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

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

(1) (2) (3)

You can solve the second part of the question using CONSERVATION OF MASS - since there's only a single product and you already know the mass of all reactants.

$$\begin{array}{r} 25.0\,g\,Br_2 \\ +\;\; 2.81\,g\,Al \\ \hline 27.8\,g\,AlBr_3 \end{array}$$

But ...

...what would you have done to calculate the mass of aluminum bromide IF you had NOT been asked to calculate the mass of aluminum FIRST?

$$25.0\,g\,Br_2 \times \frac{1\,mol\,Br_2}{159.80\,g\,Br_2} \times \frac{2\,mol\,AlBr_3}{3\,mol\,Br_2} \times \frac{266.694\,g\,AlBr_3}{1\,mol\,AlBr_3} = 27.8\,g\,AlBr_3$$

(1) convert mass bromine to moles

(2) convert moles bromine to moles aluminum bromide

(3) convert moles aluminum bromide to mass

Example:

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

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

1 - Convert 25.0 grams 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 solution. Use MOLAR CONCENTRATION.

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

$105.99\,g\ Na_2CO_3 = mol\ Na_2CO_3$

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

(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 is needed to completely react with 25.0 g of sodium carbonate?

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

1 - Convert 25.0 grams 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 solution. Use MOLAR CONCENTRATION.

(3) 6.00 mol HCl = L

$$0.4717426172 \text{ mol HCl} \times \frac{L}{6.00 \text{ mol HCl}} = 0.0786 \text{ L of } 6.00\text{ M HCl}$$

Notice the problem statement asks us for MILLILITERS and we have LITERS. No big problem here ... we just need to do a quick unit conversion.

$$mL = 10^{-3} L$$

$$0.0786 \text{ L} \times \frac{mL}{10^{-3} L} = 78.6 \text{ mL of } 6.00\text{ M HCl}$$

25.0 mL of acetic acid solution requires 37.3 mL of 0.150 M sodium hydroxide for complete reaction. The equation for this reaction is:

$$NaOH + HC_2H_3O_2 \rightarrow NaC_2H_3O_2 + H_2O$$

What is the molar concentration of the acetic acid?

$$\frac{\text{mol } HC_2H_3O_2}{\text{L solution}} \leftarrow \text{L solution} = 25.0\text{ mL or } 0.0250\text{ L}$$

Since we already know the volume of the acetic acid solution, we just need to find out the moles acetic acid in order to get the concentration. How do we find THAT? Start with the 37.3 mL of sodium hydroxide. Since we know the concentration, we can relate that volume to moles...

$\text{mL} = 10^{-3}\text{ L}$ | $0.150\text{ mol NaOH} = \text{L}$ | $\text{mol NaOH} = \text{mol } HC_2H_3O_2$

$$37.3\text{ mL} \times \frac{10^{-3}\text{ L}}{\text{mL}} \times \frac{0.150\text{ mol NaOH}}{\text{L}} \times \frac{\text{mol } HC_2H_3O_2}{\text{mol NaOH}} = 0.005595\text{ mol } HC_2H_3O_2$$

$$M = \frac{\text{mol } HC_2H_3O_2}{\text{L solution}} = \frac{0.005595\text{ mol } HC_2H_3O_2}{0.0250\text{ L}} = \boxed{0.224\text{ M } HC_2H_3O_2}$$

*Note for later: This is how the main calculation for EXPERIMENT 4C will be done!

$$\overset{42.081\ g/mol}{4\,C_3H_6} + 6\,NO \longrightarrow \overset{53.064\ g/mol}{4\,C_3H_3N} + 6\,H_2O + N_2$$

propylene | acrylonitrile

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

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1 - Convert mass propylene to moles. Use FORMULA WEIGHT of propylene (and kg->g conversion)
2 - Convert moles propylene to moles acrylonitrile. Use CHEMICAL EQUATION
3 - Convert moles acrylonitrile to mass acrylonitrile. Use FORMULA WEIGHT of acrylonitrile.

$42.081\ g\ C_3H_6 = mol\ C_3H_6$ | $4\ mol\ C_3H_6 = 4\ mol\ C_3H_3N$

$53.064\ g\ C_3H_3N = mol\ C_3H_3N$ | $kg = 10^3\ g$

$$651\ kg\ C_3H_6 \times \frac{10^3\ g}{kg} \times \frac{mol\ C_3H_6}{42.081\ g\ C_3H_6} \times \frac{4\ mol\ C_3H_3N}{4\ mol\ C_3H_6} \times \frac{53.064\ g\ C_3H_3N}{mol\ C_3H_3N} =$$

(1) (2) (3)

$$= \boxed{821000\ g\ C_3H_3N}$$ (821 kg)

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 3.36 grams 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 MOLAR CONCENTRATION.

$151.90\,g\ FeSO_4 = mol\ FeSO_4$	$10\,mol\ FeSO_4 = 2\,mol\ KMnO_4$
$0.250\,mol\ KMnO_4 = L$	$mL = 10^{-3}\,L$

$$3.36\,g\ FeSO_4 \times \frac{mol\ FeSO_4}{151.90\,g\ FeSO_4} \times \frac{2\,mol\ KMnO_4}{10\,mol\ FeSO_4} \times \frac{L}{0.250\,mol\ KMnO_4} \times \frac{mL}{10^{-3}\,L} =$$

(1) (2) (3)

= **17.7 mL of 0.250 M $KMnO_4$**