Example:

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

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

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1 - Convert 25.0 g 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 MOLARITY (6.00 M HCl)

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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

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

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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:

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1 - Convert 25.0 g 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 MOLARITY (6.00 M HCl)

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

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

Since the problem specifies that the answer should be in mL, we'll convert our final answer from liters to mL...

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

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

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.

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1 - Convert 651 g 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.

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① $42.081\ g\ C_3H_6 = 1\ mol\ C_3H_6$ ② $4\ mol\ C_3H_6 = 4\ mol\ C_3H_3N$

③ $53.064\ g\ C_3H_3N = 1\ mol\ C_3H_3N$

$$651\ g\ C_3H_6 \times \frac{1\ mol\ C_3H_6}{42.081\ g\ C_3H_6}\ (①) \times \frac{4\ mol\ C_3H_3N}{4\ mol\ C_3H_6}\ (②) \times \frac{53.064\ g\ C_3H_3N}{1\ mol\ C_3H_3N}\ (③) = \boxed{821\ g\ C_3H_3N}$$

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?

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1 - Convert 3.36 g 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. (0.250 M)

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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

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

① ② ③

Since the problem requests the answer in milliliters, convert ...

mL = 10^{-3} L

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