

## Molecular Mass, Molar Mass, and Formula Mass

1. What is the molecular mass of pentane,  $C_5H_{12}$ ? What is the molar mass?

$$5 \times (12.011 \text{ u}) + 12 \times (1.00794 \text{ u}) = \mathbf{72.15 \text{ u}}$$

$$M_m = \mathbf{72.15 \text{ g/mol}}$$

2. How many moles of oxygen are in 123.45 g?

mol  $\rightarrow$  g

$$1 \text{ mol } O_2 = 2 \times 15.9994 \text{ g/mol} = 31.999 \text{ g/mol}$$

$$123.45 \text{ g} \times 1 \text{ mol}/31.999 \text{ g} = \mathbf{3.1858 \text{ mol}}$$

3. What is the formula mass of  $Ca_3(PO_4)_2$ ? How many grams are in 6.54 moles of  $Ca_3(PO_4)_2$ ?

$$\text{Formula mass} = 3 \times 40.078 \text{ u} + 2 \times 30.9738 \text{ u} + 8 \times 15.9994 \text{ u} = \mathbf{310.18 \text{ u}}$$

$$6.54 \text{ mol } Ca_3(PO_4)_2 \times \frac{310.18 \text{ g}}{1 \text{ mol}} = \mathbf{2.03 \times 10^3 \text{ g } Ca_3(PO_4)_2}$$

4. Caffeine,  $C_8H_{10}N_4O_2$ , has a molar mass of 194.19 g/mol. How many nitrogen atoms are in 2.75 moles of caffeine?

Moles caffeine  $\rightarrow$  moles N  $\rightarrow$  # N atoms

$$2.75 \text{ mol caffeine} \times \frac{4 \text{ mol N}}{1 \text{ mol caffeine}} \times \frac{6.02 \times 10^{23} \text{ N atoms}}{1 \text{ mol N}} = \mathbf{6.62 \times 10^{24} \text{ N atoms}}$$

5. How many grams of sodium bromate are in 0.565 moles?

$$M_m \text{ NaBrO}_3 = 22.99 \text{ g/mol} + 79.904 \text{ g/mol} + 3 \times 15.9994 \text{ g/mol} = 150.89 \text{ g/mol}$$

$$0.565 \text{ mol} \times \frac{150.89 \text{ g}}{1 \text{ mol}} = \mathbf{85.3 \text{ g NaBrO}_3}$$