Molecular Formula Calculation:

require extra information that gives the molecular or molar mass of the compound in question.

eg 3 determine the molecular formula for a compound that is 54.52 % C, 9.17 % H and 36.31 % O by mass and has a molecular mass of 132.18 g/mol

In a 100 g sample:

$$\text{C: } 54.52\ \text{g} \times \frac{1\ \text{mol}}{12.01\ \text{g}} = 4.540\ \text{mol} \div 2.269\ \text{mol} = 2.001 \simeq 2$$

$$\text{H: } 9.17\ \text{g} \times \frac{1\ \text{mol}}{1.01\ \text{g}} = 9.079\ \text{mol} \div 2.269\ \text{mol} = 4.001 \simeq 4$$

$$\text{O: } 36.31\ \text{g} \times \frac{1\ \text{mol}}{16.00\ \text{g}} = 2.269\ \text{mol} \div 2.269\ \text{mol} = 1.000 \simeq 1$$

Therefore the empirical formula is C_2H_4O

Starts out the same.

No extra multiplication step required in this example

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The empirical mass is:

C: 2 x 12.01 g = 24.02 g
H: 4 x 1.01 g = 4.04 g
O: 1 x 16.00 g = 16.00 g
44.06 g

This calculates the mass of one empirical unit

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This number must be given in the question

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Number of Empirical Units are:

$\frac{\text{molecular mass}}{\text{empirical mass}} = \frac{132.18\ g}{44.06\ g} = 3$

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Therefore the molecular formula is: $3 \times (C_2H_4O) = C_6H_{12}O_3$

Multiplying by the number of empirical units gives the molecular formula of the same percent composition.