Name:

Period:

LAB 22 - CONSERVATION OF MASS & CHEMICAL EQUATIONS

BACKGROUND

We have seen how chemicals come together and break apart, and we are somewhat familiar with chemical equations. If you think of the atomic symbols as words, then you can think of chemical equations as sentences. Words by themselves are limited, but sentences can have many meanings. In chemistry, an equation (a chemical sentence) is how we express the meaning of a reaction.

Using chemical equations, we can start to identify a law of science called "Conservation of Mass". This means that matter cannot be created or destroyed. In other words, whatever atoms were present before the reaction are still there after the reaction. They may be combined differently or in a different state of matter (solid, liquid, or gas), but ***the atoms themselves are still there***.

PROBLEM

How do we model the law of conservation of mass? How does this relate to chemical equations?

PRE-LAB QUESTIONS

Examine the chemical expression below, and then answer the questions.

$5H_2O$	1. What number represents the coefficient? _____ 2. What number represents the subscript? _____ 3. What element is represented by the letter H? _____ 4. What element is represented by the letter O? 5. What does it mean that there is no subscript behind the O? _____ 6. How many H's do you have in total? _____ 7. How many O's do you have in total? _____	Draw what $5H_2O$ represents

MATERIALS

- notecards

PROCEDURE

For this activity you will be working with your lab partner and one other lab group.

1. Spread out your notecards on the lab station. Make sure they are all facing up. Now divide the cards up about evenly between each of the group members.

2. Examine table 22-1. Arrange the notecards on the lab station to replicate the first chemical equation.

3. Use the red "Reactants" and purple "Products" cards to identify each side of the equation.

4. Each person should record the following information into table 22-1.

   a. Identify and count the elements on the reactant side (write the symbols and the numbers of atoms into the "Reactants" column)
   b. Identify and count the elements on the products side (write the symbols and the numbers of atoms into the "Products" column)

5. Are the two sides equal? In other words, are the same number of atoms of each element in the products as there were in the reactants?
   a. If so, the equation is balanced, move on to step 9.
   b. If not, then the equation is not balanced, go on to the next step.

☆6. The index cards numbered 2 – 7 are your coefficients. They can **ONLY** be placed in front of the elements/molecules. **You can NOT change the subscripts.** Changing the coefficient simply changes how many of that atom or molecule there is, but changing a subscript changes the molecule itself, which would change the reaction.

7. Choose an element that is not balanced and begin to balance the equations by changing the coefficients.

8. Continue until you have worked through all the elements.

9. Once they are balanced, see if it is possible to simplify your equation. For instance, if all the atoms/molecules have a coefficient that is a multiple of 2, then you can probably divide them all by two and still have a balanced equation. Be careful that you remember that an atom without a coefficient is the same thing as having a coefficient of 1.

10. Count the final number of Reactants and Products in your equation. Record the results in table 22-1, then also record the balanced equation.

11. Repeat steps 2 – 11 for the next equation on table 22-1. The first group to correctly balance all the equations will get a prize.

12. When you are finished you should have a total of 45 cards. If you are missing any cards, please see Mr. Koerger about getting a replacement.

SUMMARY QUESTIONS

1) What do we say when we see the → symbol in a chemical reaction? What does this actually mean?

2) Why must a chemical equation be balanced?

3) Why can't you just change the subscripts to balance an equation?

EXTENDED PRACTICE

Balance the equations on the attached sheet.

Table 22-1: Unbalanced Chemical Equations

Unbalanced Equation	Reactants	Products	Balanced Reactants	Balanced Products	Balanced Equation
$H_2 + O_2 \rightarrow H_2O$	H: 2 O: 2	H: 2 O: 1	H: 4 O: 2	H: 4 O: 2	$2H_2 + O_2 \rightarrow 2H_2O$
$H_2O_2 \rightarrow H_2O + O_2$					
$Na + O_2 \rightarrow Na_2O$					
$N_2 + H_2 \rightarrow NH_3$					
$P_4 + O_2 \rightarrow P_4O_{10}$					
$Fe + H_2O \rightarrow Fe_3O_4 + H_2$					
$C + H_2 \rightarrow CH_4$					
$Na_2SO_4 + CaCl_2 \rightarrow CaSO_4 + NaCl$					
$C_2H_6 + O_2 \rightarrow CO_2 + H_2O$					
$Al_2O_3 \rightarrow Al + O_2$					

Extended Practice – Balancing Chemical Equations

Balance the equations below:

1) _____ NH_3 → _____ H_2 + _____ N_2

2) _____ $KClO_3$ → _____ KCl + _____ O_2

3) _____ NaCl + _____ F_2 → _____ NaF + _____ Cl_2

4) ~~_____ H_2 + _____ O_2 → _____ H_2O~~

5) _____ $Pb(OH)_2$ + _____ HCl → _____ H_2O + _____ $PbCl_2$

6) _____ $AlBr_3$ + _____ K_2SO_4 → _____ KBr + _____ $Al_2(SO_4)_3$

7) _____ CH_4 + _____ O_2 → _____ CO_2 + _____ H_2O

8) _____ C_3H_8 + _____ O_2 → _____ CO_2 + _____ H_2O

9) _____ C_8H_{18} + _____ O_2 → _____ CO_2 + _____ H_2O

10) _____ $FeCl_3$ + _____ NaOH → _____ $Fe(OH)_3$ + _____NaCl

11) _____ P + _____O_2 → _____P_2O_5

12) _____ Na + _____ H_2O → _____ NaOH + _____H_2

13) _____ Ag_2O → _____ Ag + _____O_2

14) _____ S_8 + _____O_2 → _____ SO_3

15) _____ CO_2 + _____ H_2O → _____ $C_6H_{12}O_6$ + _____O_2

16) _____ K + _____ MgBr → _____ KBr + _____ Mg

17) _____ HCl + _____ $CaCO_3$ → _____ $CaCl_2$ + _____H_2O + _____ CO_2

18) _____ HNO_3 + _____ $NaHCO_3$ → _____ $NaNO_3$ + _____ H_2O + _____ CO_2

19) _____ H_2O + _____ O_2 → _____ H_2O_2

20) _____ NaBr + _____ CaF_2 → _____ NaF + _____ $CaBr_2$

21) _____ H_2SO_4 + _____ $NaNO_2$ → _____ HNO_2 + _____ Na_2SO_4