Lesson: Word & Formula Equation, and Balancing Equations

Objectives: The students will be able to:
1. Write both word and formula equations for chemical reactions.
2. Apply knowledge of the law of conservation of mass to appropriately balance chemical equations.

Academic Standards:
3.4.12.A – Classify and describe, in equation form, types of chemical and nuclear reactions.

Content: word equation, formula (chemical equation), law of conservation of mass, Lavoisier, balancing chemical equations.

Materials and Equipment: Unit 6 topic sheet, worksheets: word equations (p. 59), alkanes, removing silver tarnish lab.

Activity:
1. Introduction of Unit 6
   - statement of where we have been and where we are going with our present and continuing knowledge of chemistry;
   - pass out the topic list for this unit and go through the listed items.
2. Writing Chemical Equations, Notes
   - in class reading: together as a class, we will read lesson 26 Chemical Equations;
   - upon completion of reading, the following definitions are to be written down in notebooks – word equation, formula equation, balanced equation, phases, coefficients;
   - using the classroom textbook, turn to p. 236 and write down the more common symbols used in chemical equations;
   - write a chemical formula problem on the board, teacher will guide students through means to convert from formula to a word equation. In a similar fashion, do an example problem from words to formula;
   - pass out worksheet p. 59, word equations, go through the first one together, have student work with partner to do numbers 2-8; review answers.
3. Balancing Chemical Equations, Notes
   - first step is to get the correct formula equations – remember polyatomic charges, writing ionic/covalent formulas, diatomics;
   - practice example of formation of water; introduction of vocabulary word, coefficients;
   - law of conservation of mass;
   - additional examples – practice problems on the back of lesson 26;
   - return to worksheet p. 59, balance equations 1-8 with partners; review answers.
4. Discussion of Quick Lab
   - pass out procedure, indicate what is required for lab notebook;
   - explain how to set up the experiment for tomorrow.
5. Closure
   - review important vocabulary and concepts from today’s class;
   - go over homework.

Assessment:
1. Teacher observation via in-class participation.
2. Homework: word equations, p. 62 #s 1-8 (write a formula equation, and balance).
3. Quiz on Friday 4-21.
Write the missing terms in the blanks.

4. The **reactants** are the substances that react with each other during a chemical reaction.

5. A chemical equation is **balanced** by adding coefficients in front of the symbols or formulas.

6. A plus sign on the left side of an equation means **reacts with**.

7. The letter g in parentheses following the formula of a substance means the substance is an **gas**.

8. The coefficients in an equation can refer to the number of molecules or to the number of **moles**.

9. When hydrochloric acid is poured over zinc metal, hydrogen gas bubbles from the zinc, and zinc chloride is produced in the acid solution. Write a word equation for this reaction.

   **Hydrochloric acid reacts with zinc to produce zinc chloride and hydrogen**

10. Balance the following equations.
   
   a. $\underline{2} \text{Mg} + \underline{\quad} \text{O}_2 \rightarrow \underline{2} \text{MgO}$
   
   b. $\underline{2} \text{Na} + \underline{\quad} \text{H}_2\text{O} \rightarrow \underline{2} \text{NaOH} + \underline{\quad} \text{H}_2$
   
   c. $\underline{2} \text{K} + \underline{\quad} \text{Br}_2 \rightarrow \underline{2} \text{KBr}$
   
   d. $\underline{2} \text{Al} + \underline{3} \text{Cl}_2 \rightarrow \underline{2} \text{AlCl}_3$

11. Balance the following equations.
   
   a. $\underline{2} \text{KClO}_3 \rightarrow \underline{2} \text{KCl} + \underline{3} \text{O}_2$
   
   b. $\underline{\quad} \text{N}_2 + \underline{3} \text{H}_2 \rightarrow \underline{2} \text{NH}_3$
   
   c. $\underline{2} \text{Al} + \underline{3} \text{NiCl}_2 \rightarrow \underline{2} \text{AlCl}_3 + \underline{2} \text{Ni}$
   
   d. $\underline{\quad} \text{CH}_4 + \underline{2} \text{O}_2 \rightarrow \underline{\quad} \text{CO}_2 + \underline{2} \text{H}_2\text{O}$

12. Write a balanced formula equation for the following reaction. Magnesium metal reacts with silver chloride to produce silver metal and magnesium chloride. $\underline{3} \text{Mg} + \underline{2} \text{AgCl}_2 \rightarrow \underline{2} \text{Ag} + \underline{3} \text{MgCl}_2$
Write and balance the following chemical equations.

1. Hydrogen plus oxygen yield water.
   \[ 2H_2 + O_2 \rightarrow 2H_2O \]

   \[ N_2 + 3H_2 \rightarrow 2NH_3 \]

3. Aluminum bromide plus chlorine yield aluminum chloride and bromine.
   \[ 2AlBr_3 + 3Cl_2 \rightarrow 2AlCl_3 + 3Br_2 \]

4. Hydrochloric acid plus sodium hydroxide yield sodium chloride plus water.
   \[ HCl + NaOH \rightarrow NaCl + H_2O \]

5. Iron plus lead (II) sulfate react forming iron (II) sulfate plus lead.
   \[ Fe + PbSO_4 \rightarrow FeSO_4 + Pb \]

6. Potassium chlorate when heated produces potassium chloride plus oxygen gas.
   \[ 2KClO_3 \rightarrow 2KCl + 3O_2 \]

7. Sulfuric acid decomposes to form sulfur trioxide gas plus water.
   \[ H_2SO_4 \rightarrow SO_3(g) + H_2O \]

8. Sodium oxide combines with water to make sodium hydroxide.
   \[ Na_2O + H_2O \rightarrow 2NaOH \]

9. Potassium iodide reacts with bromine forming potassium bromide plus iodine.
   \[ 2KI + Br_2 \rightarrow 2KBr + I_2 \]

10. Sodium phosphate reacts with calcium nitrate to produce sodium nitrate plus calcium phosphate.
    \[ 2Na_3PO_4 + 3Ca(NO_3)_2 \rightarrow 6NaN_3O_3 + Ca_3PO_4 \]

11. Zinc reacts with iron (III) chloride yielding zinc chloride plus iron precipitate.
    \[ 3Zn + 2FeCl_3 \rightarrow 3ZnCl_2 + 2Fe \]

12. Ammonium carbonate and magnesium sulfate react to yield ammonium sulfate plus magnesium carbonate.
    \[ (NH_4)_2CO_3 + MgSO_4 \rightarrow (NH_4)_2SO_4 + MgCO_3 \]

13. Phosphoric acid plus calcium hydroxide react forming solid calcium phosphate plus water.
    \[ 2H_3PO_4 + 3Ca(OH)_2 \rightarrow Ca_3(PO_4)_2 + 6H_2O \]

    \[ 4Al + 3O_2 \rightarrow 2Al_2O_3 \]

    \[ 2N_2(g) + 5O_2(g) \rightarrow 2N_2O_5 \]
<table>
<thead>
<tr>
<th>Reactants</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc + lead (II) nitrate</td>
<td>Zinc nitrate + lead</td>
</tr>
<tr>
<td>aluminum bromide + chlorine</td>
<td>aluminum chloride + bromine</td>
</tr>
<tr>
<td>sodium phosphate + calcium chloride</td>
<td>calcium phosphate + sodium chloride</td>
</tr>
<tr>
<td>potassium chlorate when heated</td>
<td>potassium chloride + oxygen gas</td>
</tr>
<tr>
<td>aluminum + hydrochloric acid</td>
<td>aluminum chloride + hydrogen gas</td>
</tr>
<tr>
<td>calcium hydroxide + phosphoric acid</td>
<td>calcium phosphate + water</td>
</tr>
<tr>
<td>copper + sulfuric acid</td>
<td>copper (II) sulfate + water + sulfur dioxide</td>
</tr>
<tr>
<td>hydrogen + nitrogen monoxide</td>
<td>water + nitrogen</td>
</tr>
</tbody>
</table>
Lesson: Synthesis and Decomposition Reactions & Organic Chemistry

Objectives: The students will be able to:
1. Define and give general equations for synthesis and decomposition reactions.
2. Classify a reaction as synthesis or decomposition and predict the products for simple synthesis and decomposition reactions, given the reactants.
3. Discuss the energy involved in synthesis and decomposition reactions.
4. Apply knowledge of the law of conservation of mass to appropriately balance chemical equations.
5. Differentiate among unsaturated hydrocarbons (alkenes and alkynes) and cycloalkanes.

Academic Standards:
3.4.10.A – Describe various types of chemical reactions by applying the laws of conservation of mass and energy.
3.4.10.A – Understand that carbon can form several types of compounds.
3.4.12.A – Classify and describe, in equation form, types of chemical and nuclear reactions.

Content: Chemical reactions (synthesis, decomposition), alkanes, alkenes, alkynes, cycloalkanes, benzene.

Materials and Equipment: Worksheets (p. 61 balancing equations, 9-2 practice problems), Reactions packet, Heath chemistry text, p. 111, #15 a-d, e-h.

Activity:
1. Introductory Activity
   - two problems will be put on the board, one formula to word equation, one word to formula equation;
   - students will be instructed to convert to the desired equation and balance them appropriately;
   - review the answers, as well as other material associated chemical equations.
   - verbal review of writing word and formula equations and balancing equations.
2. Synthesis & Decomposition Reaction notes
   - introduce synthesis reactions by asking students the word synthesize means;
   - give a general definition and formula for this type of reaction;
   - examples of synthesis reactions with balancing – guided and self practice on board;
   - partner work with reactions packet, #s 1 and 2 under synthesis;
   - introduce decomposition reactions by asking students the word decompose means;
   - give a general definition and formula for this type of reaction;
   - examples of decomposition reactions with balancing – guided and self practice on board;
   - partner work with reactions packet, #s 1 and 2 under decomposition.
3. Organic Chemistry
   - verbal review of organic chemistry (alkanes, nomenclature, parent/alkyl chain, straight/branched chain).
   - introduction of alkenes, alkynes, and cycloalkanes.
4. Homework
   - finish balancing equations worksheet #s 8-15
   - reactions packet, #s 3-5 for synthesis and decomposition reactions;
   - study for quiz tomorrow on writing word/formula equations and balancing.

Assessment:
1. Teacher observation via in-class participation.
2. Participation and cooperation in group work.