Chp15: Lect 2 To react or not to react? THAT is the question! 2pts ec

Chemical changes are a result of chemical reactions. All chemical reactions involve a change in substances and a change in energy. Neither matter or energy is created or destroyed in a chemical reaction---only changed. There are so many chemical reactions that it is helpful to classify them into 5 general types: _____: **A + B -> AB**

_____: **AB -> A + B**

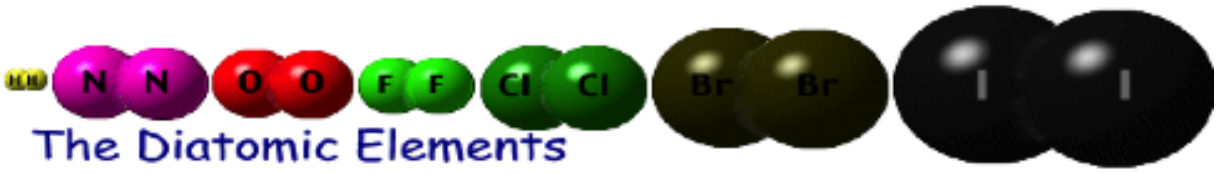
_____: **A + BC -> AC + B**

_____: **AB + CD -> AD + CB**

_____

Here is a short explanation and examples of each type of reaction

H_2 N_2 O_2 F_2 Cl_2 Br_2 and I_2



IMPORTANT: Diatomic elements are nonmetal elements that form a covalent bond between two atoms. The diatomic elements are: hydrogen, nitrogen, oxygen, fluorine, chlorine, bromine and iodine. As elements they always travel in pairs of atoms and therefore you must write then as: H_2 N_2 O_2 F_2 Cl_2 Br_2 and I_2

1. _____ (Composition)

In a synthesis reaction (also known as a composition reaction), two or more simple substances combine to form a more complex substance. Two or more reactants yielding one product is another way to identify a synthesis reaction. In the simplest type of synthesis reaction,

_____**combine to form a** _____

Here are four synthesis reactions:

Hydrogen + oxygen yields water: **$2H_2 + O_2 \rightarrow 2H_2O$**

Magnesium + nitrogen yields magnesium nitride

$3Mg + N_2 \rightarrow Mg_3N_2$

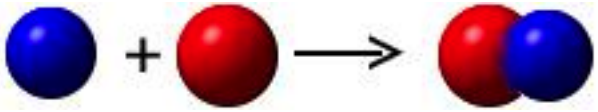
Iron + sulfur yields iron(II) sulfide **Fe + S -> FeS**

Barium + phosphorus yields barium phosphide

$3Na + P \rightarrow Na_3P$

The chemical equation for this synthesis reaction looks like:

_reactant + reactant ---> product



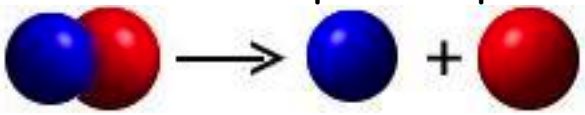
2. _____

In a decomposition reaction, **a larger substance breaks apart and forms two or more** _____

The first thing you may notice about a decomposition reaction is that it is the complete opposite of a synthesis reaction. In fact many synthesis reactions can be reversed into a decomposition reaction. When you burn hydrogen gas, the hydrogen combines with oxygen to produce water.

The chemical equation for this decomposition reaction looks like:

reactant -------> product + product



$2H_2 + O_2 \rightarrow 2H_2O$: _____

With an electrical current, water can be decomposed into hydrogen and oxygen gas.

$2H_2O \rightarrow 2H_2 + O_2$: _____

Activity Series

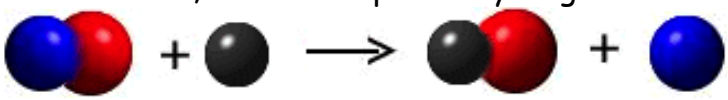
Metals	Nonmetals
lithium	fluorine
potassium	chlorine
calcium	bromine
sodium	iodine
magnesium	oxygen
aluminum	nitrogen
zinc	
chromium	
iron	
nickel	
tin	
lead	
hydrogen*	
copper	
mercury	
silver	
platinum	
gold	

More Active ↑ ↓ Less Active

*hydrogen behaves like a metal

3, _____

In a single replacement reaction a single uncombined element replaces another in a compound. **Two reactants yield** _____For example when zinc combines with hydrochloric acid, the zinc replaces hydrogen.



The chemical equation for this single replacement reaction looks like:

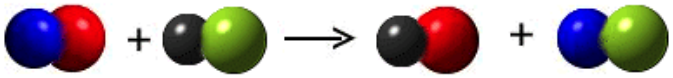
reactant + reactant------> product + product

In a single replacement reaction, a more active element replaces a less active element in a compound.

Generally, as you go across the periodic table (from I-A to IIIV-A) metals become **less chemically active**. A metal such as magnesium is more chemically active that transition metals such as copper, tin or zinc. An easier way to identify the activity of element is to use an activity series which shows the chemical activity of both metals and nonmetals.

4. _____

In a double replacement reaction, two metal ions (in aqueous compounds) switch places.



In a double replacement reaction parts of two compounds switch places to form two new compounds. Two reactants yield two products. For example when silver nitrate combines with sodium chloride, two new compounds--silver chloride and sodium nitrate are formed because the sodium and silver switched places. The chemical equation for this double replacement reaction looks like:

reactant + reactant ---------> product + product

One of the products is insoluble and forms a solid. This solid, called a precipitate, is more dense than the surrounding solution and falls to the bottom of the test tube. An arrow down is used to identify a precipitate (because the precipitate sinks). In a reaction between sodium chloride solution (NaCl (aq) and silver nitrate solution ($AgNO_3$ (aq) the products are sodium nitrate ($NaNO_3$ (aq) solution + silver chloride solid AgCl (s).

$$NaCl_{(aq)} + AgNO_{3\,(aq)} \longrightarrow NaNO_{3\,(aq)} + \downarrow AgCl_{(s)}$$

Since silver chloride is insoluble (won't dissolve in water) it forms a white solid and sinks to the bottom of the test tube. A solid that forms in a double replacement reaction is called a precipitate. Here is a photo of this reaction:

5. _____

Combustion or burning is the sequence of exothermic chemical reactions between a fuel and an oxidant accompanied by the production of heat and conversion of chemical species. The release of heat can result in the production of light in the form of either glowing or a flame. Fuels of interest often include organic compounds (especially hydrocarbons) in the gas, liquid or solid phase.

Chemical Reaction Summaries

Synthesis

Definition	Two or more substances combine to form a new substance
Equation	
Looks like	
Examples	$4Fe + 3O_2 \rightarrow 2Fe_2O_3$
Extra Info	Also called composition & addition reactions

Decomposition

Definition	A single compound is broken down into two or more smaller compounds
Equation	
Looks like	
Examples	$H_2CO_3 \rightarrow H_2O + CO_2$
Extra Info	Large compounds can also decompose into several other compounds.

Single-Replacement

Definition	One element replaces a similar element in a compound.
Equation	
Looks like	
Examples	$2HCl + Zn \rightarrow ZnCl_2 + H_2$
Extra Info	Here, more-reactive elements replace less-reactive ones - so sometimes it is impossible to reverse this reaction.

Double-Replacement

Definition	Ions in two compounds switch places.
Equation	
Looks like	
Examples	$NaCl + AgNO_3 \rightarrow NaNO_3 + AgCl$
Extra Info	Often, a solid combines with a liquid & forms a precipitate in this reaction.

Combustion

Definition	A complex series of exothermic reactions between fuel & oxygen which produces energy.
Equation	Fuel + Oxygen --(heat)--> Energy
Looks like	
Examples	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ + energy
Extra Info	Cars are powered by a combustion reaction which uses petroleum.

Energy & Rates of Chemical Reactions Chp 15 Lect 3:

CHEMICAL REACTIONS & Energy

If you've every sat by a warm campfire or in front of a stove, you've experienced heat from a chemical reaction. Burning is a chemical reaction that gives off or releases energy in the form of heat & light. In plants, photosynthesis uses or absorbs energy from sunlight. In fact, all chemical reactions involve energy

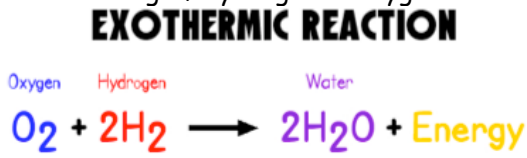
Two Types of Reactions : Energy is involved in chemical reactions in two ways.

1. At the start of a chemical reaction, some (or all) bonds between atoms in the reactants must be broken so that the atoms are available to form new bonds.
2. Energy is released when new bonds form as the atoms recombine into the new compounds of the products

We classify chemical reactions based on how energy used in (1) compares to energy released in (2).

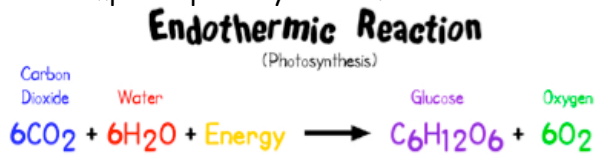
Type #1 _____

If forming new bonds releases more energy than it takes to break the old bonds, the reaction is **exothermic.** Exo means "go out" or "exit" and thermic means "heat" or "energy". If energy/heat is released, the reaction feels hot. A good example is the burning of hydrogen in oxygen



Type #2 _____

If forming new bonds in the products releases less energy than it took to break the original bonds in the reactants, the reaction is endothermic. Endothermic reactions absorb or use energy. Endo- means "go in" or "into". If energy is absorbed, the reaction may feel cold. An endothermic reaction example is photosynthesis.



BrainPOP **FIRE**

1 **What is the main difference between a log and a flame?**

- **A** The flame contains energy; a log contains no energy
- **B** The log is made of matter; the flame isn't
- **C** The log is made of wood molecules; the flame is made of fire molecules
- **D** The log is a solid; the flame is a gas

2 **Where can you find a combustion reaction taking place?**

- **A** Inside a car engine
- **B** Inside an electric toaster
- **C** Inside a firefly
- **D** Inside a lightbulb

3 **Which of the following is an essential ingredient of fire?**

- **A** Smoke
- **B** Wood
- **C** Sulfur
- **D** Oxygen

4 **Place the following events in sequence: A) A flame ignites; B) Fuel vaporizes; C) Heat is added to fuel**

- **A** C, A, B
- **B** C, B, A
- **C** B, C, A
- **D** B, A, C

5 **In most fires, where does the oxygen come from?**

- **A** Inside the fuel
- **B** Water vapor released by the heat of the flame
- **C** The earth's atmosphere
- **D** Pressurized tanks of pure oxygen

6 **If a piece of ice vaporized, it might:**

- **A** Melt into water
- **B** Lose all its energy
- **C** Catch on fire
- **D** Turn into steam

7 **When you strike a match, you create friction between the match head and the striking surface. What else is an example of friction?**

- **A** An atom being split apart in a nuclear reaction
- **B** A lightbulb being switched on
- **C** Bicycle tires skidding on the pavement
- **D** A log bursting into flame

8 **What can you infer about the exhaust that comes out of a car's tailpipe?**

- **A** It contains carbon compounds
- **B** It's mostly oxygen
- **C** It's highly combustible
- **D** It's generated through friction

9 **The main difference between a fire and an explosion is:**

- **A** The amount of heat that's required
- **B** The amount of fuel that's required
- **C** The amount of oxygen that's required
- **D** The speed at which the reaction takes place

10 **Which option best describes fire?**

- **A** Mostly harmful
- **B** Mostly harmless
- **C** Mostly helpful
- **D** Both helpful and dangerous