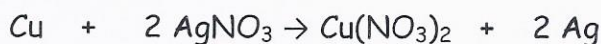


## Stoichiometry Class Problems #2

1. 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- Molecules to grams (Steps 1-4)

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

$$3.33 \times 10^7 \text{ molecules Cu} \times \frac{1 \text{ mol Cu}}{(6.02 \times 10^{23} \text{ molecules Cu})} \times \frac{2 \text{ mol AgNO}_3}{1 \text{ mol Cu}} \times \frac{169.88 \text{ g AgNO}_3}{1 \text{ mol AgNO}_3} = 1.88 \times 10^{-4} \text{ g AgNO}_3$$

### B- Grams to atoms (Steps 1-4)

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?

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

### C- Atoms to moles (Steps 1-3)

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

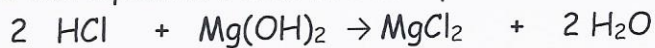
$$7.5 \times 10^4 \text{ Ag atoms} \times \frac{1 \text{ mol Ag}}{(6.02 \times 10^{23} \text{ Ag atoms})} \times \frac{2 \text{ mol AgNO}_3}{2 \text{ mol Ag}} = 1.2 \times 10^{-19} \text{ mol AgNO}_3$$

### D- Moles to molecules (steps 1, 3 and 4)

If 3.0 moles of Cu were used in the reaction, how many molecules of  $\text{Cu}(\text{NO}_3)_2$  would be produced?

$$3.0 \text{ mol Cu} \times \frac{1 \text{ mol Cu}(\text{NO}_3)_2}{1 \text{ mol Cu}} \times \frac{6.02 \times 10^{23} \text{ molec Cu}(\text{NO}_3)_2}{1 \text{ mol Cu}(\text{NO}_3)_2} = 1.8 \times 10^{24} \text{ molec Cu}(\text{NO}_3)_2$$

2. 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?

$$700.0 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18.02 \text{ g H}_2\text{O}} \times \frac{1 \text{ mol MgCl}_2}{2 \text{ mol H}_2\text{O}} \times \frac{6.02 \times 10^{23} \text{ molec MgCl}_2}{1 \text{ mol MgCl}_2} = 1.169 \times 10^{25} \text{ molec MgCl}_2$$

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

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

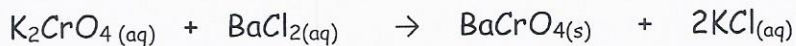
### Mole and stoichiometry combination questions

1. 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.

$$\frac{2.0 \text{ mol}}{\text{L}} \times 0.2000 \text{ L} = 0.4 \text{ mol NaI}$$

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

2. 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:



$$4.81 \text{ g BaCrO}_4 \times \frac{1 \text{ mol BaCrO}_4}{253.33 \text{ g BaCrO}_4} \times \frac{1 \text{ mol BaCl}_2}{1 \text{ mol BaCrO}_4} = 0.01897092 \text{ mol}$$

$$\frac{0.01897092 \text{ mol}}{0.075 \text{ L}} = 0.25 \text{ mol/L}$$

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



$$4.85 \text{ g NaHCO}_3 \times \frac{1 \text{ mol NaHCO}_3}{84.01 \text{ g NaHCO}_3} \times \frac{1 \text{ mol HCl}}{1 \text{ mol NaHCO}_3} = 0.05771222 \text{ mol}$$

$$\frac{0.05771222 \text{ mol}}{6.0 \text{ mol/L}} = 9.6 \text{ mL}$$