

- 1) What is the molar mass of  $C_2H_7$  given to 3 sig figs?
- 2) How many mols of  $C_2H_7$  are in 321g?
- 3) What is the percent weight of C in  $C_2H_7$ ?
- 4) How many grams would 0.750 mols of  $C_2H_7$  weigh?

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## Molecular vs Empirical Formulas

Empirical formulas are the ratio of atoms in a molecule

Molecular formulas are the COMPLETE number of atoms in an element.

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## Examples

### Empirical formula of CH

This means that for every atom of carbon, there is one atom of hydrogen.

Molecular formulas with the same ratio -

acetylene -  $C_2H_2$

benzene -  $C_6H_6$

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Other examples of different compounds with the same empirical formula

ethylene  $C_2H_4$

butene  $C_4H_8$

cyclohexane  $C_6H_{12}$

What is the common empirical formula?

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The empirical formula of hexane is  $C_3H_7$ . Its molecular weight is 86.2 amu. What is the molecular formula of hexane?

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Solution

1. Calculate the formula weight of  $C_3H_7$ .
2. Calculate the ratio between the molecular weight and the empirical weight:
3. The molecular formula must be twice the empirical formula:

$(C_3H_7)_2$  or  $C_6H_{14}$

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The compound ethylene glycol is often used as an antifreeze. It contains 38.7% carbon, 9.75% hydrogen, and the rest oxygen. The molecular weight of ethylene glycol is 62.07 g. What is the molecular formula of ethylene glycol?

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1. Calculate the empirical formula. Assume 100 g of the compound, which will contain 38.70 g carbon, 9.75 g hydrogen and the rest oxygen

$$? \text{ g O} = 100 \text{ g} - 38.70 \text{ g C} - 9.75 \text{ g H} = 51.55 \text{ g O.}$$

2. Calculate the moles of each element present:

3. Next calculate the ratio of molecular weight to empirical formula weight. The molecular weight is given. The empirical formula is  $\text{CH}_3\text{O}$ , so the empirical formula weight is  $12.01 + 3(1.008) + 16.00 = 31.03$ .

Therefore the molecular formula is twice the empirical formula:  $\text{C}_2\text{H}_6\text{O}_2$ .

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