November 26, 2018

7th Chemical Reactions Review

***Vocab***

* **Matter:** anything with mass and volume
* **Atoms:** the smallest particle of matter that still retains the properties of an element
* **Chemical bonds:** the forces between atoms that hold those atoms together to form compounds
* **Formula:** a description of a chemical compound using the letter designations of the elements
	+ Ex. the chemical formula for water is H2O, and the formula for carbon dioxide is CO2
* **Chemical reaction:** occurs when the bonds between atoms are broken and rearranged
	+ The atoms in “reactant” molecules are rearranged to make “product” molecules
	+ Example of a chemical reaction: CH4 + 2O2 🡪 CO2 + 2H2O
	+ *Every atom in the reactants shows up in the products in the same amount*
		- In the example above, there is 1 “C” atom on both sides of the arrow, 4 “H” atoms, and 4 “O” atoms
	+ Molecules must come into contact for a reaction to occur
* **Reactant:** a compound that is *consumed* in a chemical reaction 🡪 reactants *react*
* **Product:** a compound that is *produced* in a chemical reaction 🡪 products are *produced*
* **React:** when reactants interact to form products
	+ This always requires the breaking and reforming of chemical bonds
* **Consumed:** when a reactant is converted to a product
* **Unreacted:** when a reactant is *not* converted to a product
* **Chemical equation:** describes a chemical reaction using the formulas of all reactants and products
	+ Example of a chemical equation: CH4 + 2O2 🡪 CO2 + 2H2O
* **Yield:** the amount of a product produced by a chemical reaction compared to the amount of reactant
	+ In chemical equations, yield is shown using an arrow “🡪”
* **Calorimeter:** an insulated container that prevents a chemical reaction from gaining heat from its surroundings or losing heat to its surroundings
	+ We used a Styrofoam calorimeter in Inv. #1 to measure the heat given off by a reaction
* **Law of Conservation of Matter:** matter is never created or destroyed, it only changes form
	+ *This is why chemical equations always show the same type and number of atoms on each side of the arrow – this tells us that no matter appeared or disappeared!*
* **Rate of reaction:** the amount of reactants consumed or the amount of products produced *during a specific time period*
	+ We observed the rate of reaction in Inv. #3 by timing how long it took for iodine to be consumed, which occurred when the solution changed from reddish to clear
* **Catalyst:** a chemical that speeds up the rate of a chemical reaction without being consumed in the reaction
	+ A catalyst is *not* a product or reactant because it is not changed by the reaction
	+ Usually written above the yield sign (🡪) in a chemical reaction
* **Visible light:** humans perceive the color of light that is *reflected* by an object
	+ Light behaves like a wave
	+ A typical human eye will respond to wavelengths from about 390 to 700 nanometers
		- This is the “visible light spectrum”
* **Spectrophotometer:** an instrument used to measure the amount of light of a specific wavelength that is *absorbed* by a chemical compound
	+ Humans see reflected light while we used the spectrophotometer to test light absorption
		- This is why the numbers on the spectrophotometer slowly moved towards “0” – as the color in the cuvette changed from red to clear, there was less and less color absorbed
* **Absorbance:** the ability of a chemical compound to take in color of a specific wavelength

***Focus Questions***

*How do reactants interact to form products in a chemical reaction?*

* The atoms in reactant molecules rearrange themselves to form product molecules.
	+ Ex. NH4OH + HCl 🡪 H2O + NH4Cl is a chemical reaction because the atoms in the reactants were rearranged to form different products
	+ Ex. NaCl + H2O 🡪 H2O + NaCl is **NOT** a reaction because the atoms are not rearranged
* Reactants MUST come into contact with each other in order for these rearrangements to occur

*In a reaction, what is the relationship between the amount of reactants and the amount of products?*

* As the amounts of the reactants increase, the amounts of the products produced also increase.

*In a chemical reaction, do the amounts of the reactants affect the amounts of products produced?*

* If one reactant is present in smaller amounts than the other reactant, the amount of product produced will rely on the reactant present in *lower* quantities
	+ After one reactant is used up, no more product can be produced and the reaction will stop!
	+ Some of the reactant present in larger amounts will remain unreacted

*How does the Law of Conservation of Matter relate to chemical reactions?*

* No matter is lost from a chemical reaction even if reactants are present in amounts that are not equal
* You can see this in written chemical reactions – the amounts of atoms on each side of the yield symbol are **always** equal
	+ Ex. 6CO2 + 6H2O 🡪 C6H12O6 + 6O2
		- 6 carbons on each side, 18 oxygens on each side, and 12 hydrogens on each side
	+ Ex. NaCl + AgNO3 🡪 NaNO3 + AgCl
		- 1 sodium (Na) on each side, 1 chlorine (Cl), 1 silver (Ag), 1 nitrogen, and 3 oxygens

*In a chemical reaction, what is the relationship among the reactants, the products, and the time it takes to complete the reaction?*

* As more reactants are added to a reaction, more products will be produced, and the products will be produced more quickly.

*What are four ways in which we can* ***increase the rate*** *of chemical reactions?*

* Increase the concentration of the reactants
	+ If the reactants are more “crowded”, they are more likely to bump into each other and react
* Stir the reactants
	+ Increasing the kinetic energy of the reactants increases molecular motion
	+ Increasing molecular motion increases the chances that reactants will bump into each other
* Increase the temperature
	+ Increasing the temperature increases the kinetic energy of the reactants
	+ This increases the molecular motion of the reactants, causing them to bump into each other
* Introduce a catalyst
	+ Catalysts by definition increase the rate (speed) of chemical reactions

*What are three examples of evidence that a chemical reaction has occurred?*

* *­*Temperature change 🡪 we saw this in Investigation #1
* Gas formation (bubbles) 🡪 we saw this in Investigation #2
* Color change 🡪 we saw this in Investigation #3

*How do we perceive color?*

* The colors we see are wavelengths of light **reflected** by objects
* Ex. A red apple absorbs all colors except for red, which the apple reflects back to our eyes