mary jane woody

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Stoichiometry Worksheet 3 – Gram-to-Gram Calculations

Learning Target Students will calculate the theoretical yield in moles and grams

Textbook Section 9.2

Directions: You must solve each of the following problems using dimensional analysis. EVERY number in your work should be followed by a unit and a formula.

1. For this reaction: $Fe_3O_4 + 4\ CO \rightarrow 3\ Fe + 4\ CO_2$

   a. How many grams of iron are produced from 23.2 grams of carbon monoxide?

   $\frac{23.2gCO}{1} \cdot \frac{1\ mole\ CO}{28gCO} \cdot \frac{3\ moles\ Fe}{4\ moles\ CO} \cdot \frac{56gFe}{1\ mole\ Fe} = 34gFe$

   b. How many grams of carbon dioxide are produced to react with 0.945 grams of Fe_3O_4?

   $\frac{0.945g\ Fe_3O_4}{1} \cdot \frac{1\ mole\ Fe_3O_4}{232g\ Fe_3O_4} \cdot \frac{4\ moles\ CO_2}{1\ mole\ Fe_3O_4} = \frac{44g\ CO_2}{1\ mole\ CO_2} = 0.72g\ Fe_3O_4$

2. For this reaction: $6\ PbO + O_2 \rightarrow 2\ Pb_3O_4$

   a. How many grams of Pb_3O_4 are produced from 7.85 grams of lead(II) oxide?

   $\frac{7.85g\ PbO}{1} \cdot \frac{1\ mole\ PbO}{223g\ PbO} \cdot \frac{2\ moles\ Pb_3O_4}{6\ moles\ PbO} \cdot \frac{685g\ Pb_3O_4}{1\ mole\ Pb_3O_4} = 8.04g\ Pb_3O_4$

   b. How many grams of lead(II) oxide must react with 1.75 grams of oxygen?

   $\frac{1.75g\ O_2}{1} \cdot \frac{1\ mole\ O_2}{32g\ O_2} \cdot \frac{6\ moles\ PbO}{1\ mole\ O_2} \cdot \frac{223g\ PbO}{1\ mol\ PbO} = 73g\ PbO$

3. For this reaction: $4\ Al + 3\ O_2 \rightarrow 2\ Al_2O_3$

   a. How many grams of aluminum oxide will be formed from 17 grams of aluminum reacting?

   $\frac{17gAl}{1} \cdot \frac{1\ mole\ Al}{27g\ Al} \cdot \frac{2\ moles\ Al_2O_3}{4\ moles\ Al} \cdot \frac{102g\ Al_2O_3}{1\ mole\ Al_2O_3} = 32g\ Al_2O_3$

   b. How many grams of oxygen are needed to react with 12.8 grams of aluminum?

   $\frac{1.89\ Al}{1} \cdot \frac{1\ mole\ Al}{27g\ Al} \cdot \frac{3\ moles\ O_2}{4\ moles\ Al} \cdot \frac{32g\ O_2}{1\ mole\ O_2} = 11g\ O_2$

4. For this reaction: $4\ NH_3 + 5\ O_2 \rightarrow 4\ NO + 6\ H_2O$

   a. How many grams of oxygen are needed to react with 1.24 grams of NH_3?

   $\frac{1.24g\ NH_3}{1} \cdot \frac{1\ mole\ NH_3}{17g\ NH_3} \cdot \frac{5\ moles\ O_2}{4\ mole\ NH_3} \cdot \frac{32g\ O_2}{1\ mole\ O_2} = 2.9g\ O_2$

   b. How many grams of water are produced from 7.65 grams of oxygen?

   $\frac{7.65g\ O_2}{1} \cdot \frac{1\ mole\ O_2}{32g\ O_2} \cdot \frac{6\ moles\ H_2O}{5\ moles\ O_2} \cdot \frac{18g\ H_2O}{1\ mole\ H_2O} = 5.2g\ H_2O$

1a) 34.7 g iron
1b) 0.718 g carbon dioxide
2a) 8.04 g Pb_3O_4
2b) 73.2 g lead(II) oxide
3a) 32 g aluminum oxide
3b) 11.4 g oxygen
4a) 2.91 g oxygen
4b) 5.17 g water