$$2\,Al(s) + 3\,Br_2(l) \longrightarrow 2\,AlBr_3(s)$$

* Given that we have 25.0 g of liquid bromine, how many grams of aluminum would we need to react away all of the bromine?

① Convert the 25.0 g of bromine to moles. Use formula weight. Br_2: 2×79.90

159.8

$159.8\ g\ Br_2 = 1\ mol\ Br_2$

$$25.0\ g\ Br_2 \times \frac{1\ mol\ Br_2}{159.8\ g\ Br_2} = 0.156445559\ mol\ Br_2$$

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② Convert the moles bromine to moles aluminum. Use chemical equation.

$2\ mol\ Al = 3\ mol\ Br_2$

$$0.156445559\ mol\ Br_2 \times \frac{2\ mol\ Al}{3\ mol\ Br_2} = 0.104297038\ mol\ Al$$

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③ Convert the moles aluminum to mass. Use formula weight. Al: 26.98

$26.98\ g\ Al = 1\ mol\ Al$

$$0.104297038\ mol\ Al \times \frac{26.98\ g\ Al}{1\ mol\ Al} = \boxed{2.81\ g\ Al}$$

You can combine all three steps on one line if you like!

1 - Convert the 25.0 g of bromine to moles. Use formula weight.
2 - Convert the moles bromine to moles aluminum. Use chemical equation.
3 - Convert the moles aluminum to mass. Use formula weight.

① $159.8\ g\ Br_2 = mol\ Br_2$

② $2\ mol\ Al = 3\ mol\ Br_2$

③ $26.98\ g\ Al = mol\ Al$

$$25.0\ g\ Br_2 \times \underset{①}{\frac{mol\ Br_2}{159.8\ g\ Br_2}} \times \underset{②}{\frac{2\ mol\ Al}{3\ mol\ Br_2}} \times \underset{③}{\frac{26.98\ g\ Al}{mol\ Al}} = \boxed{2.81\ g\ Al}$$

Example:

How many grams of sodium carbonate is needed to make 15.5 grams of sodium chloride, assuming there is sufficient hydrochloric acid for the reaction

$$2HCl(aq) + Na_2CO_3(s) \longrightarrow H_2O(l) + CO_2(g) + 2NaCl(aq)$$

1 - Convert 15.5 g NaCl to moles. Use FORMULA WEIGHT.
2 - Convert mol NaCl to mol sodium carbonate. Use BALANCED CHEMICAL EQUATION.
3 - Convert mol sodium carbonate to grams sodium carbonate. Use FORMULA WEIGHT.

① NaCl - Na: 1 x 22.99
Cl: 1 x 35.45

58.44 g NaCl = mol NaCl

$$15.5\ \text{g NaCl} \times \frac{\text{mol NaCl}}{58.44\ \text{g NaCl}} = 0.265229295\ \text{mol NaCl}$$

② mol Na_2CO_3 = 2 mol NaCl

$$0.265229295\ \text{mol NaCl} \times \frac{\text{mol } Na_2CO_3}{2\ \text{mol NaCl}} = 0.132614647\ \text{mol } Na_2CO_3$$

Example:

How many grams of sodium carbonate is needed to make 15.5 grams of sodium chloride, assuming there is sufficient hydrochloric acid for the reaction

$$2HCl(aq) + Na_2CO_3(s) \longrightarrow H_2O(l) + CO_2(g) + 2NaCl(aq)$$

1 - Convert 15.5 g NaCl to moles. Use FORMULA WEIGHT.
2 - Convert mol NaCl to mol sodium carbonate. Use BALANCED CHEMICAL EQUATION.
3 - Convert mol sodium carbonate to grams sodium carbonate. Use FORMULA WEIGHT.

③ Na_2CO_3 — Na : 2 x 22.99
C : 1 x 12.01
O : 3 x 16.00

105.99 g Na_2CO_3 = mol Na_2CO_3

$$0.132614675 \text{ mol } Na_2CO_3 \times \frac{105.99 \text{ g } Na_2CO_3}{\text{mol } Na_2CO_3} = \boxed{14.1 \text{ g } Na_2CO_3}$$

EXAMPLE PROBLEM:

$2\,Na(s) + Cl_2(g) \rightarrow 2\,NaCl(s)$

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

1 - Convert 2545 g chlorine gas to moles chlorine gas. Use FORMULA WEIGHT
2 - Convert moles chlorine gas to moles sodium metal. Use BALANCED CHEMICAL EQUATION
3 - Convert moles sodium metal to grams. Use FORMULA WEIGHT.

① Cl_2: $\frac{2 \times 35.45}{70.90\ g\ Cl_2} = mol\ Cl_2$

② $\frac{2\ mol\ Na}{mol\ Cl_2}$

③ Na: $\frac{22.99\ g\ Na}{mol\ Na}$

$$2545\ g\ Cl_2 \times \frac{mol\ Cl_2}{70.90\ g\ Cl_2} \times \frac{2\ mol\ Na}{mol\ Cl_2} \times \frac{22.99\ g\ Na}{mol\ Na} = \boxed{1650.\ g\ Na}$$

① ② ③