Name: _____ *Date:* _____

Unit 1 - Topic 5

Physical vs. Chemical Changes & Endothermic vs. Exothermic Reactions

In a physical change, the original substance still exists, it has only changed in form. In a chemical change, a new substance is produced. Energy changes always accompany chemical changes.

Classify the following as being a physical or a chemical change.

1. Sodium hydroxide dissolves in water. _____
2. Hydrochloric acid reacts with potassium hydroxide to produce a salt, water, and heat. _____
3. Ice melting. _____
4. Milk sours. _____
5. Evaporation. _____
6. Potassium chlorate decomposes to potassium chloride and oxygen gas. _____

Sate whether the following reactions or processes are exothermic or endothermic.

7. $2H_2(g) + O_2(g) \rightarrow 2H_2O(g) + \text{heat}$ _____
8. The combustion of ethylene, C_2H_4, liberates 1400 kJ/mole. _____
9. $CaCO_3(s) + \text{heat} \rightarrow CaO(s) + CO_2(g)$ _____
10. Barium hydroxide mixed with ammonium chloride yields the gas ammonia and the flask gets cold. _____

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For the following, classify each statement as being either a chemical OR a physical change, as well as an exothermic OR endothermic change.

Statement	Physical OR Chemical	Exothermic OR Endothermic
Water freezes to ice at 0 degrees Celsius.		
Water boils on a stove.		
Ice becomes liquid water at 0 degrees Celsius.		

Chemical Equations & Formulas

Chemical formulas are used in chemical equations to describe reactants and products. A **subscript** in a formula tells how many atoms of each kind are in a molecule. (no subscript = 1 atom)

Examples: H_2O 2 H's and 1 O in each molecule
C_2H_6 2 H's and 6H's in each molecule
Na_2SO_4 2 Na, 1 S and 4 O in each molecule

Subscripts are distributive when there are parentheses

Example: $Ca(NO_3)_2$ 1 Ca, 2 N and 6 O in each molecule

A number before the formula is called a **coefficient.** This number tells how many molecules we are dealing with or describing. That number is always distributive with respect to the atoms in the formula.

Examples: $2\ H_2O$ 2 molecules of H_2O containing a total of 4H and 2 O
$7\ Na_2CO_3$ 7 molecules of Na_2CO_3 containing a total of 14 Na, 7 C and 21 O

20. Tell how many **molecules** are in the following:

a) $AlCl_3$ _____

b) $6\ Na_2SO_4$ _____

c) a mixture of $3H_2O$ and $2CO_2$ _____

21. Tell how many **atoms** of each element are in the following

a) $(NH_4)_3PO_4$ _____

b) $3Al(NO_3)_3$ _____

22. ***(IB ONLY)*** Balance the following equations. Remember, you cannot change subscripts (little numbers), only coefficients (big numbers in front).

a) ____ NaCl + ____ Br_2 → ____ NaBr + ____ Cl_2

b) ____ Fe_2O_3 → ____ Fe + ____ O_2