

Chemistry Lecture #53: Molar Mass of Compounds

To find the molar mass of an ionic compound or a molecule, add the molar masses of the atoms in the compound.

Find the molar mass of C_2H_5OH (also known as ethanol).

Answer: Ethanol has 2 carbons, 6 hydrogens and 1 oxygen. We'll also take molar masses off the periodic chart, and round them to 3 significant figures.

$$C: 2 \times 12.0 = 24.0 \text{ g}$$

$$H: 6 \times 1.01 = 6.06 \text{ g}$$

$$O: 1 \times 16.0 = 16.0 \text{ g}$$

46.06 which rounds to 46.1 g/mole.

Sometimes high school textbooks are not consistent in how they use significant figures or how they round. As long as your answer is close to the answer in the book, don't worry.

Find the molar mass of $Al_2(SO_4)_3$.

Answer:

$$Al: 2 \times 27.0 = 54.0 \text{ g}$$

$$S: 3 \times 32.1 = 96.3 \text{ g}$$

$$O: 12 \times 16.0 = 192 \text{ g}$$

342.3 which rounds to 342 g/mole.

What is the mass of 2.50 moles of C_2H_5OH ?

Answer:

moles  grams

1 mole C_2H_5OH = 46.1 g C_2H_5OH

$$\frac{2.50 \text{ moles } C_2H_5OH}{1} \times \frac{46.1 \text{ g } C_2H_5OH}{\text{mole } C_2H_5OH} = 115.25 = 115 \text{ g } C_2H_5OH$$

Calculate the number of moles aluminum sulfate in 1460.34 g of $Al_2(SO_4)_3$.

Answer:

grams  moles

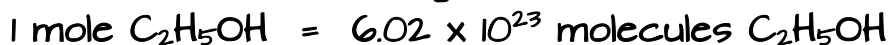
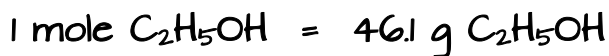
1 mole $Al_2(SO_4)_3$ = 342 g $Al_2(SO_4)_3$

$$\frac{1460.34 \text{ g } Al_2(SO_4)_3}{1} \times \frac{\text{mole } Al_2(SO_4)_3}{342 \text{ g } Al_2(SO_4)_3} = 4.27 \text{ g } Al_2(SO_4)_3$$

How many C_2H_5OH molecules are in a 60.4 g sample?

Answer:

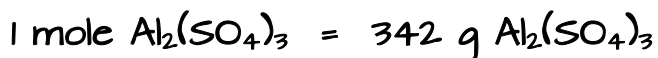
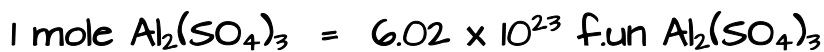
grams \longrightarrow moles \longrightarrow molecules



$$\begin{aligned} \frac{60.4 \text{ g } C_2H_5OH}{1} \times \frac{1 \text{ mole } C_2H_5OH}{46.1 \text{ g } C_2H_5OH} \times \frac{6.02 \times 10^{23} \text{ molecules } C_2H_5OH}{1 \text{ mole } C_2H_5OH} \\ = 7.89 \times 10^{23} \text{ molecules } C_2H_5OH \end{aligned}$$

What is the mass of 5.26×10^{21} formula units of $Al_2(SO_4)_3$?

formula units (f.un) \longrightarrow moles \longrightarrow grams



$$\begin{aligned} \frac{5.26 \times 10^{21} \text{ f.un } Al_2(SO_4)_3}{1} \times \frac{1 \text{ mole } Al_2(SO_4)_3}{6.02 \times 10^{23} \text{ f.un } Al_2(SO_4)_3} \times \frac{342 \text{ g } Al_2(SO_4)_3}{1 \text{ mole } Al_2(SO_4)_3} \\ = 2.99 \text{ g } Al_2(SO_4)_3 \end{aligned}$$