

See pages 3-5for worked out problems*

1. Given the following equation: $2 \text{C}_4\text{H}_{10} + 13 \text{O}_2 \rightarrow 8 \text{CO}_2 + 10 \text{H}_2\text{O}$, show what the following molar ratios should be.

a. $\text{C}_4\text{H}_{10} / \text{O}_2$ *2/13*

b. O_2 / CO_2 *13/8*

c. $\text{O}_2 / \text{H}_2\text{O}$ *13/10*

d. $\text{C}_4\text{H}_{10} / \text{CO}_2$ *2/8*

e. $\text{C}_4\text{H}_{10} / \text{H}_2\text{O}$ *2/10*

2. Given the following equation: $2 \text{KClO}_3 \rightarrow 2 \text{KCl} + 3 \text{O}_2$

How many moles of O_2 can be produced by letting 12.00 moles of KClO_3 react?

18 mol O_2

3. Given the following equation: $2 \text{K} + \text{Cl}_2 \rightarrow 2 \text{KCl}$

How many grams of KCl is produced: A) from 2.50 g of K and excess Cl_2 . B) From 1.00 g of Cl_2 and excess K ?

4.78 g KCl

2.10 g KCl

4. Given the following equation: $\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2 \text{NaOH}$

How many grams of NaOH is produced from 1.20×10^2 grams of Na_2O ? How many grams of Na_2O are required to produce 1.60×10^2 grams of NaOH ?

124 g Na_2O

154.84 g NaOH

5. Given the following equation: $8 \text{Fe} + \text{S}_8 \rightarrow 8 \text{FeS}$

What mass of iron is needed to react with 16.0 grams of sulfur? How many grams of FeS are produced?

28 g Fe

44 g FeS

6. Given the following equation: $2 \text{NaClO}_3 \rightarrow 2 \text{NaCl} + 3 \text{O}_2$

12.00 moles of NaClO_3 will produce how many grams of O_2 ? How many grams of NaCl are produced when 80.0 grams of O_2 are produced?

↓ 576g O_2

↓ 97.5 g NaCl

7. Given the following equation: $\text{Cu} + 2 \text{AgNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2 \text{Ag}$

How many moles of Cu are needed to react with 3.50 moles of AgNO_3 ? If 89.5 grams of Ag were produced, how many grams of Cu reacted?

↓
1.75 mol Cu

↓
26.3 g Cu

8. Molten iron and carbon monoxide are produced in a blast furnace by the reaction of iron(III) oxide and coke (pure carbon). If 25.0 kilograms of pure Fe_2O_3 is used, how many kilograms of iron can be produced?

The reaction is: $\text{Fe}_2\text{O}_3 + 3 \text{C} \rightarrow 2 \text{Fe} + 3 \text{CO}$

17.5 kg Fe

9. The average human requires 120.0 grams of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) per day. How many grams of CO_2 (in the photosynthesis reaction) are required for this amount of glucose?

The photosynthetic reaction is: $6 \text{CO}_2 + 6 \text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{O}_2$

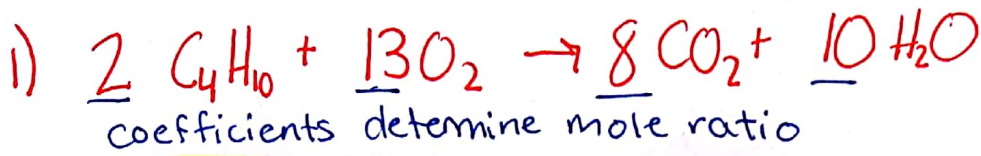
176g CO_2

10. Given the reaction: $4 \text{NH}_3 (\text{g}) + 5 \text{O}_2 (\text{g}) \rightarrow 4 \text{NO} (\text{g}) + 6 \text{H}_2\text{O} (\text{l})$

When 1.20 mole of ammonia reacts, the total number of moles of products formed is:

1.2 mol NO

1.8 mol H_2O



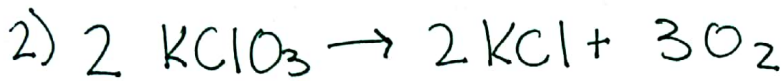
a. $\frac{2 \text{ mol C}_4\text{H}_{10}}{13 \text{ mol O}_2}$

b. $\frac{13 \text{ mol O}_2}{8 \text{ mol CO}_2}$

c. $\frac{13 \text{ mol O}_2}{10 \text{ mol H}_2\text{O}}$

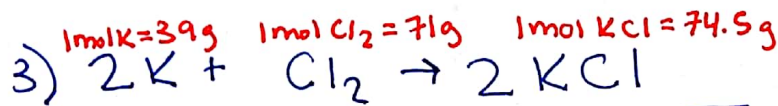
d. $\frac{2 \text{ mol C}_4\text{H}_{10}}{8 \text{ mol CO}_2}$

e. $\frac{2 \text{ mol C}_4\text{H}_{10}}{10 \text{ mol H}_2\text{O}}$



1 step problem $\frac{\text{mole A}}{\text{coefficients}} \rightarrow \text{mole B}$

$\frac{12 \text{ mol KClO}_3}{2 \text{ mol KClO}_3} \times \frac{3 \text{ mol O}_2}{3 \text{ mol O}_2} = \frac{36}{2} = 18 \text{ mol O}_2$

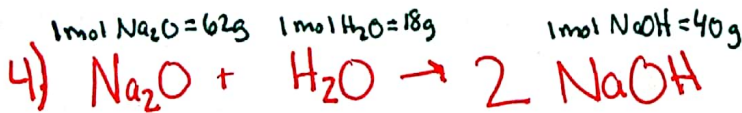


A) 3 step problem $\text{mass A} \rightarrow \text{moles A} \rightarrow \text{moles B} \rightarrow \text{mass B}$

$\frac{2.5 \text{ g K}}{39 \text{ g K}} \times \frac{2 \text{ mol KCl}}{2 \text{ mol K}} \times \frac{74.5 \text{ g KCl}}{74.5 \text{ g KCl}} = \frac{372.5}{78} = 4.78 \text{ g KCl}$

B) also a 3 step problem

$\frac{1.00 \text{ g Cl}_2}{71 \text{ g Cl}_2} \times \frac{2 \text{ mol KCl}}{1 \text{ mol Cl}_2} \times \frac{74.5 \text{ g KCl}}{74.5 \text{ g KCl}} = \frac{149}{71} = 2.10 \text{ g KCl}$

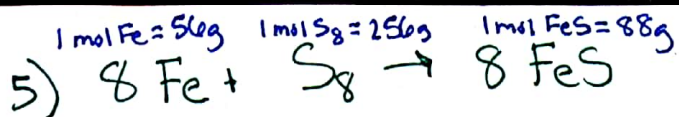


A) 3 step problem ($1.20 \times 10^2 = 120$)

$\frac{120 \text{ g Na}_2\text{O}}{62 \text{ g Na}_2\text{O}} \times \frac{2 \text{ mol NaOH}}{1 \text{ mol Na}_2\text{O}} \times \frac{40 \text{ g NaOH}}{40 \text{ g NaOH}} = \frac{9600}{62} = 154.84 \text{ g NaOH}$

B) 3 step problem ($1.60 \times 10^2 = 160$)

$\frac{160 \text{ g NaOH}}{40 \text{ g NaOH}} \times \frac{1 \text{ mol Na}_2\text{O}}{2 \text{ mol NaOH}} \times \frac{62 \text{ g Na}_2\text{O}}{62 \text{ g Na}_2\text{O}} = \frac{9920}{80} = 124 \text{ g Na}_2\text{O}$

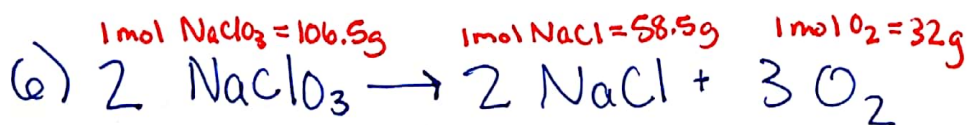


A) 3 step problem

$$\frac{16 \text{ g S}_8}{256 \text{ g S}_8} \times \frac{1 \text{ mol S}_8}{1 \text{ mol S}_8} \times \frac{8 \text{ mol Fe}}{1 \text{ mol S}_8} \times \frac{56 \text{ g Fe}}{1 \text{ mol Fe}} = \frac{7168}{256} = 28 \text{ g Fe}$$

B) 3 step problem

$$\frac{16 \text{ g S}_8}{256 \text{ g S}_8} \times \frac{1 \text{ mol S}_8}{1 \text{ mol S}_8} \times \frac{8 \text{ mol FeS}}{1 \text{ mol S}_8} \times \frac{88 \text{ g FeS}}{1 \text{ mol FeS}} = \frac{11264}{256} = 44 \text{ g FeS}$$

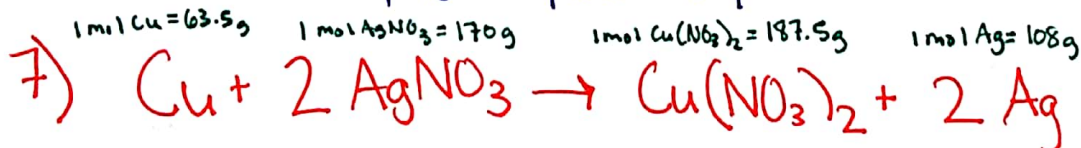


A) 2 step problem mole A \rightarrow mole B \rightarrow mass B

$$\frac{12 \text{ mol NaClO}_3}{2 \text{ mol NaClO}_3} \times \frac{3 \text{ mol O}_2}{1 \text{ mol NaClO}_3} \times \frac{32 \text{ g O}_2}{1 \text{ mol O}_2} = \frac{1152}{2} = 576 \text{ g O}_2$$

B) 3 step problem

$$\frac{80 \text{ g O}_2}{32 \text{ g O}_2} \times \frac{1 \text{ mol O}_2}{1 \text{ mol O}_2} \times \frac{2 \text{ mol NaCl}}{3 \text{ mol O}_2} \times \frac{58.5 \text{ g NaCl}}{1 \text{ mol NaCl}} = \frac{9360}{96} = 97.5 \text{ g NaCl}$$

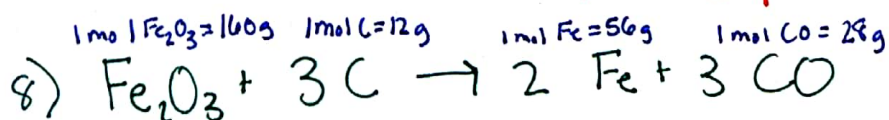


A) 1 step problem mole A \rightarrow mole B

$$\frac{3.5 \text{ mol AgNO}_3}{2 \text{ mol AgNO}_3} \times \frac{1 \text{ mol Cu}}{1 \text{ mol AgNO}_3} = \frac{3.5}{2} = 1.75 \text{ mol Cu}$$

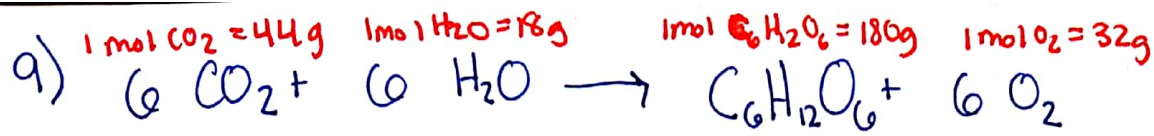
B) 3 step problem

$$\frac{89.5 \text{ g Ag}}{108 \text{ g Ag}} \times \frac{1 \text{ mol Ag}}{1 \text{ mol Ag}} \times \frac{1 \text{ mol Cu}}{2 \text{ mol Ag}} \times \frac{63.5 \text{ g Cu}}{1 \text{ mol Cu}} = \frac{5683.25}{216} = 26.3 \text{ g Cu}$$



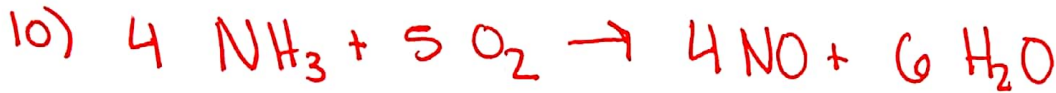
3 step problem (1000 g = 1 kg)

$$\frac{25,000 \text{ g Fe}_2\text{O}_3}{160 \text{ g Fe}_2\text{O}_3} \times \frac{1 \text{ mol Fe}_2\text{O}_3}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{2 \text{ mol Fe}}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{56 \text{ g Fe}}{1 \text{ mol Fe}} = \frac{2800000}{160} = 17500 \text{ g} \rightarrow 17.5 \text{ kg Fe}$$



3 step problem

$$\frac{120.0 \text{ g C}_6\text{H}_{12}\text{O}_6}{180 \text{ g C}_6\text{H}_{12}\text{O}_6} \times \frac{1 \text{ mol C}_6\text{H}_{12}\text{O}_6}{1 \text{ mol C}_6\text{H}_{12}\text{O}_6} \times \frac{6 \text{ mol CO}_2}{1 \text{ mol C}_6\text{H}_{12}\text{O}_6} \times \frac{44 \text{ g}}{1 \text{ mol CO}_2} = \frac{31680}{180} = 176 \text{ g CO}_2$$



all are 1 step problems

$$\frac{1.20 \text{ mol NH}_3}{4 \text{ mol NH}_3} \times \frac{4 \text{ mol NO}}{4 \text{ mol NH}_3} = \frac{4.8}{4} = 1.2 \text{ mol NO}$$

$$\frac{1.20 \text{ mol NH}_3}{4 \text{ mol NH}_3} \times \frac{6 \text{ mol H}_2\text{O}}{4 \text{ mol NH}_3} = \frac{7.2}{4} = 1.8 \text{ mol H}_2\text{O}$$