Mole Conversion Practice

Perform the following conversions, showing all of your work and reporting your final answer to the proper number of significant figures.

1) Draw a concept map that relates the units of grams, moles, molecules, and atoms and shows how to convert between the units.

   - Molar Mass (g/mol) \( \rightarrow \) moles
   - Avogadro's # \( \left( \frac{6.02 \times 10^{23}}{1 \text{ mol}} \right) \) \( \rightarrow \) Molecules
   - Chemical Formula \( \left( \frac{"X" \text{ atoms}}{1 \text{ molecule}} \right) \) \( \rightarrow \) Atoms

2) How many molecules of \( \text{P}_2\text{O}_5 \) are there in 4.05 moles?

   \[
   4.05 \text{ mol} \left( \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol}} \right) = 2.44 \times 10^{24} \text{ molecules} \left( \frac{\text{P}_2\text{O}_5}{1 \text{ molecule}} \right)
   \]

3) How many moles are there in \( 1.01 \times 10^{21} \) molecules of \( \text{CO}_2 \)?

   \[
   1.01 \times 10^{21} \text{ molecules} \left( \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molecules}} \right) = 0.00168 \text{ mol} \left( \frac{\text{CO}_2}{1 \text{ molecule}} \right)
   \]

4) How many hydrogen atoms are there in 3.30 moles of \( \text{NH}_3 \)?

   \[
   3.30 \text{ mol} \left( \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol}} \right) \left( \frac{3 \text{ H atoms}}{1 \text{ molecule NH}_3} \right) = 5.96 \times 10^{24} \text{ H atoms}
   \]

5) How many moles of \( \text{AgCl} \) are there in 0.450 grams?

   \[
   0.450 \text{ g} \left( \frac{1 \text{ mol}}{143.32 \text{ g}} \right) = 0.00314 \text{ mol} \left( \frac{\text{AgCl}}{1 \text{ molecule}} \right)
   \]
6) How many grams does 3.2 moles of H$_2$O weigh?

$$3.2 \text{ mol} \left( \frac{18.02 \text{ g}}{1 \text{ mol}} \right) = 57.7 \text{ g H}_2\text{O}$$

7) How many moles are there in 0.0670 g of Na$_2$SO$_4$?

$$0.0670 \text{ g} \left( \frac{1 \text{ mol}}{142.04 \text{ g}} \right) = 0.000472 \text{ mol Na}_2\text{SO}_4$$

8) How many molecules of K$_3$PO$_4$ are there in 5.00 grams?

$$5.00 \text{ g} \left( \frac{1 \text{ mol}}{212.29 \text{ g}} \right) \left( \frac{6.02 \times 10^{23} \text{ molec}}{1 \text{ mol}} \right) = 1.42 \times 10^{22} \text{ molecules K}_3\text{PO}_4$$

9) How many grams would 9.02 x 10$^{24}$ molecules of H$_2$O$_2$ weigh?

$$9.02 \times 10^{24} \text{ molecules} \left( \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molec}} \right) \left( \frac{34.02 \text{ g}}{1 \text{ mol}} \right) = 509.6 \text{ g H}_2\text{O}_2$$

10) A sample of NO$_2$ contains 2.2 x 10$^{24}$ atoms of oxygen. How much does it weigh in grams?

$$2.2 \times 10^{24} \text{ atoms} \left( \frac{1 \text{ molecule NO}_2}{2 \text{ O atoms}} \right) \left( \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molec}} \right) \left( \frac{46.01 \text{ g}}{1 \text{ mol}} \right) = 84 \text{ g NO}_2$$

11) A sample of Cl$_2$ weighs 10.05 g, how many chlorine atoms are in the sample?

$$10.05 \text{ g} \left( \frac{1 \text{ mol}}{70.90 \text{ g}} \right) \left( \frac{6.02 \times 10^{23} \text{ molec}}{1 \text{ mol}} \right) \left( \frac{2 \text{ Cl atoms}}{1 \text{ molec}} \right) = 1.707 \times 10^{23} \text{ atoms Cl}$$