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

① $159.80\ g\ Br_2 = mol\ Br_2$ ② $2\ mol\ Al = 3\ mol\ Br_2$ ③ $26.98\ g\ Al = mol\ Al$

$$25.0\ g\ Br_2 \times \underbrace{\frac{mol\ Br_2}{159.80\ g\ Br_2}}_{①} \times \underbrace{\frac{2\ mol\ Al}{3\ mol\ Br_2}}_{②} \times \underbrace{\frac{26.98\ g\ Al}{mol\ Al}}_{③} = \boxed{2.81\ g\ Al}$$

Things we can do:

| If we have ... | ... and we need ... | Use ... |
|---|---|---|
| MASS | MOLES | FORMULA WEIGHT |
| SOLUTION VOLUME | MOLES | MOLAR CONCETRATION (MOLARITY) |
| MOLES OF A | MOLES OF B | BALANCED CHEMICAL EQUATION |

Example:

How many milliliters of 6.00M hydrochloric acid (FW=36.46 g/mol) is needed to completely react with 25.0 g of sodium carbonate (FW=105.99 g/mol)?

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

---

1 - Convert mass sodium carbonate to moles. Use FORMULA WEIGHT.
2 - Convert moles sodium carbonate to moles HCl. Use CHEMICAL EQUATION.
3 - Convert moles HCl to volume HCl. Use MOLARITY.

---

① $105.99\ g\ Na_2CO_3 = mol\ Na_2CO_3$

$$25.0\ g\ Na_2CO_3 \times \frac{mol\ Na_2CO_3}{105.99\ g\ Na_2CO_3} = 0.2358713086\ mol\ Na_2CO_3$$

---

② $2\ mol\ HCl = mol\ Na_2CO_3$

$$0.2358713086\ mol\ Na_2CO_3 \times \frac{2\ mol\ HCl}{mol\ Na_2CO_3} = 0.4717426172\ mol\ HCl$$

Example:

How many milliliters of 6.00M hydrochloric acid (FW=36.46 g/mol) is needed to completely react with 25.0 g of sodium carbonate (FW=105.99 g/mol)?

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

1 - Convert mass sodium carbonate to moles. Use FORMULA WEIGHT.
2 - Convert moles sodium carbonate to moles HCl. Use CHEMICAL EQUATION.
3 - Convert moles HCl to volume HCl. Use MOLARITY.

(3) $6.00\ mol\ HCl = L$

$$0.4717426172\ mol\ HCl \times \frac{L}{6.00\ mol\ HCl} = 0.07861\ L\ of\ 6.00\ m\ HCl$$

Problem specifies we need to report the volume in mL, not L:

$mL = 10^{-3} L$

$$0.07861\ L \times \frac{mL}{10^{-3}\ L} = \boxed{78.6\ mL\ of\ 6.00\ m\ HCl}$$

42.081 g/mol 53.064 g/mol

$$4\,C_3H_6 + 6\,NO \longrightarrow 4\,C_3H_3N + 6\,H_2O + N_2$$

propylene acrylonitrile

Calculate how many grams of acrylonitrile could be obtained from 651 g of propylene, assuming there is excess NO present.

---

1 - Convert mass propylene to moles. Use FORMULA WEIGHT.
2 - Convert moles propylene to moles acrylonitrile. Use CHEMICAL EQUATION.
3 - Convert moles acrylonitrile to mass. Use FORMULA WEIGHT.

---

① $42.081\ g\ C_3H_6 = mol\ C_3H_6$

② $4\ mol\ C_3H_6 = 4\ mol\ C_3H_3N$

③ $53.064\ g\ C_3H_3N = mol\ C_3H_3N$

$$651\ g\ C_3H_3N \times \frac{mol\ C_3H_6}{42.081\ g\ C_3H_6} \times \frac{4\ mol\ C_3H_3N}{4\ mol\ C_3H_6} \times \frac{53.064\ g\ C_3H_3N}{mol\ C_3H_3N} = \boxed{821\ g\ C_3H_3N}$$

(① ② ③)

151.90 g/mol

$$10\,FeSO_4 + 2\,KMnO_4 + 8\,H_2SO_4 \rightarrow 5\,Fe_2(SO_4)_3 + 2\,MnSO_4 + K_2SO_4 + 8\,H_2O$$

How many mL of 0.250M potassium permangenate are needed to react with 3.36 g of iron(II) sulfate?

---

1 - Convert mass iron(II) sulfate to moles. Use FORMULA WEIGHT.
2 - Convert moles iron(II) sulfate to moles potassium permangenate. Use CHEMICAL EQUATION.
3 - Convert moles potassium permangenate to volume. Use MOLARITY.

---

① 151.90 g $FeSO_4$ = mol $FeSO_4$

② 10 mol $FeSO_4$ = 2 mol $KMnO_4$

③ 0.250 mol $KMnO_4$ = L

$$3.36\,g\,FeSO_4 \times \frac{\text{mol } FeSO_4}{151.90\,g\,FeSO_4} \times \frac{2\,\text{mol } KMnO_4}{10\,\text{mol } FeSO_4} \times \frac{L}{0.250\,\text{mol } KMnO_4} = 0.0177\,L$$

(① ② ③)

Do a quick unit conversion to get volume in mL ...

mL = $10^{-3}$ L

$$0.0177\,L \times \frac{mL}{10^{-3}\,L} = \boxed{17.7\,mL \text{ of } 0.250\,M\,KMnO_4}$$