

**Quantitative Chemistry 1  
Worksheet**

- 1) How many moles of acetic acid,  $\text{CH}_3\text{COOH}$ , are contained within 24.71 g of acetic acid?
- 2) How many moles of sodium carbonate,  $\text{Na}_2\text{CO}_3$ , are contained by 57.3 g of sodium carbonate?
- 3) How many moles of sulfuric acid,  $\text{H}_2\text{SO}_4$ , are contained by 157 g of sulfuric acid?
- 4) How many grams of  $\text{NaOH}$  are contained within 0.785 moles of  $\text{NaOH}$ ?
- 5) How many grams of  $\text{C}_6\text{H}_6$  are present in 12.70 moles of  $\text{C}_6\text{H}_6$ ?
- 6) How many grams of  $\text{CCl}_4$  are present in 2.67 moles of  $\text{CCl}_4$ ?
- 7) How many carbon atoms are contained in 84.3 g of ethyne ( $\text{C}_2\text{H}_2$ )?
- 8) How many ethyne molecules are contained in 84.3 g of ethyne ( $\text{C}_2\text{H}_2$ )?
- 9)  $\text{C}_2\text{H}_4$  reacts with  $\text{O}_2$  to form  $\text{CO}_2$  and water.
  - a. Make a particulate drawing which shows that atoms are conserved during this reaction.
  - b. Use your drawing to explain why all atoms were conserved during this reaction.
  - c. Use your drawing to explain how the law of conservation of mass applies to this reaction.
- 10) How many moles of hydrogen gas can be produced if 0.57 moles of hydrochloric acid reacts with excess solid zinc according to the following chemical equation?
$$2 \text{HCl} + \text{Zn} \rightarrow \text{H}_2 + \text{ZnCl}_2$$
- 11) Nitrogen gas will react with hydrogen gas to produce ammonia. How many moles of hydrogen gas are required to produce 0.86 moles of  $\text{NH}_3$ ?
- 12)  $\text{N}_2\text{O}_5$  reacts with water to produce nitric acid. If 1.93 moles of  $\text{N}_2\text{O}_5$  react with excess water, how many moles of nitric acid can be produced?
- 13) Suppose 1.65 moles of  $\text{C}_6\text{H}_6$  react with excess oxygen to produce carbon dioxide and water.
  - a. How many moles of carbon dioxide will be produced in this reaction?
  - b. How many moles of water will be produced in this reaction?
  - c. How many moles of oxygen gas will be consumed during the reaction?

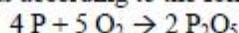
- 14) How many grams of lithium are needed to produce 45.0 g of lithium nitride, according to the following process?



- 15) A 14.5 g sample of sodium chloride reacts with excess fluorine gas according to the following chemical equation.



- How many grams of sodium fluoride are produced?
  - How many grams of chlorine gas are produced?
- 16) What mass of  $\text{P}_2\text{O}_5$  can be produced when a 172.1 g sample of phosphorus reacts with an excess of oxygen gas according to the following chemical equation.



- 17) Determine the mass of lithium hydroxide that is produced when 12.87 g of lithium nitride reacts with an excess of water according to the following process.



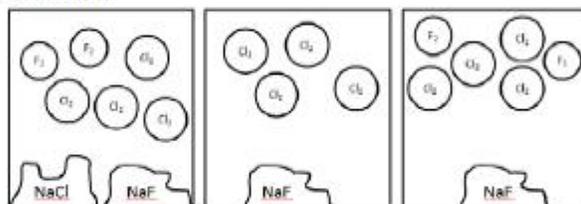
- 18) Suppose 31.4 g of antimony (III) oxide reacts with excess carbon according to the following process.



- What mass of antimony will be produced?
  - What mass of CO will be produced?
  - What mass of carbon is consumed during the reaction?
- 19) A 24.5 g sample of sodium chloride reacts with 41.3 g of fluorine gas according to the following chemical equation.



- What is the limiting reactant? Justify your answer.
- How many grams of chlorine gas are produced?
- Which particulate representation could be used to describe the species present in the reaction vessel after the process has gone to completion? Justify your answer.



(A)

(B)

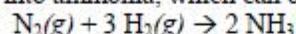
(C)

- 20) A 84.1 gram sample of phosphorus reacts with 85.0 g of oxygen gas according to the following chemical equation.



- Find the limiting reactant? Justify your answer.
- How many grams of  $\text{P}_2\text{O}_5$  are produced in theory?
- If only 123 g of  $\text{P}_2\text{O}_5$  are produced, what is the percentage yield?

- 21) Most nitrogen exists in a gaseous state. Plants require a soluble form of nitrogen so they can absorb it from the ground. Ammonia is a good fertilizer, as the mass percent of nitrogen in ammonia is very high. The following reaction is used to convert gaseous nitrogen into ammonia, which can be used as fertilizer.



Suppose 186.3 g of  $\text{N}_2(\text{g})$  react with 289.8 g of  $\text{H}_2(\text{g})$ .

- Which reactant is limiting? Justify your answer.
  - What mass of ammonia can be produced in theory?
  - If this reaction is known to have a 73.8% yield, what mass of ammonia could you expect to produce?
- 22) A 5.75 g sample of silicon dioxide reacts with 5.50 g of sodium hydroxide according to the following chemical equation.
- $$\text{SiO}_2(\text{s}) + 2 \text{NaOH}(\text{aq}) \rightarrow \text{Na}_2\text{SiO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l})$$
- What is the limiting reactant? Justify your answer.
  - How many grams of  $\text{Na}_2\text{SiO}_3(\text{aq})$  are produced?
  - What is the % yield if only 7.24 g  $\text{Na}_2\text{SiO}_3(\text{aq})$  are produced.
- 23) The reaction between phosphorus and liquid bromine is outlined below.
- $$2 \text{P}(\text{s}) + 3 \text{Br}_2(\text{l}) \rightarrow 2 \text{PBr}_3(\text{l})$$
- Identify the limiting reactant when 5.78 g of phosphorus react with 27.9 g of liquid bromine. Justify your answer.
  - Based on your answer from part (I), determine the maximum mass of  $\text{PBr}_3$  that can be produced in this reaction.
  - If the actual yield of  $\text{PBr}_3$  is found to be 22.3 g, find the percent yield in this reaction.
- 24) The reaction between dihydrogen sulfide and sulfur dioxide is outlined below.
- $$2 \text{H}_2\text{S}(\text{g}) + \text{SO}_2(\text{g}) \rightarrow 3 \text{S}(\text{s}) + 2 \text{H}_2\text{O}(\text{g})$$
- Identify the limiting reactant when 3.89 g of dihydrogen sulfide react with 4.11 g of sulfur dioxide. Justify your answer.
  - Based on your answer from part (I), determine the maximum mass of sulfur that can be produced in this reaction.
  - If the actual yield of sulfur is found to be 4.89 g, find the percent yield in this reaction.