Investigating Chemical Reactions

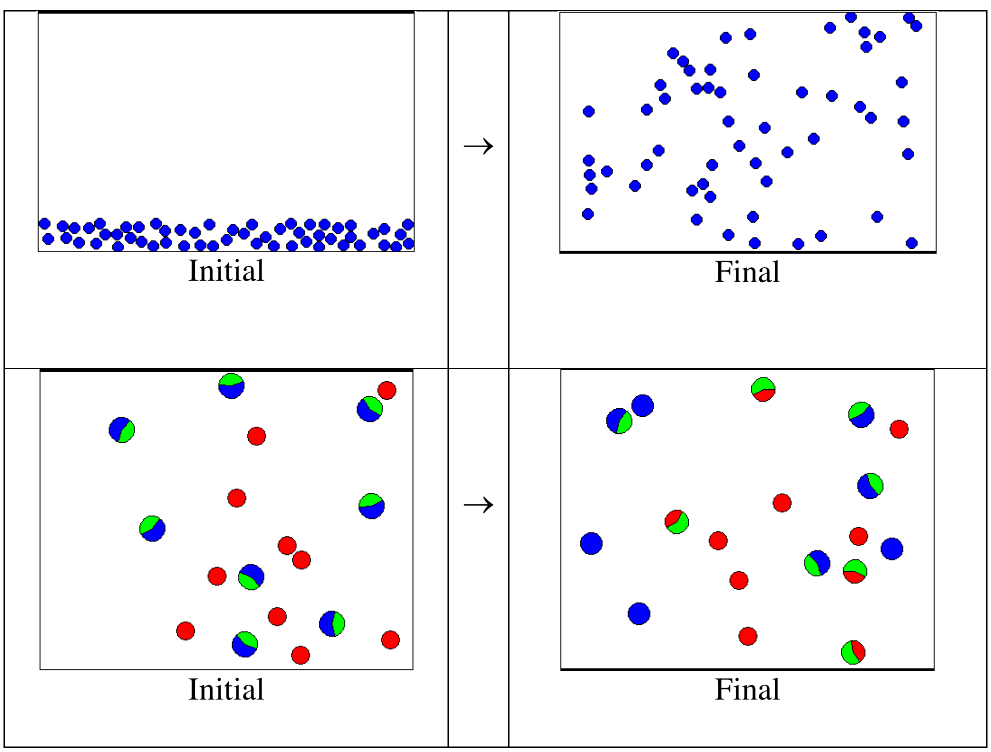
Name ____ Section (CRN)_______

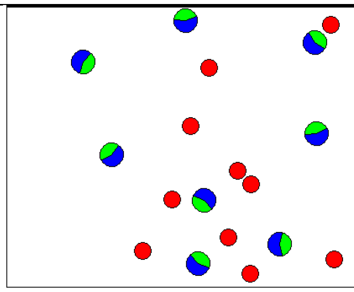
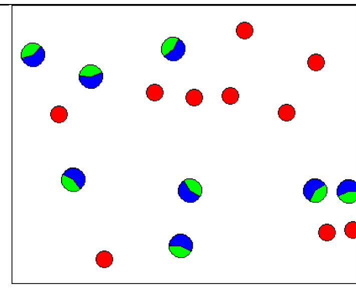
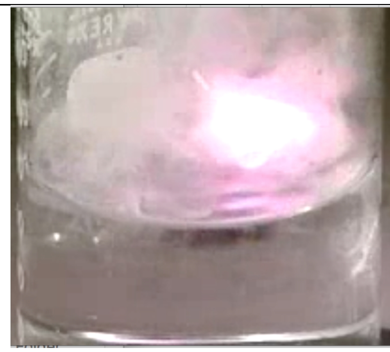
Problem Statement: How are masses of reactants and products related in a chemical reaction?

I. Preliminary Information

A. Using your textbook or an online source define/describe a chemical reaction. (Cite your source.)

B. For each of the following changes indicate which represents a chemical change and which represents a physical change. For each provide a brief explanation to support your claim.



 Initial	→	 Final
 Initial	→	 Final

C. Answer the questions below regarding the reaction between hydrogen and oxygen to form water.

i) Write the formula for the element, hydrogen.

ii) Write the formula for the element oxygen.

iii) Write the formula for the compound water.

iv) Write the balanced chemical equation (using the smallest whole number coefficients) that describes the reaction of hydrogen plus oxygen to form water.

v) In the chemical equation you wrote in Civ above, if you multiplied each of the coefficients by 2 does that change anything about the chemical equation? Provide a brief explanation to support your yes or no answer.

D. Figure I. below depicts the particulate level (submicroscopic) representation of a container (the box on the left) with a mixture of hydrogen and oxygen molecules before a reaction occurs, and the <u>same</u> container (the box on the right) after a reaction occurs.

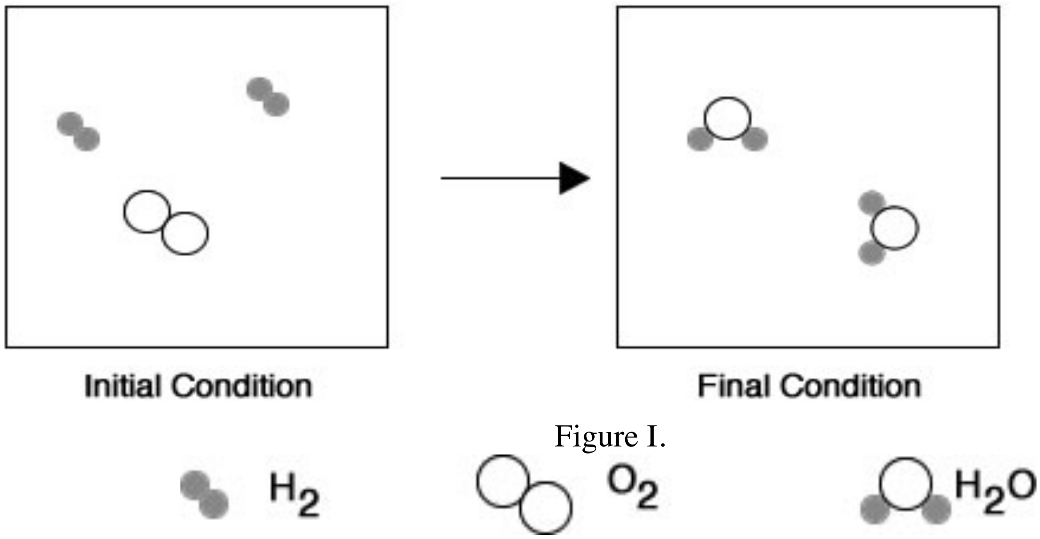


Figure I.

Write the balanced chemical equation (using whole number coefficients) that describes the reaction of hydrogen plus oxygen to form water.

E. Figure II. below depicts the particulate level (submicroscopic) representation of a container (the box on the left) with a mixture of hydrogen and oxygen molecules before a reaction occurs, and the same container (the box on the right) after a reaction occurs.

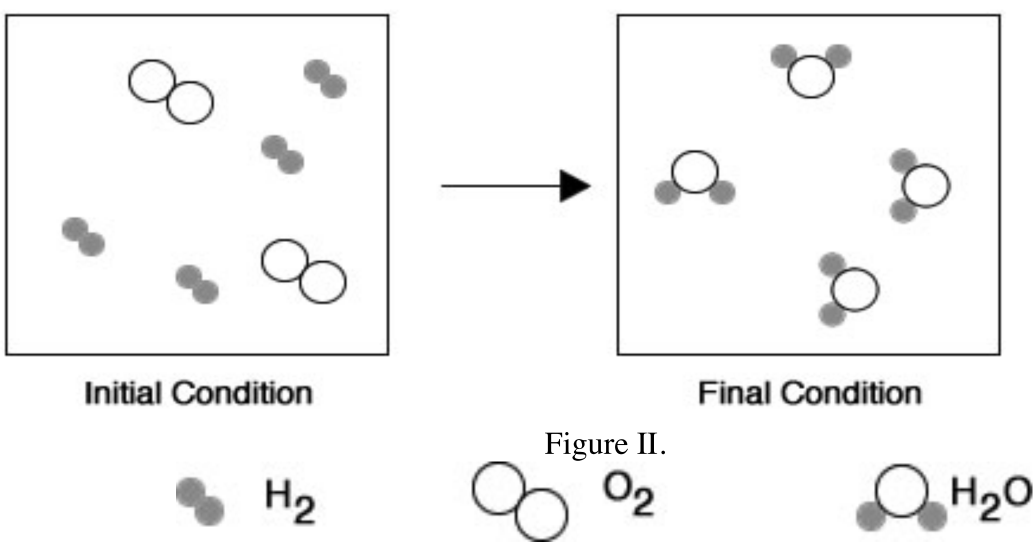


Figure II.

Write the balanced chemical equation (using whole number coefficients) that describes the reaction of hydrogen plus oxygen to form water.

F. The Figure III. below depicts the particulate level (submicroscopic) representation of a container (the box on the left) with a mixture of hydrogen and oxygen molecules before a reaction occurs, and the same container (the box on the right) after a reaction occurs.

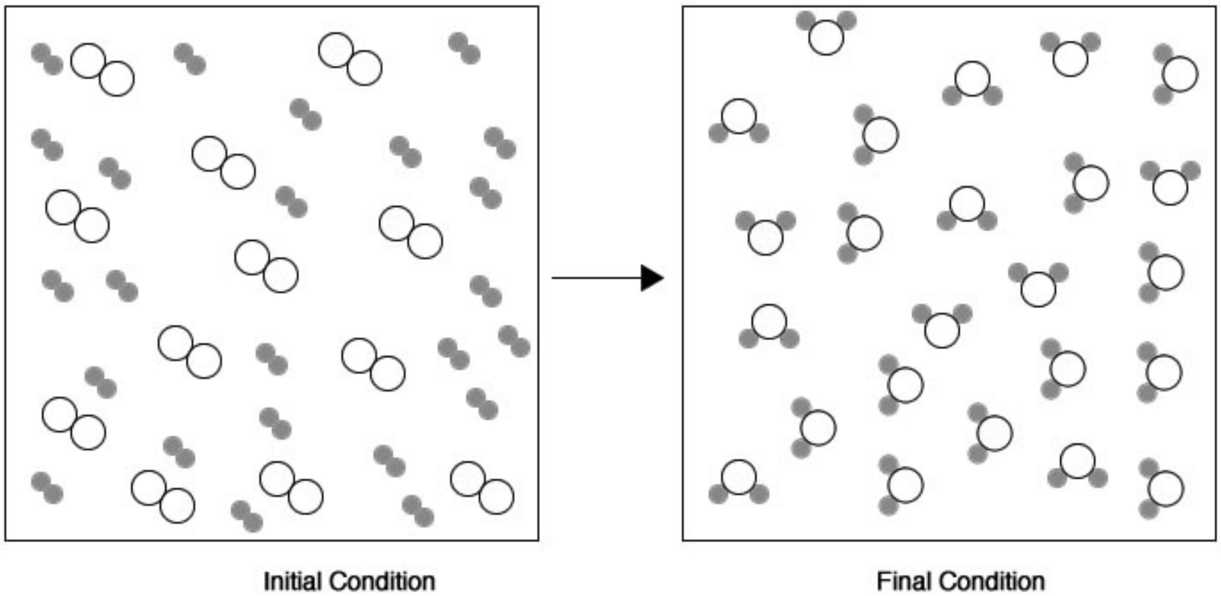
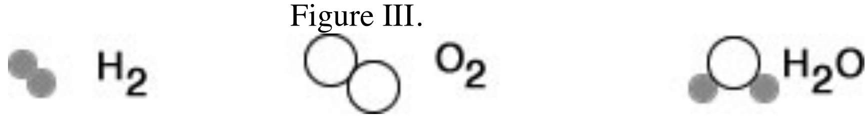


Figure III.



Write the balanced chemical equation (using whole number coefficients) that describes the reaction of hydrogen plus oxygen to form water.

G. Summarizing parts D – F.

i) What is different about Figures I - III shown above?

ii) What is the same about Figures I - III shown above?

H. The Figure IV. below depicts the particulate level (submicroscopic) representation of a container (the box on the left) with a mixture of hydrogen and oxygen molecules before a reaction occurs, and the same container (the box on the right) after a reaction occurs.

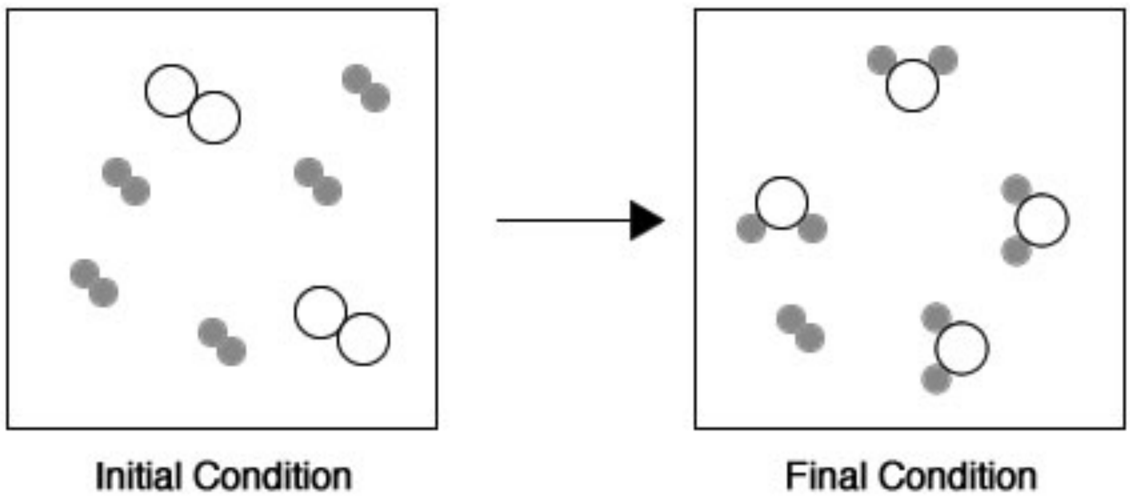
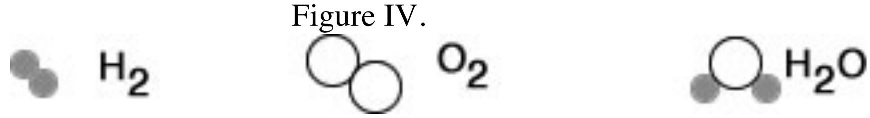


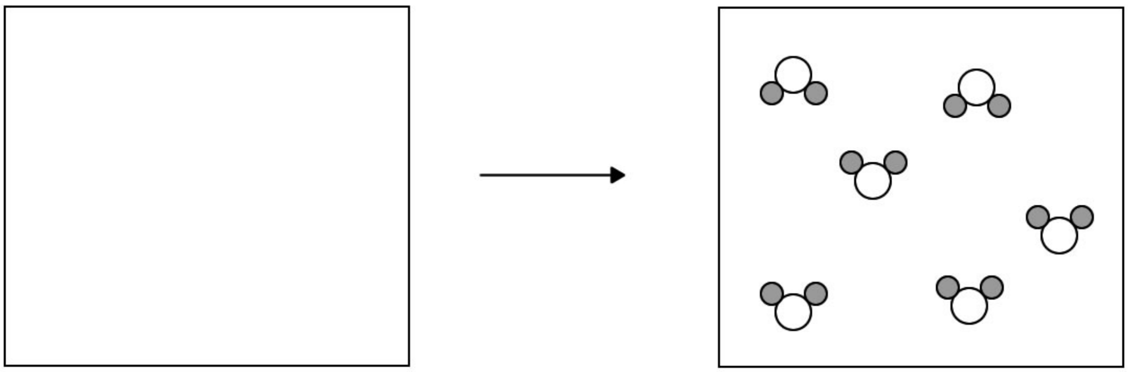
Figure IV.



i) Write the balanced chemical equation (using whole number coefficients) that describes the reaction of hydrogen plus oxygen to form water.

I. What is different about the Initial condition in Figure IV compared to Figures I - III?

J. Consider Figure V below and complete the contents of the Initial Conditions, before the reaction begins.



Initial Condition

Final Condition

Figure V.

K. One way to summarize the amounts of reactants and products in a chemical reaction is to use a table that shows the Initial amounts of reactants and products, the Final amounts of reactants and products and the Change in the amounts of reactants and products.

Returning to Figure I in part D above, the table that summarizes the amounts of reactants and products in the chemical reaction would look like the following;

Looking at the Initial Conditions

	$2H_2(g)$ +	$O_2(g)$	→	$2H_2O(g)$
Initial	2 molecules	1 molecule		0 molecules
Change				
Final				

Looking at the Final Conditions

	$2H_2(g)$ +	$O_2(g)$	→	$2H_2O(g)$
Initial	2 molecules	1 molecule		0 molecules
Change				
Final	0 molecules	0 molecules		2 molecules

Determine the Change amounts

	$2H_2(g)$ +	$O_2(g)$	→	$2H_2O(g)$
Initial	2 molecules	1 molecule		0 molecules
Change	–2 molecules	–1 molecules		+2 molecules
Final	0 molecules	0 molecules		2 molecules

Complete the tables below for Figures II, III, IV and V.

Figure II:

	$2H_2(g)$ +	$O_2(g)$	→	$2H_2O(g)$
Initial				
Change				
Final				

Figure III:

	$2H_2(g)$ +	$O_2(g)$	→	$2H_2O(g)$
Initial				
Change				
Final				

Figure IV:

	$2H_2(g)$ +	$O_2(g)$	→	$2H_2O(g)$
Initial				
Change				
Final				

Figure V:

	$2H_2(g)$ +	$O_2(g)$	→	$2H_2O(g)$
Initial				
Change				
Final				

L. Consider the Change amounts for each of the tables above. What is interesting about the ratios of the numbers in the Change row for all four examples.

5. In the synthesis reaction

$$2\ SO_2(g) + O_2(g) \rightarrow 2\ SO_3(g)$$

Calculate the number of moles of SO_3 formed when:

a. 2.0 moles of SO_2 are mixed with 5.0 moles of O_2 and allowed to react.

b. 4.0 moles of SO_2 are mixed with 6.0 moles of O_2 and allowed to react.

c. 5.0 moles of SO_2 are mixed with 9.0 moles of O_2 and allowed to react.

d. 0.812 moles of SO_2 are mixed with 0.125 moles of O_2 and allowed to react.

e. 20.0 grams of SO_2 are mixed with 15.0 grams of O_2 and allowed to react.