

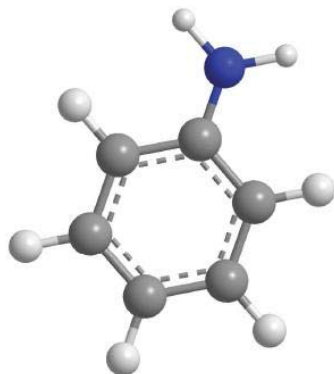
## CHEM 1211 FIRST MONTH

1. Given 15.00 g of each element, calculate the volume of each and then arrange the elements in order of increasing volume. The numbers in parentheses are densities.  
gold (19.32 g/cm<sup>3</sup>)  
lead (11.34 g/cm<sup>3</sup>)  
iron (7.87 g/cm<sup>3</sup>)  
sulfur (2.07 g/cm<sup>3</sup>)
2. Gasoline has a fuel value of 48 kJ/g. How much energy in joules can be obtained by filling an automobile's 16.3 gal tank with gasoline, assuming gasoline has a density of 0.70 g/mL?
3. 8.00 grams (g) of methane are burned in 32.00 g of oxygen. The reaction produces 22.00 g of carbon dioxide and an unmeasured mass of water. What mass of water is produced?
4. A 7.040g sample of calcium sulfate dihydrate  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$  and sand is heated repeatedly in a crucible. After multiple heatings, the mass of the residue in the crucible is 6.363 grams. What is the percent by mass of calcium sulfate dihydrate in the original mixture?

5. Two hydrates were weighed, heated to drive off the waters of hydration, and then cooled. The residues were then reweighed. Based on the following results, what are the formulas of the hydrates?

Compound	Initial Mass (g)	Mass after Cooling (g)
$\text{NiSO}_4 \cdot x\text{H}_2\text{O}$	2.08	1.22
$\text{CoCl}_2 \cdot x\text{H}_2\text{O}$	1.62	0.88

6. How many moles of  $\text{CO}_2$ ,  $\text{H}_2\text{O}$ , and  $\text{N}_2$  will be produced by combustion analysis of 0.0080 mol of aniline?



Aniline

7. Combustion of a 34.8 mg sample of benzaldehyde, which contains only carbon, hydrogen, and oxygen, produced 101 mg of  $\text{CO}_2$  and 17.7 mg of  $\text{H}_2\text{O}$ .
- What was the mass of carbon and hydrogen in the sample?
  - Assuming that the original sample contained only carbon, hydrogen, and oxygen, what was the mass of oxygen in the sample?
  - What was the mass percentage of oxygen in the sample?
  - What is the empirical formula of benzaldehyde?
  - The molar mass of benzaldehyde is 106.12 g/mol. What is its molecular formula?
8. The reaction of propane gas ( $\text{CH}_3\text{CH}_2\text{CH}_3$ ) with chlorine gas ( $\text{Cl}_2$ ) produces two monochloride products:  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$  and  $\text{CH}_3\text{CHClCH}_3$ . The first is obtained in a 43% yield and the second in a 57% yield.
- If you use 2.78 g of propane gas, how much chlorine gas would you need for the reaction to go to completion?
  - How many grams of each product could theoretically be obtained from the reaction starting with 2.78 g of propane?
  - Use the actual percent yield to calculate how many grams of each product would actually be obtained.

9. A student was titrating 25.00 mL of a basic solution with an HCl solution that was 0.281 M. The student ran out of the HCl solution after having added 32.46 mL, so she borrowed an HCl solution that was labeled as 0.317 M. An additional 11.5 mL of the second solution was needed to complete the titration. What was the concentration of the basic solution?