Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pd: \_\_\_\_\_ Ast: \_\_\_\_\_

**Chemical Equations and the Law of Conservation of Mass**

**Chemical equations are much like a mathematical equation where numbers are used to add and multiply elements.** When a coefficient is placed in front of an element or chemical formula (group of elements), it is multiplied through to all of the elements in the formula. For example:

**2Na** = two sodium atoms **2NaCl** = two sodium atoms AND two chlorine atoms

When a subscript is placed behind an element, it belongs only to that element. For example:

**CO2** = one carbon atom and two oxygen atoms (the two belongs ONLY to the oxygen)

If an element with a subscript also has a coefficient in front, multiply the coefficient and the subscript. For example:

**4O2** = EIGHT oxygen atoms

**3CO2** = THREE carbon atoms and SIX oxygen atoms

**The law of conservation of mass states that matter is neither created nor destroyed. This means that when chemicals react, the mass of the reactants will equal the mass of the products. This concept is illustrated in chemical equations when the equation is balanced. A balanced chemical equation is one in which the number of atoms of each element in the reactants is the same as the number of each element in the products. CHEMICAL EQUATIONS MUST BE BALANCED; unbalanced equations are INCORRECT!**

In the space provided to the left of the chemical equations, tell whether the equation is balanced or not by writing “Y” for yes if it is balanced or “N” for no if it is unbalanced.

1. \_\_\_\_\_\_ 4Fe + 3O2 🡪 2Fe2O3
2. \_\_\_\_\_\_ CO2 + NaOH 🡪 NaHCO3
3. \_\_\_\_\_\_ NO + 3O2 🡪 2NO2
4. \_\_\_\_\_\_ 2NO + 2Cl2 🡪 2NOCl
5. \_\_\_\_\_\_ 2Fe + 3Cl2 🡪 2FeCl3
6. \_\_\_\_\_\_ 2KClO3 🡪 2KCl + 3O2
7. \_\_\_\_\_\_ Na + 2H2O 🡪 NaOH + 2H2
8. \_\_\_\_\_\_ 2Ag2CO3 🡪 4Ag + 2CO2 + O2
9. \_\_\_\_\_\_ C4H10O + 6O2 🡪 4CO2 + 5H2O
10. \_\_\_\_\_\_ PCl3 + 3H2O 🡪 H3PO3 + 3HCl

**Insert the correct coefficient on the line that will balance the chemical equation.**

**On the line to the right, classify the reaction as “synthesis”, “decomposition”, or “replacement”.**

1. Zn + \_\_\_\_\_HCl 🡪 ZnCl2 + H2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. 2CO2 + 2H2O + 2CaCO3 🡪 Ca2 + \_\_\_\_\_HCO3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. SnO2 + \_\_\_\_\_H2 🡪 Sn + 2H2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. 2NO + O2 🡪 \_\_\_\_\_NO2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. 2AgI + Na2S 🡪 Ag2S + \_\_\_\_\_ NaI \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Balance the following equations by putting the correct coefficient on the line. *If no coefficient is needed, leave the line blank*. On the line to the right, classify the reaction as “synthesis”, “decomposition”, or “replacement”.**

1. \_\_\_\_\_Fe + \_\_\_\_\_Cl2 🡪 \_\_\_\_\_FeCl3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_KOH + \_\_\_\_\_H3PO4 🡪 \_\_\_\_\_K3PO4 + \_\_\_\_\_H2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_KClO3 🡪 \_\_\_\_\_KCl + \_\_\_\_\_O2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. \_\_\_\_\_CO2 + \_\_\_\_\_ H2O 🡪 \_\_\_\_\_C6H12O6 + \_\_\_\_\_O2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. \_\_\_\_\_Fe + \_\_\_\_\_O2 🡪 \_\_\_\_\_Fe2O3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Challenge: Balance these equations!**

**On the line to the right, classify the reaction as “synthesis”, “decomposition”, or “replacement”.**

1. \_\_\_\_\_S8 + \_\_\_\_\_F2 🡪 \_\_\_\_\_SF6 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_FeS + \_\_\_\_\_O2 🡪 \_\_\_\_\_Fe2O3 + \_\_\_\_\_SO2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_CO + \_\_\_\_\_H2 🡪 \_\_\_\_\_C8H18 + \_\_\_\_\_H2O\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. \_\_\_\_\_C2H6O + \_\_\_\_\_O2 🡪 \_\_\_\_\_CO2 + \_\_\_\_\_H2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. \_\_\_\_\_NH3 + \_\_\_\_\_O2 🡪 \_\_\_\_\_NO + \_\_\_\_\_H2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. \_\_\_\_\_C3H6 + \_\_\_\_\_O2 🡪 \_\_\_\_\_CO2 + \_\_\_\_\_H2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Short Answer**

1. Explain the law of conservation of mass in your own words.
2. In a chemical reaction, how are the reactants related to the products?
3. Why are balanced chemical equations essential to the law of conservation of mass?
4. Before a chemical reaction, the reactants all have a mass of 200 g. After the reaction, what would you expect the mass of your products to be? Explain.
5. Imagine that you mix 10g of Alka-Seltzer with 100 g of water. After the reaction, you measure the mass of the solution to be 109.8 g. What is the mass of the carbon dioxide gas that was produced in the reaction? How do you know?