

## CHEM. Ch. 6 Notes ~ CHEMICAL REACTIONS AND BALANCING EQUATIONS

NOTE: Vocabulary terms are in **boldface and underlined**. Supporting details are in *italics*.

### 6.1 Notes

#### I. Chemical Reactions (rxns.)

A. **chemical reaction**—an expression showing the *conversion of reactants to products, forming new substances* with new properties

1) **reactant**—*starting substance* in a rxn.

2) **product**—*ending substance* in a rxn.



B. **skeleton equation**—*unbalanced* chemical equation  $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$

C. **catalyst**—a substance that *increases the reaction rate without being used up* in the reaction (symbol written above the arrow)

D. clues that a chemical reaction has taken place

1) *solid (precipitate) formation*

2) *gas production*

3) *temperature change, without being heated or cooled*

**exothermic** – giving off energy      **endothermic** – absorbing energy

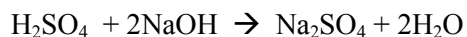
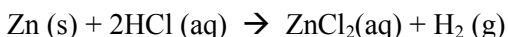
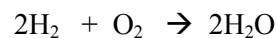
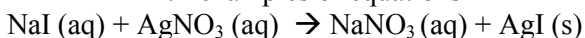
4) *odor change*

5) *cannot be reversed by physical means*

E. common reaction symbols



F. examples of equations



#### II. Balancing Equations

A. *Law of Conservation of Mass* = all atoms must be accounted for (balanced eq.)

B. **balanced equations** must have the same number of atoms on both sides

C. **coefficient**—a whole number *in front of a formula*, can be changed in order to balance the equation (4Na<sub>2</sub>O has a coefficient of 4)

D. **subscript**—a whole number telling how many atoms are in a chemical formula; *cannot be changed when balancing equations*

#### “Chartin’ Martin Balance Method” est. 1986

##### 1) Write the unbalanced equation.

Be sure all formulas are correct. Separate reactants and products with an arrow.

##### 2) Draw a small box around each formula.

This will warn you not to change anything inside while you balance the equation.

##### 3) Put a blank line (underscore) in front of each boxed formula.

This is where your coefficients will go as you balance.

##### 4) Make a chart below the reaction, with two columns, R & P.

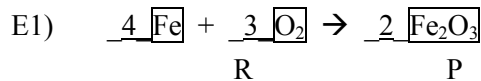
List all symbols shown in the reaction for both sides. If there are polyatomic ions, you may keep them together as a unit for convenience.

##### 5) Balance the equation.

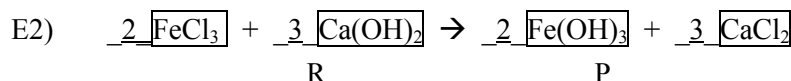
Use trial and error, changing coefficients, *not subscripts*. Pay attention to multiples. Change the atom totals in the chart as you balance. The equation is balanced when the numbers of atoms in the R & P columns are equal.

When you become more experienced at balancing, you may not need to use a chart. Some students do not need the chart format at all. I suggest you keep doing steps 1 & 3. Step 2 may become unnecessary in time.

E. examples



	R	P
Fe	<del>1</del> 4	<del>2</del> 4
O	<del>2</del> 6	<del>3</del> 6



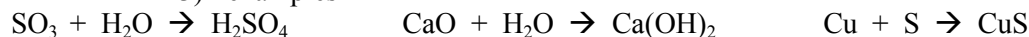
	R	P
Fe	<del>1</del> 2	<del>1</del> 2
Cl	<del>3</del> 6	<del>2</del> 6
Ca	<del>1</del> 3	<del>1</del> 3
(OH)	<del>2</del> 6	<del>3</del> 6

## 6.2 Notes

III. Types of Reactions

A. **combination (synthesis)**  $A + B \rightarrow AB$

- 1) *two or more reactants combine to form one product*
- 2) energy is given off
- 3) examples



B. **decomposition**  $AB \rightarrow A + B$

- 1) *one reactant decomposes into two or more products*
- 2) most decomposition rxns. require energy
- 3) examples



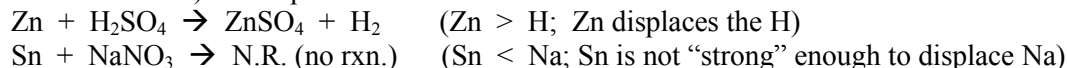
C. **single replacement (single displacement)**  $A + BC \rightarrow AC + B$

- 1) *atoms replace other atoms in a compound*
- 2) *“activity series” shows which will be displaced*

### ACTIVITY SERIES:

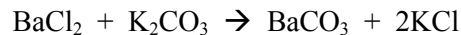
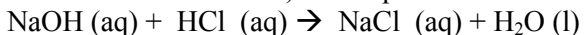
<b>HIGH</b>	→	→	→	→	decreasing activity	→	→	→	→	<b>LOW</b>						
(will displace others)										(will not displace)						
F <sub>2</sub>			Cl <sub>2</sub>					Br <sub>2</sub>		I <sub>2</sub>						
Li	K	Ba	Ca	Na	Mg	Al	Zn	Fe	Ni	Sn	Pb	H	Cu	Hg	Ag	Au

3) examples



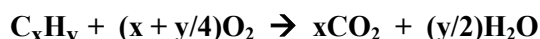
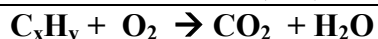
D. **double replacement (double displacement)**  $AB + CD \rightarrow AD + CB$

- 1) a *swapping* of cations in a reaction
- 2) usually occurs in aqueous solution (aq)
- 3) characteristics of at least one of the products: *solid (precipitate)*, *gas*, or *molecular compd.*
- 4) examples

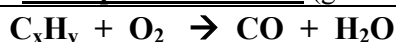


E. **combustion**

- 1) *burning*
- 2) *always involves oxygen (O<sub>2</sub>) as a reactant*
- 3) hydrocarbon **complete combustion**:



- 4) hydrocarbon **incomplete combustion** (general format):



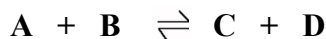
6.3 Notes

IV. Nature of Reactions

A. **reversible reactions**—reactions which can *change direction* (reversible reaction arrow is used)



- 1) **equilibrium**—a system in *balance* (no net change)
- 2) **dynamic equilibrium**—forward and backward reactions occur at the same rate
- 3) *LeChatlier's Principle*—if a system at equilibrium is disturbed, it will correct itself to reestablish equilibrium



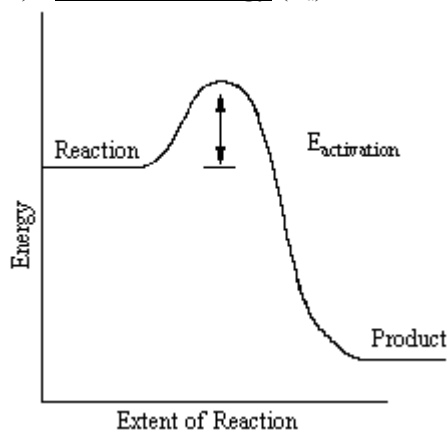
a) Changing direction

- add more A/B, or remove C/D, so more C/D will be produced
- add more C/D, or remove A/B to form more A/B

b) Adding or removing energy (heat)

B. reaction rate

- 1) **activation energy** ( $E_a$ ) – amount of energy needed to initiate a reaction



- 2) **catalyst**—*substance which lowers the activation energy without acting as reactant or product (makes it easier to react)*

