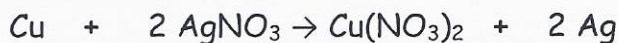


## Stoichiometry Class Worksheet

1. According to the equation below, adding copper (Cu) to silver nitrate (AgNO<sub>3</sub>) allows a chemical reaction to occur that produces silver (Ag) and copper nitrate (Cu(NO<sub>3</sub>)<sub>2</sub>).



A- You need 2.0 g of silver (Ag) for an experiment. What mass of the silver nitrate will you require to obtain the 2.0 g of silver that you need?

G

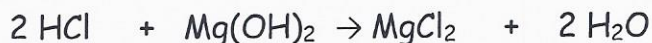
$$2.0 \text{ g Ag} \times \frac{1 \text{ mol Ag}}{107.87 \text{ g Ag}} \times \frac{2 \text{ mol AgNO}_3}{2 \text{ mol Ag}} \times \frac{169.88 \text{ g AgNO}_3}{1 \text{ mol AgNO}_3} = 3.1 \text{ g AgNO}_3$$

B- You need 2.0 g of silver (Ag) for an experiment. How many moles of the Cu will you require to obtain the 2.0 g of silver that you need?

G

$$2.0 \text{ g Ag} \times \frac{1 \text{ mol Ag}}{107.87 \text{ g Ag}} \times \frac{1 \text{ mol Cu}}{2 \text{ mol Ag}} = 0.0093 \text{ mol Cu}$$

2. To neutralize hydrochloric acid (HCl), magnesium hydroxide (Mg(OH)<sub>2</sub>), a base is added. The neutralization reaction is represented by the following equation:



A- You have 4.0 moles of HCl, what mass of Mg(OH)<sub>2</sub> is required to neutralize the 4.0 moles of HCl?

G

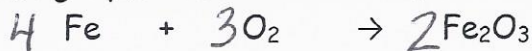
$$4.0 \text{ mol HCl} \times \frac{1 \text{ mol Mg(OH)}_2}{2 \text{ mol HCl}} \times \frac{58.33 \text{ g Mg(OH)}_2}{1 \text{ mol Mg(OH)}_2} = 120 \text{ g Mg(OH)}_2$$

B- You have 4.0 moles of HCl, how many moles of Mg(OH)<sub>2</sub> is required to neutralize the 4 moles of HCl?

G

$$4.0 \text{ mol HCl} \times \frac{2 \text{ mol H}_2\text{O}}{2 \text{ mol HCl}} = 4.0 \text{ mol H}_2\text{O}$$

3. The following equation describes how iron oxide,  $\text{Fe}_2\text{O}_3$ , is produced.



How much  $\text{Fe}_2\text{O}_3$  is formed by the complete oxidation of 448 g of iron?

G

$$448 \text{ g Fe} \times \frac{1 \text{ mol Fe}}{55.85 \text{ g Fe}} \times \frac{2 \text{ mol Fe}_2\text{O}_3}{4 \text{ mol Fe}} \times \frac{159.70 \text{ g Fe}_2\text{O}_3}{1 \text{ mol Fe}_2\text{O}_3} = 641 \text{ g Fe}_2\text{O}_3$$

4. How many moles of ammonia ( $\text{NH}_3$ ) are needed to obtain 7.00 g of copper (Cu)?



G

$$7.00 \text{ g Cu} \times \frac{1 \text{ mol Cu}}{63.55 \text{ g Cu}} \times \frac{2 \text{ mol NH}_3}{3 \text{ mol Cu}} = 0.0734 \text{ mol NH}_3$$

5. According to the equation below, adding copper (Cu) to silver nitrate ( $\text{AgNO}_3$ ) allows a chemical reaction to occur that produces silver (Ag) and copper nitrate ( $\text{Cu}(\text{NO}_3)_2$ ).



A- If  $3.33 \times 10^7$  molecules of Cu are available, how many moles of silver nitrate  $\text{AgNO}_3$  would react with it?

G

$$3.33 \times 10^7 \text{ molecules Cu} \times \frac{1 \text{ mol Cu}}{(6.02 \times 10^{23} \text{ molecules})} \times \frac{2 \text{ mol AgNO}_3}{1 \text{ mol Cu}} = 1.11 \times 10^{-6} \text{ mol AgNO}_3$$

B- If 400.0 g of copper nitrate  $\text{Cu}(\text{NO}_3)_2$  was produced, how many Cu atoms must have reacted with the copper nitrate?

G

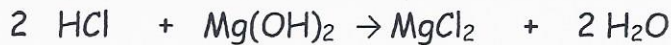
$$400.0 \text{ g Cu}(\text{NO}_3)_2 \times \frac{1 \text{ mol Cu}(\text{NO}_3)_2}{187.50 \text{ g Cu}(\text{NO}_3)_2} \times \frac{1 \text{ mol Cu}}{1 \text{ mol Cu}(\text{NO}_3)_2} \times \frac{6.02 \times 10^{23} \text{ Cu atoms}}{1 \text{ mol Cu}} = 1.284 \times 10^{24} \text{ Cu atoms}$$

C- If  $7.5 \times 10^4$  Ag atoms are available, how many moles of silver nitrate  $\text{AgNO}_3$  would react with it?

G

$$7.5 \times 10^4 \text{ Ag atoms} \times \frac{1 \text{ mol Ag}}{(6.02 \times 10^{23}) \text{ Ag atoms}} \times \frac{2 \text{ mol AgNO}_3}{2 \text{ mol Ag}} = 1.2 \times 10^{-19} \text{ mol AgNO}_3$$

6. Use the equation below to solve questions A and B



A- If 700.0 g of water was produced, how many molecules of magnesium chloride ( $\text{MgCl}_2$ ) must have reacted with the oxygen?

G

$$700.0 \text{g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18.02 \text{g H}_2\text{O}} \times \frac{1 \text{ mol MgCl}_2}{2 \text{ mol H}_2\text{O}} \times \frac{6.02 \times 10^{23} \text{ molecules MgCl}_2}{1 \text{ mol MgCl}_2} = 1.69 \times 10^{25} \text{ molecules MgCl}_2$$

B- If  $3.3 \times 10^9$  molecules of HCl are available, how many moles of water react with it?

G

$$3.3 \times 10^9 \text{ molecules HCl} \times \frac{1 \text{ mol HCl}}{(6.02 \times 10^{23}) \text{ molecules HCl}} \times \frac{2 \text{ mol H}_2\text{O}}{2 \text{ mol HCl}} = 5.5 \times 10^{-15} \text{ mol H}_2\text{O}$$

### Mole and stoichiometry combination question

7. 200.0 mL of NaI whose concentration is 2.0 M are reacted with  $\text{Pb(NO}_3)_2$  in order to obtain the precipitate  $\text{PbI}_2$ . Calculate the mass of  $\text{PbI}_2$  obtained.

$n = CV$   
 $\frac{2.0 \text{ mol}}{\text{L}} \times 0.2000 \text{ L} = 0.4 \text{ mol}$   
 = given

$$2 \text{ NaI} + \text{Pb(NO}_3)_2 \rightarrow \text{PbI}_2 + 2 \text{ Na(NO}_3)$$

$$0.4 \text{ mol NaI} \times \frac{1 \text{ mol PbI}_2}{2 \text{ mol NaI}} \times \frac{461.00 \text{ g PbI}_2}{1 \text{ mol PbI}_2} = 92 \text{ g PbI}_2$$

8. 75 mL of  $\text{BaCl}_2$  is used to produce  $\text{BaCrO}_4$ . If 4.81 g of  $\text{BaCrO}_4$  is made, what is the concentration of the  $\text{BaCl}_2$  used? The following equation represents the reaction:

G

$$\text{K}_2\text{CrO}_4(\text{aq}) + \text{BaCl}_2(\text{aq}) \rightarrow \text{BaCrO}_4(\text{s}) + 2 \text{KCl}(\text{aq})$$

$$4.81 \text{g BaCrO}_4 \times \frac{1 \text{ mol BaCrO}_4}{253.33 \text{g BaCrO}_4} \times \frac{1 \text{ mol BaCl}_2}{1 \text{ mol BaCrO}_4} = \frac{0.018987092 \text{ mol}}{0.075 \text{ L}} = 0.25 \frac{\text{mol}}{\text{L}}$$

9. How many mL of a 6.0M solution of HCl are needed to react with 4.85g of  $\text{NaHCO}_3$ ? The equation that represents the reaction follows.



G

$$4.85 \text{g NaHCO}_3 \times \frac{1 \text{ mol NaHCO}_3}{84.01 \text{g NaHCO}_3} \times \frac{1 \text{ mol HCl}}{1 \text{ mol NaHCO}_3} = 0.057731222 \text{ mol HCl}$$

$$\frac{6 \text{ mol}}{\text{L}} = \frac{0.0577}{x}$$

$$= 9.6 \text{ mL}$$