

PRACTICE PROBLEMS: MOLE RATIOS (CONVERSIONS) FROM BALANCED EQUATIONS.

For each word equation below, write a balanced equation then write a conversion factor for the change requested.

1. Potassium + Sodium Sulfide → Potassium Sulfide + Sodium



- a. Write a conversion factor for changing moles of potassium to moles of potassium sulfide.

$$\frac{1 \text{ mol } K_2S}{2 \text{ mol } K}$$

- b. Write a conversion factor for changing moles of sodium sulfide to potassium.

$$\frac{2 \text{ mol } K}{1 \text{ mol } Na_2S}$$

2. Ammonium Nitrate + Magnesium Oxide → Magnesium Nitrate + Ammonium Oxide



- a. Write a conversion factor for changing moles of magnesium nitrate to moles of magnesium oxide.

$$\frac{1 \text{ mol } MgO}{1 \text{ mol } Mg(NO_3)_2}$$

- b. Write a conversion factor for changing moles of ammonium nitrate to magnesium nitrate

$$\frac{1 \text{ mol } Mg(NO_3)_2}{2 \text{ mol } NH_4NO_3}$$

3. Hydrogen + Oxygen → Water



- a. What is the conversion factor used to change from moles of oxygen to moles of water?

$$\frac{2 \text{ mol } H_2O}{1 \text{ mol } O_2}$$

- b. What is the conversion factor used to change from moles hydrogen to moles of oxygen?

$$\frac{1 \text{ mol } O_2}{2 \text{ mol } H_2}$$

4. Lithium Carbonate + Sodium Chloride \rightarrow Sodium Carbonate + Lithium Chloride



- a. Write a conversion factor used to change from moles of sodium chloride to moles of sodium carbonate.

$$\frac{1 \text{ mol Na}_2\text{CO}_3}{2 \text{ mol NaCl}}$$

- b. Write a conversion factor used to change from moles of lithium carbonate to moles of sodium carbonate.

$$\frac{1 \text{ mol Na}_2\text{CO}_3}{1 \text{ mol Li}_2\text{CO}_3}$$

5. Aluminum Oxide \rightarrow Aluminum and Oxygen



- a. Write a conversion factor used to change from moles of aluminum oxide to moles of aluminum.

$$\frac{4 \text{ mol Al}}{2 \text{ mol Al}_2\text{O}_3}$$

- b. Write a conversion factor used to change from moles of oxygen to moles of aluminum oxide.

$$\frac{2 \text{ mol Al}_2\text{O}_3}{3 \text{ mol O}_2}$$

STOICHIOMETRY PROBLEMS

Lead (IV) sulfate + Lithium Chloride → Lithium Sulfate + Lead (IV) Chloride

1. Write a symbol equation.
2. Balance the equation.



3. According to the balance equation, how many moles of lead sulfate are needed to react with 2 moles of lithium chloride?

$$2 \text{ mol LiCl} \left| \frac{1 \text{ mol Pb}(\text{SO}_4)_2}{4 \text{ mol LiCl}} \right. = 0.5 \text{ mol Pb}(\text{SO}_4)_2$$

4. How many moles of lead chloride will be produced if I have 1 mole of lead sulfate to react?

$$1 \text{ mol Pb}(\text{SO}_4)_2 \left| \frac{1 \text{ mol PbCl}_4}{1 \text{ mol Pb}(\text{SO}_4)_2} \right. = 1 \text{ mol PbCl}_4$$

5. How many moles of lithium sulfate will form if I have 0.67 moles of lithium chloride?

$$0.67 \text{ mol LiCl} \left| \frac{2 \text{ mol Li}_2\text{SO}_4}{4 \text{ mol LiCl}} \right. = 0.335 \text{ mol Li}_2\text{SO}_4$$

Aluminum + hydrogen sulfate → aluminum sulfate + hydrogen gas

1. Write the symbol equation.
2. Balance the equation.



3. How many moles of aluminum will react with 3 moles of hydrogen sulfate?

$$3 \text{ mol H}_2\text{SO}_4 \left| \frac{2 \text{ mol Al}}{3 \text{ mol H}_2\text{SO}_4} \right. = 2 \text{ mol Al}$$

4. How many moles of aluminum sulfate will form when I react 0.87 moles of hydrogen sulfate?

$$0.87 \text{ mol H}_2\text{SO}_4 \left| \frac{2 \text{ mol Al}}{3 \text{ mol H}_2\text{SO}_4} \right. = 0.58 \text{ mol Al}$$

5. How many moles of hydrogen do I have, if I have 1.22 moles of aluminum?

$$1.22 \text{ mol Al} \left| \frac{3 \text{ mol H}_2}{2 \text{ mol Al}} \right. = 1.83 \text{ mol H}_2$$

PRACTICE PROBLEMS: MOLE-MOLE STOICHIOMETRY

Write balanced equations from the following word equations, then convert as requested.

1. Iron (III) Nitrate + Copper (I) Hydroxide → Iron (III) Hydroxide + Copper (I) Nitrate



- a. How many moles of iron hydroxide can be produced from 2.6 moles of copper hydroxide? (0.87)

$$2.6 \text{ mol CuOH} \left| \frac{1 \text{ mol Fe}(\text{OH})_3}{3 \text{ mol CuOH}} \right. = 0.87 \text{ mol Fe}(\text{OH})_3$$

- b. How many moles of iron nitrate are needed to react with 0.5 moles of copper hydroxide? (0.17)

$$0.5 \text{ mol CuOH} \left| \frac{1 \text{ mol Fe}(\text{NO}_3)_3}{3 \text{ mol CuOH}} \right. = 0.17 \text{ mol Fe}(\text{NO}_3)_3$$

2. Barium Oxide + Silver Nitrate → Silver Oxide + Barium Nitrate



- a. How many moles of silver oxide are produced if 3.5 moles of silver nitrate are used? (1.75)

$$3.5 \text{ mol AgNO}_3 \left| \frac{1 \text{ mol Ag}_2\text{O}}{2 \text{ mol AgNO}_3} \right. = 1.75 \text{ mol Ag}_2\text{O}$$

- b. How many moles of barium nitrate are produced if 1.7 moles of silver oxide are also produced? (1.7)

$$1.7 \text{ mol Ag}_2\text{O} \left| \frac{1 \text{ mol Ba}(\text{NO}_3)_2}{1 \text{ mol Ag}_2\text{O}} \right. = 1.7 \text{ mol Ba}(\text{NO}_3)_2$$

3. Ammonium Phosphate + Barium Chloride → Ammonium Chloride + Barium Phosphate



- a. How many moles of barium chloride will react with 5 moles of ammonium phosphate? (7.5)

$$5 \text{ mol } (\text{NH}_4)_3\text{PO}_4 \left| \frac{3 \text{ mol BaCl}_2}{2 \text{ mol } (\text{NH}_4)_3\text{PO}_4} \right. = 7.5 \text{ mol BaCl}_2$$

- b. How many moles of ammonium chloride are produced from 7.5 moles of ammonium phosphate?

$$7.5 \text{ mol } (\text{NH}_4)_3\text{PO}_4 \left| \frac{6 \text{ mol NH}_4\text{Cl}}{2 \text{ mol } (\text{NH}_4)_3\text{PO}_4} \right. = 22.5 \text{ mol NH}_4\text{Cl}$$

4. Lithium + Strontium Sulfide → Lithium Sulfide + Strontium



a. How many moles of strontium are produced when 2.5 moles of lithium are reacted?

$$2.5 \text{ mol Li} \left| \frac{1 \text{ mol Sr}}{2 \text{ mol Li}} \right. = 1.25 \text{ mol Sr}$$

b. How many moles of strontium are reacted when 0.57 moles of strontium sulfide are used up?

$$0.5 \text{ mol SrS} \left| \frac{1 \text{ mol Sr}}{1 \text{ mol SrS}} \right. = 0.5 \text{ mol SrS}$$

5. Methane (CH₄) + Oxygen → Carbon Dioxide and Water



a. How many moles of water are produced from burning 2 moles of methane?

$$2 \text{ mol CH}_4 \left| \frac{2 \text{ mol H}_2\text{O}}{1 \text{ mol CH}_4} \right. = 4 \text{ mol H}_2\text{O}$$

b. How many moles of methane are consumed to produce 10 moles of oxygen?

$$10 \text{ mol O}_2 \left| \frac{1 \text{ mol CH}_4}{2 \text{ mol O}_2} \right. = 5 \text{ mol CH}_4$$

6. Ammonia (NH₃) → Nitrogen + Hydrogen

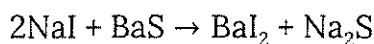


a. What quantity (in moles) of hydrogen is released when 4.1 moles of ammonia decomposes?

$$4.1 \text{ mol NH}_3 \left| \frac{3 \text{ mol H}_2}{2 \text{ mol NH}_3} \right. = 6.15 \text{ mol H}_2$$

Even More Stoichiometry Problems

Use this balanced equation for questions 1 to 3:



1. If I have 0.893 moles of BaI_2 , how many grams of sodium iodide can I produce?

$$0.893 \text{ mol BaI}_2 \left| \frac{2 \text{ mol NaI}}{1 \text{ mol BaI}_2} \right| \frac{149.89 \text{ g NaI}}{1 \text{ mol NaI}} = 267.7 \text{ g NaI}$$

2. Calculate how many moles of barium sulfide I need, if I have 177 grams of sodium iodide.

$$177 \text{ g NaI} \left| \frac{1 \text{ mol NaI}}{149.89 \text{ g NaI}} \right| \frac{1 \text{ mol BaS}}{2 \text{ mol NaI}} = 0.59 \text{ mol BaS}$$

3. If 19 grams of barium iodide is produced, how many moles of sodium sulfide are also produced.

$$19 \text{ g BaI}_2 \left| \frac{1 \text{ mol BaI}_2}{391.13 \text{ g}} \right| \frac{1 \text{ mol Na}_2\text{S}}{1 \text{ mol BaI}_2} = 0.049 \text{ mol Na}_2\text{S}$$

Use this unbalanced equation for questions 4 to 7:



4. Calculate the grams of gallium sulfide produced from 19 grams of sulfur. (46)

$$19 \text{ g S} \left| \frac{1 \text{ mol S}}{32.07 \text{ g S}} \right| \frac{1 \text{ mol Ga}_2\text{S}_3}{3 \text{ mol S}} \left| \frac{235.71 \text{ g}}{1 \text{ mol Ga}_2\text{S}_3} \right| = 46 \text{ g Ga}_2\text{S}_3$$

5. Determine the grams of sulfur needed to produce 125 grams of gallium sulfide. (51)

$$125 \text{ g Ga}_2\text{S}_3 \left| \frac{1 \text{ mol Ga}_2\text{S}_3}{235.71 \text{ g Ga}_2\text{S}_3} \right| \frac{3 \text{ mol S}}{1 \text{ mol Ga}_2\text{S}_3} \left| \frac{32.07 \text{ g S}}{1 \text{ mol S}} \right| = 51 \text{ g S}$$

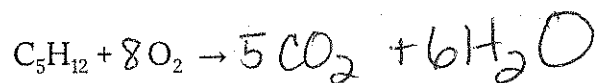
6. How many grams of sulfur are needed to react with 1.33 moles of gallium?
(64)

$$1.33 \text{ mol Ga} \left| \frac{3 \text{ mol S}}{2 \text{ mol Ga}} \right| \frac{32.07 \text{ g S}}{1 \text{ mol S}} = 64 \text{ g S}$$

7. What amount (in grams) of gallium sulfide is produced if 1.77 moles of gallium is used? (208)

$$1.77 \text{ mol Ga} \left| \frac{1 \text{ mol Ga}_2\text{S}_3}{2 \text{ mol Ga}} \right| \frac{235.71 \text{ g Ga}_2\text{S}_3}{1 \text{ mol Ga}_2\text{S}_3} = 208.6 \text{ g}$$

Predict the products and balance the equation then use for questions #8-10



8. Calculate the moles of carbon dioxide formed from 32 moles of oxygen.

$$32 \text{ mol O}_2 \left| \frac{5 \text{ mol CO}_2}{8 \text{ mol O}_2} \right| = 20 \text{ mol CO}_2$$

9. Determine the number of water molecules formed when 124 grams of C_5H_{12} are burned.

$$124 \text{ g C}_5\text{H}_{12} \left| \frac{1 \text{ mol C}_5\text{H}_{12}}{72.05 \text{ g C}_5\text{H}_{12}} \right| \frac{6 \text{ mol H}_2\text{O}}{1 \text{ mol C}_5\text{H}_{12}} \left| \frac{6.02 \times 10^{23}}{1 \text{ mol}} \right| =$$

10. How many grams of oxygen are needed to burn 36 grams of pentane?

$$36 \text{ g C}_5\text{H}_{12} \left| \frac{1 \text{ mol C}_5\text{H}_{12}}{72.05 \text{ g C}_5\text{H}_{12}} \right| \frac{8 \text{ mol O}_2}{1 \text{ mol C}_5\text{H}_{12}} \left| \frac{32 \text{ g O}_2}{1 \text{ mol O}_2} \right| = 127.9 \text{ g}$$

PRACTICE PROBLEMS: MORE COMPLEX STOICHIOMETRY

1. Potassium chlorate decomposes to form potassium chloride and oxygen.

a. What mass of oxygen gas forms, when 49.89 grams of potassium chlorate decomposes to form potassium chloride and oxygen gas?

2. Nitrogen and hydrogen gas combined to form ammonia (NH_3).

a. What mass of ammonia is formed when 7.5 moles of nitrogen gas reacts with hydrogen gas?

3. Propane (C_3H_8) burns in the presence of oxygen to form carbon dioxide and water.

a. What mass of water is produced when 35 grams of propane is burned?

4. Lead (II) Sulfate reacts with lithium chloride to produce lithium sulfate and lead (II) chloride.

a. What mass of lithium chloride is used to produce 5 moles of lithium sulfate?

5. Aluminum reacts with sulfuric acid (H_2SO_4) to produce aluminum sulfate and hydrogen gas.

a. How much aluminum is consumed when mixed with 75 grams of sulfuric acid?