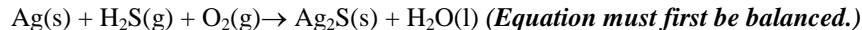
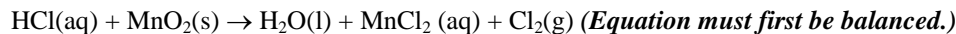


Stoichiometry Worksheet

1. Silver sulfide (Ag_2S) is the common tarnish on silver objects. What weight of silver sulfide can be made from 1.23 mg of hydrogen sulfide (H_2S) obtained from a rotten egg? The reaction of formation of silver sulfide is given below:



2. A somewhat antiquated method for preparing chlorine gas involves heating hydrochloric acid with pyrolusite (manganese dioxide), a common manganese ore. (Reaction given below.) How many kg of HCl react with 5.69 kg of manganese dioxide?



3. 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. $\text{C}_4\text{H}_{10} / \text{O}_2$ b. O_2 / CO_2 c. $\text{O}_2 / \text{H}_2\text{O}$
d. $\text{C}_4\text{H}_{10} / \text{CO}_2$ e. $\text{C}_4\text{H}_{10} / \text{H}_2\text{O}$

4. 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?

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

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

6. 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?

7. 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?

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

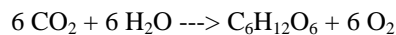
12.00 moles of NaClO_3 will produce how many grams of O_2 ? How many grams of NaCl are produced when 80.0 grams of O_2 are produced?

9. 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?

10. 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: $\text{Fe}_2\text{O}_3 + 3 \text{C} \rightarrow 2 \text{Fe} + 3 \text{CO}$

11. 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:



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

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

- a. 1.20 b. 1.50 c. 1.80 d. 3.00 e. 12.0

$n_{\text{Na}_2\text{O}} = \frac{m}{M} = \frac{1.20 \times 10^2 \text{ g}}{61.98 \text{ g/mol}} = 1.94 \text{ mol}$ $n_{\text{NaOH}} = n_{\text{Na}_2\text{O}} \times 2 = 3.87 \text{ mol}$ $m_{\text{NaOH}} = nM = 3.87 \text{ mol} \times 40.00 \text{ g/mol} = 155 \text{ g}$	$\frac{M_{\text{Na}_2\text{O}}}{2\text{Na} = 45.98 \text{ g/mol}}$ $\frac{1\text{O} = 16.00 \text{ g/mol}}{61.9806 \text{ g/mol}}$	$\frac{M_{\text{NaOH}}}{1\text{Na} = 22.99 \text{ g/mol}}$ $1\text{O} = 16.00 \text{ g/mol}$ $\frac{1\text{H} = 1.01 \text{ g/mol}}{40.00 \text{ g/mol}}$
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How many grams of Na₂O are required to produce 1.60 x 10² grams of NaOH?

$n_{\text{NaOH}} = \frac{m}{M} = \frac{1.60 \times 10^2 \text{ g}}{40.00 \text{ g/mol}} = 4.00 \text{ mol}$ $n_{\text{Na}_2\text{O}} = n_{\text{NaOH}} \times \frac{1}{2} = 2.00 \text{ mol}$ $m_{\text{Na}_2\text{O}} = nM = 2.00 \text{ mol} \times 61.98 \text{ g/mol} = 124 \text{ g}$	<p>See molar masses above</p>
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7. Given the following equation: 8 Fe + S₈ → 8 FeS

What mass of iron is needed to react with 16.0 grams of sulfur?



$$m = ??? \quad m = 16.00 \text{ g}$$

$$n_{\text{S}_8} = \frac{m}{M} = \frac{16.00 \text{ g}}{256.48 \text{ g/mol}} = 0.0624 \text{ mol}$$

$$n_{\text{Fe}} = n_{\text{S}_8} \times 8 = 0.0624 \text{ mol} \times 8 = 0.500 \text{ mol}$$

$$m_{\text{Fe}} = nM = 0.500 \text{ mol} \times 55.85 \text{ g/mol} = 27.9 \text{ g}$$

How many grams of FeS are produced?



$$n = 0.500 \text{ mol} \quad m = ???$$

$n_{\text{Fe}} = 0.500 \text{ mol (from previous calculation)}$ $n_{\text{FeS}} = n_{\text{Fe}} = 0.500 \text{ mol}$ $m_{\text{FeS}} = nM = 0.500 \text{ mol} \times 87.91 \text{ g/mol} = 43.9 \text{ g}$	$\frac{M_{\text{FeS}}}{1\text{Fe} = 55.85 \text{ g/mol}}$ $\frac{1\text{S} = 32.06 \text{ g/mol}}{87.91 \text{ g/mol}}$
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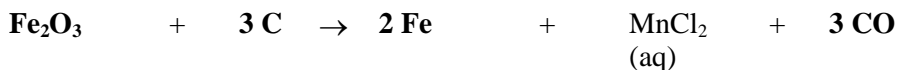
8. Given the following equation: 2 NaClO₃ → 2 NaCl + 3 O₂

12.00 moles of NaClO₃ will produce how many grams of O₂?



$$n = 12.00 \text{ mol} \quad m = ???$$

10. 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 Fe₂O₃ is used, how many kilograms of iron can be produced? The reaction is: Fe₂O₃ + 3 C → 2 Fe + 3 CO



$$m = 25.0 \text{ kg} \qquad m \text{ (kg)} = \text{???}$$

Note that since you are asked for the mass in kg and given the mass in kg, then you don't need to convert to grams. Just keep the "k" and cancel out everything you can, and the answer will turn out in kg.

$$n_{\text{Fe}_2\text{O}_3} = \frac{m}{M} = \frac{25.0 \text{ kg}}{159.69 \text{ g/mol}} = 0.156 \text{ kmol}$$

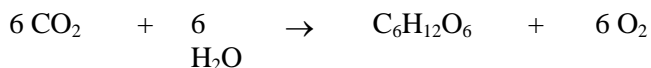
(Note only the "g"'s cancel; left with kmol)

$$n_{\text{Fe}} = n_{\text{Fe}_2\text{O}_3} \times 2 = 0.156 \text{ kmol} \times 2 = 0.312 \text{ kmol}$$

$$m_{\text{Fe}} = nM = 0.312 \text{ kmol} \times 55.85 \text{ g/mol} = 17.5 \text{ kg}$$

(Note only the "mol" cancels; left with "kg")

11. The average human requires 120.0 grams of glucose (C₆H₁₂O₆) per day. How many grams of CO₂ (in the photosynthesis reaction) are required for this amount of glucose? The photosynthetic reaction is: 6 CO₂ + 6 H₂O → C₆H₁₂O₆ + 6 O₂



$$m = \text{???} \qquad m = 120.0$$

$n_{\text{C}_6\text{H}_{12}\text{O}_6} = \frac{m}{M} = \frac{120.0 \text{ g}}{180.18 \text{ g/mol}} = 0.6660 \text{ mol}$	$\frac{M_{\text{C}_6\text{H}_{12}\text{O}_6}}{6\text{C}} = 72.06 \text{ g/mol}$	$\frac{M_{\text{CO}_2}}{\text{C}} = 12.01 \text{ g/mol}$
$n_{\text{CO}_2} = n_{\text{C}_6\text{H}_{12}\text{O}_6} \times \frac{6}{1} = 0.6660 \text{ mol} \times \frac{6}{1} = 3.996 \text{ mol}$	$12\text{H} = 12.12 \text{ g/mol}$	$2\text{O} = 32.00 \text{ g/mol}$
$m_{\text{CO}_2} = nM = 3.996 \text{ mol} \times 44.01 \text{ g/mol} = 175.9 \text{ g}$	$6\text{O} = 96.00 \text{ g/mol}$	<u>44.01 g/mol</u>
	<u>180.18 g/mol</u>	

12. Given the reaction: 4 NH₃ (g) + 5 O₂ (g) → 4 NO (g) + 6 H₂O (l)

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

- a. 1.20 b. 1.50 c. 1.80 d. 3.00 e. 12.0

The correct answer is d.

$$\text{NH}_3 / (\text{NO} + \text{H}_2\text{O}) = 4 / 10$$

$$4 / 10 = 1.20 / x \quad x = 3.00 \text{ mol}$$