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 x 12.0 = 24.0 g
H: 6 x 1.01 = 6.06 g
O: 1 x 16.0 = 16.0 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 x 27.0 = 54.0 g
S: 3 x 32.1 = 96.3 g
O: 12 x 16.0 = 192 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 → moles → molecules

1 mole C_2H_5OH = 46.1 g C_2H_5OH

1 mole C_2H_5OH = 6.02×10^{23} molecules C_2H_5OH

$$\frac{60.4 \text{ g } C_2H_5OH}{1} \times \frac{\text{mole } C_2H_5OH}{46.1 \text{ g } C_2H_5OH} \times \frac{6.02 \times 10^{23} \text{ molecules } C_2H_5OH}{\text{mole } C_2H_5OH}$$

$$= 7.89 \times 10^{23} \text{ molecules } C_2H_5OH$$

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

formula units (f.un) → moles → grams

1 mole $Al_2(SO_4)_3$ = 6.02×10^{23} f.un $Al_2(SO_4)_3$

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

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

$$= 2.99 \text{ g } Al_2(SO_4)_3$$