

## Part I: Introduction to Chemical Reactions

1. Below are two ways in which chemists describe chemical processes. These are the *chemical reaction* and *written description*.



**Written Description:** Solid sodium hydroxide is added to aqueous hydrochloric acid to produce an aqueous solution of sodium chloride and liquid water.

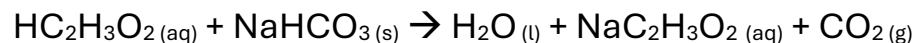
- a. Complete the following table by comparing the *chemical reaction* and the *written description* from above.

Symbol	What it Represents
NaOH	
(s)	
+	
HCl	
(aq)	

Symbol	What it Represents
→	
NaCl	
(aq)	
H <sub>2</sub> O	
(l)	

- b. Draw a circle around each *reactant* and a box around each *product* in the table above.
- c. What is the difference between  $\text{NaCl}_{(l)}$  and  $\text{NaCl}_{(aq)}$ ? As part of your answer, explain how each could be made starting with  $\text{NaCl}_{(s)}$ .

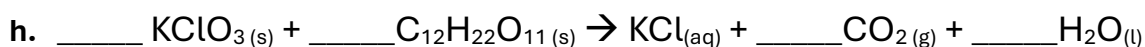
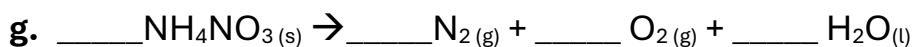
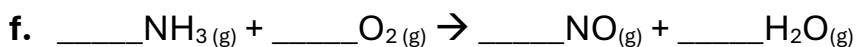
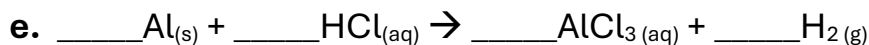
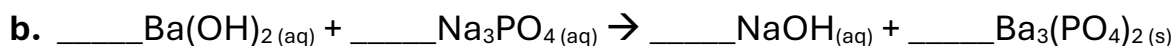
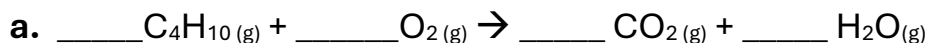
2. A popular experiment in elementary and middle school is to mix vinegar and baking soda which reacts to form a gas (notably used for making volcanoes). The chemical reaction for this is shown below. Translate this chemical reaction into a written using the written description in question 1.



## CHEM 4 PAL— Balancing Chemical Equations

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3. Balancing chemical reactions requires practice, and sometimes trial and error. Begin by balancing elements that only occur in one place on each side of the equation. Typically, this means leaving oxygen and/or hydrogen to balance last. The following questions will give you some practice.

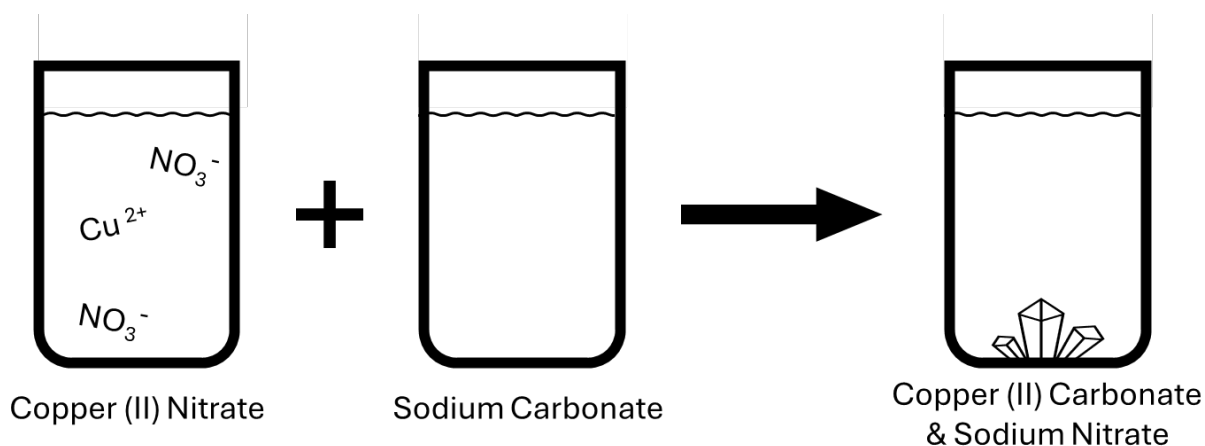


For the remaining problems, begin by translating the written description into a chemical formula. Finish by balancing the chemical formula. [*Hint*: remember that certain elements are diatomic. For example, “hydrogen gas” would be translated as “ $\text{H}_{2(g)}$ .” Most other pure elements are simply written as a single atom. For example, “solid copper” would translate as “ $\text{Cu(s)}$ .”]

4. Solid iron(IV) sulfide reacts with gaseous oxygen to produce solid iron(III) oxide and gaseous sulfur dioxide. Write the balanced chemical reaction for this process.
  
5. Write the balanced chemical reaction that occurs in a car battery where solid metallic lead and solid lead(IV) oxide react with aqueous sulfuric acid to produce solid lead(II) sulfate and liquid water.
  
6. In our bodies, carbohydrates and other sugars can be broken down or converted to glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ) and used as fuel. Write the balanced chemical reaction for the combustion of glucose.

7. When an aqueous solution of copper(II) nitrate is mixed with aqueous sodium carbonate, the result is the formation of solid copper(II) carbonate and aqueous sodium nitrate.
- a. Write the balanced chemical reaction for the written description above.

- b. If all the aqueous ionic compounds in question 9a exist broken up into their ions in water, fill in the boxes below with drawings that indicate what is present in each of the corresponding beakers. The first beaker has been drawn for you. Note that the ions have their correct charges and are drawn in the correct ratio indicated by their formulas. For clarity, water molecules have not been shown but are indicated by the squiggle line.



- c. Based on the balanced reaction and the drawing, what would you expect to be able to see if you carried out the above reaction?