Molecular Mass, Molar Mass, and Formula Mass

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

   5 x (12.011 u) + 12 x (1.00794 u) = **72.15 u**

   M_m = **72.15 g/mol**

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

   mol → g

   1 mol O_2 = 2 x 15.9994 g/mol = 31.999 g/mol

   123.45 *g* x 1 mol/31.999 *g* = **3.858 mol**

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

   Formula mass = 3 x 40.078 u + 2 x 30.9738 u + 8 x 15.9994 u = **310.18 u**

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

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 → moles N → # N atoms

   $$2.75\ mol\ caffeine \times \frac{4\ mol\ N}{1\ mol\ caffeine} \times \frac{6.02\times10^{23}\ N\ atoms}{1\ mol\ N} = \mathbf{6.62 \times 10^{24}\ N\ atoms}$$

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

   M_m $NaBrO_3$ = 22.99 g/mol + 79.904 g/mol + 3 x 15.9994 g/mol = 150.89 g/mol

   $$0.565\ mol \times \frac{150.89\ g}{1\ mol} = 85.3\ g\ NaBrO_3$$