Worksheet 1.6

Supplemental Instruction
Iowa State University

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1.) A piece of aluminum foil 1.00 cm square and 0.550 mm thick is allowed to react with bromine to form aluminum bromide.

a.) How many moles of aluminum were used? (density Al = 2.699 g/cm^3)

$.550\text{mm} \times \frac{1\text{cm}}{10\text{mm}} = .055\text{cm}$

$1\text{cm} \times 1\text{cm} \times .055\text{cm} = .055\text{cm}^3 \times \frac{2.699\text{g}}{\text{cm}^3} = .148445\text{g Al} \times \frac{1\text{mol Al}}{26.98\text{g Al}} = .005502\text{mol Al}$

5.50×10^{-3} mol Al

b.) How many grams of aluminum bromide form, assuming the aluminum reacts completely? What type of reaction is this?

$2Al + 3Br_2 \rightarrow 2AlBr_3$

$5.50 \times 10^{-3}\text{mol Al} \times \frac{2\text{mol AlBr}_3}{2\text{mol Al}} \times \frac{266.69\text{g AlBr}_3}{1\text{mol AlBr}_3} = 1.47\text{g}$

composition reaction

2.) The chemical formula for benzene is C_6H_6.

a. Determine the percent composition of H and C for benzene.

$6(12.01) + 6(1.01) = 78.12$

C: $\frac{72.06}{78.12} \times 100 = 92\%$ H: $100 - 92\% = 8\%$

C: 92%
H: 8%

b. Write a balanced combustion reaction for benzene.

$2C_6H_6 + 15O_2 \rightarrow 12CO_2 + 6H_2O$

c. Assuming you have 364g of benzene, how many moles of O_2 will be required to completely combust this amount of benzene?

$364\text{g} \times \frac{1\text{mol } C_6H_6}{78.12\text{g } C_6H_6} \times \frac{15\text{mol } O_2}{2\text{mol } C_6H_6} = 35.0\text{mol}$

d. How many grams of CO_2 will this produce? How many grams of H_2O?

CO_2: $364\text{g } C_6H_6 \times \frac{1\text{mol } C_6H_6}{78.12\text{g } C_6H_6} \times \frac{12\text{mol } CO_2}{2\text{mol } C_6H_6} \times \frac{44.01\text{g } CO_2}{1\text{mol } CO_2} = 1.23 \times 10^3\text{g } CO_2$

H_2O: $364\text{g } C_6H_6 \times \frac{1\text{mol } C_6H_6}{78.12\text{g } C_6H_6} \times \frac{6\text{mol } H_2O}{2\text{mol } C_6H_6} \times \frac{18\text{g } H_2O}{1\text{mol } H_2O} = 2.52 \times 10^2\text{g } H_2O$

e. You perform the combustion, and 956g of CO_2 are produced. What is the percent yield?

$\frac{\text{Actual}}{\text{Theoretical}} \quad \frac{956\text{g } CO_2}{1230\text{g } CO_2} \times 100 = 77.7\%$