

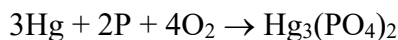
Assignment #1

Chemistry Module 6 Homework
SHOW ALL MATH CALCULATIONS
OR NO CREDIT

Module 6

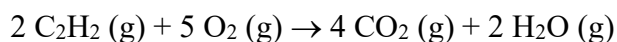
Read pages 163 – 185.

1. Calculate the ratios of the chemicals using the following equation to fill in the table:



Moles of Hg	Moles of P	Moles of O ₂	Moles of Hg ₃ (PO ₄) ₂
12 moles			
	10 moles		
		12 moles	
	7 moles		

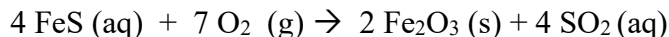
2. Write Gay-Lussac's Law. What has to be true for you to use Gay-Lussac's Law in stoichiometry?
3. In welding, acetylene gas, C₂H₂, is burned with oxygen gas to produce a hot flame and melt the metal. The reaction is: (Math)



- When 7.50 liters of C₂H₂ are burned with excess oxygen, how many liters of carbon dioxide will be formed?
 - When 18.0 liters of oxygen are burned with excess C₂H₂, how many liters of water vapor (H₂O) are produced?
4. What is a limiting reactant? Why do you need to know which substance is the limiting reactant when you do stoichiometry?
5. For the following reaction, if a chemist adds 3.0 moles of Zn to 4.0 moles of HNO₃, what is the limiting reactant? (Math)



6. When iron sulfide is mixed with oxygen, the following reaction occurs:



If 15.0 moles of iron sulfide are reacted with 25.0 moles of oxygen, what is the limiting reactant? (Math)

7. For the reaction: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g})$ How many liters of water vapor can be produced by reacting 6.3 liters of H₂ with 4.7 liters of O₂?
- Find the limiting reactant first. Which reactant runs out first?
 - Use the limiting reactant to determine the amount of water produced.

Stoichiometry Steps

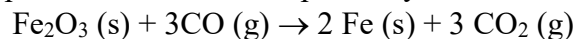
Set-Up:	Determine which two chemicals are used in the problem.
	Calculate the molar mass of each chemical. (Look up the weight on the chart.)
Calculate:	A. Change grams to moles.
	B. Trade moles
	C. Change moles to grams

8. Use this reaction to answer the questions: $\text{H}_2\text{SO}_4 + 2 \text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2 \text{H}_2\text{O}$ A chemist reacts 50.0 grams of sulfuric acid (H_2SO_4) with excess NaOH. How many grams of water will be produced?
- What are the two chemicals you are going to use?
 - What is the molar mass of each chemical?
 - Convert grams of sulfuric acid to moles. (Grams to moles, divide.)
 - Trade moles of sulfuric acid for moles of water. (Use the numbers in the equation.)
 - Convert moles of water to grams. (Moles to grams, multiply.)
9. A phosphorous fertilizer, $\text{CaH}_2\text{P}_2\text{O}_8$, can be made using this reaction:
- $$\text{Ca}_3\text{P}_2\text{O}_8 + 2\text{H}_2\text{SO}_4 + 4 \text{H}_2\text{O} \rightarrow \text{CaH}_2\text{P}_2\text{O}_8 + 2 \text{CaH}_4\text{SO}_6$$
- If 150.0 grams of H_2SO_4 are reacted with excess $\text{Ca}_3\text{P}_2\text{O}_8$ and water, how many moles of $\text{CaH}_2\text{P}_2\text{O}_8$ (fertilizer) are produced?
- What are the two chemicals you are using?
 - What is the molar mass of each chemical?
 - Change grams of H_2SO_4 to moles.
 - Trade moles of H_2SO_4 for moles of fertilizer ($\text{CaH}_2\text{P}_2\text{O}_8$). How many moles of fertilizer are produced?
 - Convert moles of fertilizer to grams.
10. Methanol, CH_3OH , is made by reacting carbon monoxide with hydrogen gas at high temperature and pressure. (Math)
- Write the balanced equation for the reaction.
 - How many grams of carbon monoxide are needed to make 600.0 g of CH_3OH ? (Do all the steps.)

11. Calcium can be reacted with nitric acid (HNO_3) to produce calcium nitrate ($\text{Ca}(\text{NO}_3)_2$) and hydrogen gas. Calcium nitrate is used in cold packs and in some types of concrete mixes. The balanced chemical equation for this reaction is: $\text{Ca} + 2 \text{HNO}_3 \rightarrow \text{Ca}(\text{NO}_3)_2 + \text{H}_2$
- If a chemist reacts 80.0 grams of calcium with 50.0 grams of nitric acid, which is the limiting reactant?
 - Use the limiting reactant to determine the number of grams of calcium nitrate produced.
12. Copper reacts with sulfur to form copper (II) sulfide. $2 \text{Cu (s)} + \text{S (s)} \rightarrow \text{Cu}_2\text{S (s)}$ (Math)
- How many grams of Cu_2S will be produced when 100.0 g of Cu are reacted with excess S?
 - What is the maximum number of grams of Cu_2S that can be formed when 80.0 g of Cu reacts with 25.0 g of S?
13. Explain the difference between empirical formulas and molecular formulas.
14. Which of the following are empirical formulas? If the molecular formula is given, write its empirical formula.
- | | |
|---|--|
| a. Sulfuric acid: H_2SO_4 | d. Disulfur dichloride: S_2Cl_2 |
| b. Sodium peroxide: Na_2O_2 | e. Lauric acid: $\text{C}_{12}\text{H}_{24}\text{O}_2$ |
| c. Glucose: $\text{C}_6\text{H}_{12}\text{O}_6$ | f. Iron oxide (rust): Fe_2O_3 |
15. A compound has an empirical formula of CH_4N . If its molar mass is 60 g, what is the molecular formula?
16. An unknown compound was decomposed into 34.5 g Na, 39.0 g Cr, and 48.0 g O_2 .
- How many moles of each element?
 - What is the ratio of the moles?
 - What is the molecule's empirical formula?
17. The compound methyl butanoate smells like apples. A sample of it was decomposed into 58.8 g of carbon, 4.9 g of hydrogen gas, and 15.7 g of oxygen gas. If its molar mass is 243 g/mol, what is its molecular formula?
18. Honors: A compound is 29.1% Na, 40.5% S, and 30.4% O. What is the empirical formula of the compound?

19. Honors – Explain the difference between theoretical yield and actual yield?

20. Honors - When 84.8 g of iron (III) oxide reacts with an excess of carbon monoxide, then 57.8 g of iron is produced. What is the percent yield for this reaction?



21. Honors – A student reacts benzene, C_6H_6 , with bromine, Br_2 , to prepare bromobenzene, $\text{C}_6\text{H}_5\text{Br}$.
 $\text{C}_6\text{H}_6 + \text{Br}_2 \rightarrow \text{C}_6\text{H}_5\text{Br} + \text{HBr}$

- a. What is the theoretical yield of bromobenzene in this reaction when 30.0 g of benzene reacts with 65.0 g of bromine?
- b. If the actual yield of bromobenzene was 56.7 g, what was the percentage yield?