

Summer Mini-Session 4:

Stoichiometry

Reading Assignments

Modern Chemistry (2006), Chpt. 3 (sect. 3), Chpt. 7 (sects. 3,4), Chpt. 9

Homework/Activities

- Sect. Review (Chpt. 3, Sect. 3) (p.87) #5-7
- Chapter Review (Chpt 3) #17-18, 21-24, 28
- Sect. Review (Chpt. 7, Sect. 3) (p.244) #1-5
- Sect. Review (Chpt. 7, Sect. 4) (p.249) #1-5
- Chapter Review (Chpt 7) #28-33, 36-40, 42-43
- Sect. Review (Chpt. 9, Sect. 2) (p.311) #1-5
- Sect. Review (Chpt. 9, Sect. 3) (p.318) #1-4
- Chapter Review (Chpt. 9) #5-12, 14-15, 22-24, 26-31, 36
- Worksheets: The Mole!, The Mole 2!, Some Stoich Problems

Concepts/Topics

- Avogadro's number: the mole
- Converting moles to particles; particles to moles
- Molar mass; Moles in chemical formulas
- Converting moles to grams; grams to moles (converting grams to particles & vice versa)
- Empirical formulas; molecular formulas; percent composition
- Hydrates
- Limiting reactants; Percent yield

Web Resources

Mass to mole; mole to mass
Mole to mole conversions
Mass to mass stoichiometry
General stoichiometry
Limiting reagent
Percent yields
Online Periodic Table
Empirical Formulas

science.widener.edu/svb/tutorial/atomsmolescsn7.html
science.widener.edu/svb/tutorial/rxnsmolestomolescsn7.html
science.widener.edu/svb/tutorial/rxnsgramstogramscsn7.html
science.widener.edu/svb/tutorial/genstoichiometrycsn7.html
science.widener.edu/svb/tutorial/limitreagentcsn7.html
science.widener.edu/svb/tutorial/percentyieldcsn7.html
www.learnerstv.com/animation/animation.php?ani=184&cat=chemistry
science.widener.edu/svb/tutorial/empiricalformulascsn7.html

Avogadro's Number: the Mole!

Be sure to use the correct number of significant figures, and express your answers in scientific notation when appropriate.

1. How many hydrogen atoms (**H**) are there in 3.0 mol of hydrogen atoms?
2. How many hydrogen molecules (**H₂**) are there in 2.00 mol of hydrogen molecules?
3. How many **H** atoms are there in 2.5 mol of hydrogen *molecules* (be careful!)?
4. How many moles of duck-billed platypi are represented by 2.107×10^{24} platypi?
5. If you have 1.505×10^{23} purple syrples, how many moles of purple syrples do you have?

The Mole 2: Avogadro's Revenge!

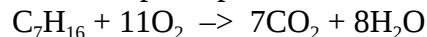
Be sure to use the correct number of significant figures, and express your answers in scientific notation when appropriate.

1. How many grams of sodium chloride are there in 3.00 mol of sodium chloride?
2. What is the mass of 7.50 mol of water?
3. How many moles of sulfuric acid would be in a 25.0 g sample of sulfuric acid?
4. How many moles of calcium phosphate would have a mass of 450. g?
5. If 2.70 mol of a substance has a mass of 182.5 g, what is the molecular weight of that substance?

Some Stoich Problems

Please make sure that you **show all work!** (italics, bold and underlined – get it?) Some problems include points for intermediate steps as well as the final answer. If the intermediate step isn't shown, the points aren't given!

1. The combustion of heptane proceeds according to the balanced equation:



If you burn enough heptane to produce 2.85 mol of water, how many moles of carbon dioxide are produced?

2. You are a forensic consultant called to the scene of The Great Ice Cream Robbery of 2009. A purplish-green unknown substance is found on the knob of the ice cream shop's back door which leads into the alley. You analyze this substance on your North Thurston Super Mass Spectrometer 3000 and find that it is a compound made up of the following elements:

47.3 % carbon

10.6 % hydrogen

42.1 % sulfur

What is the empirical formula of the purplish-green goop you analyzed?

3. Walking out to the North Thurston Forensi-Van with your purplish-green sample, you step in a puddle of orange ooze. Being the ~~complete science nerd~~ well-respected scientist you are, you decide to analyze the orange stuff as well. Popping the orange stuff into the NTHS SMS3000, you find that your orange compound has a molecular weight of 229.58 g/mol and is made up of:

47.1 % carbon

6.6 % hydrogen

46.3 % chlorine

What are the empirical formula and the molecular formula for the orange ooze?

4. What is the percent composition by mass of the compound potassium nitrite (KNO_2)? (Please give percentages to the nearest one tenth of a percent).
5. In the reaction $2\text{BiCl}_3 + 3\text{H}_2\text{S} \rightarrow \text{Bi}_2\text{S}_3 + 6\text{HCl}$ bismuth chloride and hydrogen sulfide undergo a double displacement reaction to form bismuth sulfide and hydrochloric acid. Initially you have 0.56 mol of BiCl_3 and 0.81 mol of H_2S . Which reactant is in excess and how many extra moles of that reactant are left over after the reaction is complete?
6. In a chemical reaction, phosphorus pentachloride and water react to form phosphoric acid and hydrochloric acid. Given initial amounts of 62.47 g of phosphorus pentachloride and 24.32 g of water, determine **a)** which reactant is in excess; **b)** how many grams of that reactant remain after the reaction is complete; **c)** what mass of phosphoric acid *should* be produced; and **d)** what the percent yield is if only 23.0 g of phosphoric acid are produced.
7. A 96.144 g sample of a copper sulfate hydrate is heated over a Bunsen burner. After sufficient heating, the sample is found to contain 71.824 g of copper sulfate (CuSO_4). What is the correct chemical formula for the copper sulfate hydrate before heating?