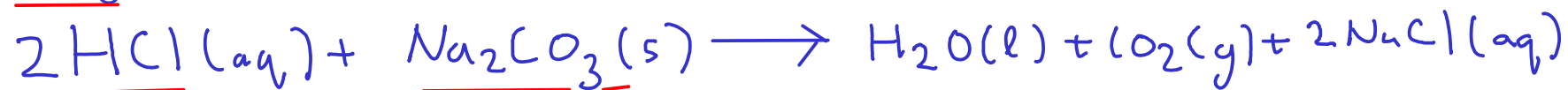


Example:

How many milliliters of 6.00M hydrochloric acid is needed to completely react with 25.0 g of sodium carbonate?



- 
- 1 - Convert 25.0g of sodium carbonate (mass) to moles using the formula weight.
  - 2 - Convert moles sodium carbonate to moles hydrochloric acid using chemical equation.
  - 3 - Convert moles hydrochloric acid to volume using concentration (6.00 moles / L)
- 

①  $\text{Na}_2\text{CO}_3$  : Na :  $2 \times 22.99$     <- Formula weight calculation  
                  C :  $1 \times 12.01$   
                  O :  $3 \times 16.00$   
                  105.99 g  $\text{Na}_2\text{CO}_3$  = mol  $\text{Na}_2\text{CO}_3$

$$25.0 \text{ g } \text{Na}_2\text{CO}_3 \times \frac{\text{mol } \text{Na}_2\text{CO}_3}{105.99 \text{ g } \text{Na}_2\text{CO}_3} = 0.2358713086 \text{ mol } \text{Na}_2\text{CO}_3$$

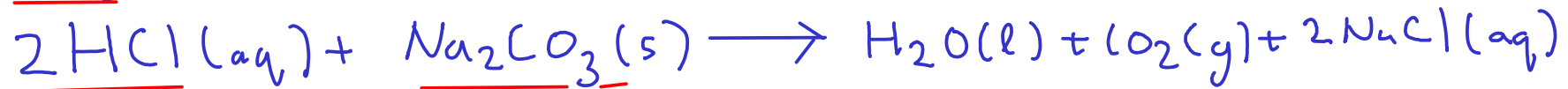
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②  $2 \text{ mol HCl} = 1 \text{ mol } \text{Na}_2\text{CO}_3$

$$0.2358713086 \text{ mol } \text{Na}_2\text{CO}_3 \times \frac{2 \text{ mol HCl}}{1 \text{ mol } \text{Na}_2\text{CO}_3} = 0.4717426172 \text{ mol HCl}$$

Example:

How many milliliters of 6.00M hydrochloric acid is needed to completely react with 25.0 g of sodium carbonate?



- 1 - Convert mass sodium carbonate to moles. Use formula weight.
- 2 - Convert moles sodium carbonate to moles hydrochloric acid. Use chemical equation.
- 3 - Convert moles hydrochloric acid to volume. Use concentration (6.00 M)

③  $6.00 \text{ mol HCl} = \text{L} \quad \text{mL} = 10^{-3} \text{L}$

$$0.4717426172 \text{ mol HCl} \times \frac{\text{L}}{6.00 \text{ mol HCl}} \times \frac{\text{mL}}{10^{-3} \text{L}} = \boxed{78.6 \text{ mL}}$$

If you like, you can solve the entire problem on one line and enter everything into the calculator at once!

$$\underbrace{25.0 \text{ g Na}_2\text{CO}_3 \times \frac{1 \text{ mol Na}_2\text{CO}_3}{105.99 \text{ g Na}_2\text{CO}_3}}_{\textcircled{1}} \times \underbrace{\frac{2 \text{ mol HCl}}{1 \text{ mol Na}_2\text{CO}_3}}_{\textcircled{2}} \times \underbrace{\frac{\text{L}}{6.00 \text{ mol HCl}} \times \frac{\text{mL}}{10^{-3} \text{L}}}_{\textcircled{3}} = \boxed{78.6 \text{ mL}}$$

EXAMPLE PROBLEM:



How many grams of sodium metal is required to completely react with 2545 grams of chlorine gas?

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- 1 - Convert 2545g of chlorine gas to moles using the formula weight of chlorine gas.
  - 2 - Convert moles chlorine gas to moles sodium metal using chemical equation.
  - 3 - Convert moles sodium chloride to mass using formula weight of sodium metal.
- 

$$\textcircled{1} \text{Cl}_2 : 2 \times 35.45 : 70.90 \text{ g Cl}_2 = \text{mol Cl}_2 \quad \textcircled{2} 2 \text{ mol Na} = \text{mol Cl}_2$$

$$\textcircled{3} 22.99 \text{ g Na} = \text{mol Na}$$

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$$2545 \text{ g Cl}_2 \times \frac{\text{mol Cl}_2}{70.90 \text{ g Cl}_2} \times \frac{2 \text{ mol Na}}{\text{mol Cl}_2} \times \frac{22.99 \text{ g Na}}{\text{mol Na}} = \boxed{1650. \text{ g Na}} \\ (1.650 \times 10^3 \text{ g Na})$$