH}^+][\text{OH}^-]}{[\text{B}]}$$

- Large  $K_b$  = Strong base
- Small  $K_b$  = Weak base

7. How do you calculate pH or pOH if given the hydrogen or hydroxide concentration? How are pH and pOH related?  
 $-\log [\text{H}^+]$ ,  $-\log [\text{OH}^-]$ ,  $\text{pH} + \text{pOH} = 14$
8. What are the reactants and products in a neutralization reaction?

9. Define what a titration is and what buffers are.

10. Define chemical equilibrium.  $K_{eq}$  is the ratio of product concentrations to that of reactants (raised to the power of their coefficients). What does it mean if  $K_{eq}$  is greater than 1? Less than 1?



$$K_c = \frac{[C]_{eq}^c [D]_{eq}^d}{[A]_{eq}^a [B]_{eq}^b}$$

$K_c \gg 1$ : Mixture contains mostly products

$K_c \ll 1$ : Mixture contains mostly reactants

11. Be able to name the three factors that affect equilibrium according to Le Chatelier's Principle.

**Le Chatelier's Principle**

Disturbing a system at dynamic equilibrium shifts the equilibrium in the direction that counteracts the change.

$A + B \rightleftharpoons C + D$

Concentration	Temperature	Pressure
<ul style="list-style-type: none"> <li>↑ reactant concentration</li> <li>↑ favors product formation</li> </ul>	<ul style="list-style-type: none"> <li>↑ temperature</li> <li>↑ favors endothermic reaction</li> </ul>	<ul style="list-style-type: none"> <li>↑ pressure</li> <li>↑ favors side with fewer molecules</li> </ul>
<ul style="list-style-type: none"> <li>↑ product concentration</li> <li>↑ favors reactant formation</li> </ul>	<ul style="list-style-type: none"> <li>↓ temperature</li> <li>↓ favors exothermic reaction</li> </ul>	<ul style="list-style-type: none"> <li>↓ pressure</li> <li>↓ favors side with more molecules</li> </ul>

sciencenotes.org

12. What is the equation for calculating reaction rate?

$$\text{REACTION RATE} = \frac{\text{CHANGE IN MASS OF REACTANT OR PRODUCT}}{\text{TIME}}$$

13. What is collision theory and activation energy?

14. Be able to name 4 different factors that affect reaction rates.

## Vocabulary

Endothermic

Exothermic

Thermochemical equation

Acid

Base

Conjugate acid

Conjugate base

pH

pOH

Buffer

Titration

Chemical equilibrium

Le Chatelier's Principle

Reaction Rate

Collision Theory

Activation Energy

Surface area

Concentration

Temperatures

Catalyst

Pressure

Neutralization

Bronsted Lowry Model

Arrhenius Model