

Finding the molar mass:

1)	H ₂ O	$\frac{18.02 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}}$	water
2)	HgO	$\frac{216.59 \text{ g HgO}}{1 \text{ mol HgO}}$	mercury (II) oxide
3)	Hg ₂ O	$\frac{417.18 \text{ g Hg}_2\text{O}}{1 \text{ mol Hg}_2\text{O}}$	mercury (I) oxide
4)	I ₂	$\frac{253.80 \text{ g I}_2}{1 \text{ mol I}_2}$	iodine
5)	I ⁻	$\frac{126.90 \text{ g I}^-}{1 \text{ mol I}^-}$	iodide
6)	CH ₃ OH	$\frac{32.05 \text{ g CH}_3\text{OH}}{1 \text{ mol CH}_3\text{OH}}$	(methanol)
7)	Ca(NO ₃) ₂	$\frac{164.09 \text{ g Ca(NO}_3)_2}{1 \text{ mol Ca(NO}_3)_2}$	calcium nitrate
8)	Al(OH) ₃	$\frac{78.01 \text{ g Al(OH)}_3}{1 \text{ mol Al(OH)}_3}$	aluminum hydroxide
9)	C ₁₂ H ₂₂ O ₁₁	$\frac{342.34 \text{ g C}_{12}\text{H}_{22}\text{O}_{11}}{1 \text{ mol C}_{12}\text{H}_{22}\text{O}_{11}}$	(sucrose)
10)	Ba ₃ (PO ₄) ₂	$\frac{601.96 \text{ g Ba}_3(\text{PO}_4)_2}{1 \text{ mol Ba}_3(\text{PO}_4)_2}$	barium phosphate
11)	Sr(MnO ₄) ₂	$\frac{325.49 \text{ g Sr(MnO}_4)_2}{1 \text{ mol Sr(MnO}_4)_2}$	strontium permanganate
12)	(NH ₄) ₂ Cr ₂ O ₇	$\frac{252.10 \text{ g (NH}_4)_2\text{Cr}_2\text{O}_7}{1 \text{ mol (NH}_4)_2\text{Cr}_2\text{O}_7}$	ammonium dichromate
13)	PtCl ₂ (NH ₃) ₂	$\frac{300.06 \text{ g PtCl}_2(\text{NH}_3)_2}{1 \text{ mol PtCl}_2(\text{NH}_3)_2}$	(cisplatin)
14)	C ₂₃ H ₄₀ N ₇ O ₁₇ P ₃ S	$\frac{811.48 \text{ g C}_{23}\text{H}_{40}\text{N}_7\text{O}_{17}\text{P}_3\text{S}}{1 \text{ mol C}_{23}\text{H}_{40}\text{N}_7\text{O}_{17}\text{P}_3\text{S}}$	(acetyl coenzyme A)

Dealing with moles:

- 1) How many moles are there in 1 mol of moles?

$$1.0000 \text{ mol mole} \times \frac{6.022 \times 10^{23} \text{ moles}}{1 \text{ mol mole}} = 6.022 \times 10^{23} \text{ moles}$$

- 2) How many atoms are there in 7.42 moles of tin?

$$7.42 \text{ mol Sn} \times \frac{6.022 \times 10^{23} \text{ atoms Sn}}{1 \text{ mol Sn}} = 4.47 \times 10^{24} \text{ atoms Sn}$$

- 3) How many molecules are there in 3.14 moles of water?

$$3.14 \text{ mol H}_2\text{O} \times \frac{6.022 \times 10^{23} \text{ molecules H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = 1.89 \times 10^{24} \text{ molecules H}_2\text{O}$$

- 4) How many ATOMS are there in 8.22 moles of H₂ molecules?

$$8.22 \text{ mol H}_2 \times \frac{2 \text{ mol H}}{1 \text{ mol H}_2} \times \frac{6.022 \times 10^{23} \text{ atom H}}{1 \text{ mol H}} = 9.90 \times 10^{24} \text{ atom H}$$

- 5) How many moles are there in 5.87×10^{24} formula units of NaCl

$$5.89 \times 10^{24} \text{ form. units NaCl} \times \frac{1 \text{ mol NaCl}}{6.022 \times 10^{23} \text{ form. units NaCl}} = 9.78 \text{ mol NaCl}$$

- 6) How many moles are there in 9.46×10^{18} formula units of AgNO₃?

$$9.46 \times 10^{18} \text{ form. units AgNO}_3 \times \frac{1 \text{ mol AgNO}_3}{6.022 \times 10^{23} \text{ form. units AgNO}_3} = 1.57 \times 10^{-5} \text{ mol AgNO}_3$$

NEXT SECTION

- 1) If a 1-liter flask contains 55.4 moles of H₂O, how many atoms of hydrogen are in the flask?

$$55.4 \text{ mol H}_2\text{O} \times \frac{2 \text{ mol H}}{1 \text{ mol H}_2\text{O}} \times \frac{6.022 \times 10^{23} \text{ atoms H}}{1 \text{ mol H}} = 6.67 \times 10^{25} \text{ atoms H}$$

- 2) A sample has 1.93×10^{20} atoms of Iron. How many moles of Fe₂O₃ would this make?

$$1.93 \times 10^{20} \text{ atoms Fe} \times \frac{1 \text{ mol Fe}}{6.022 \times 10^{23} \text{ atoms Fe}} \times \frac{1 \text{ mol Fe}_2\text{O}_3}{2 \text{ mol Fe}} = 1.60 \times 10^{-4} \text{ mol Fe}_2\text{O}_3$$

- 3) How many atoms of carbon are there in 6.15×10^{-8} moles of (CH₃CH₂CO₂)₂C₆H₄

$$6.15 \times 10^{-8} \text{ mol (CH}_3\text{CH}_2\text{CO}_2)_2\text{C}_6\text{H}_4 \times \frac{12 \text{ mol C}}{1 \text{ mol (CH}_3\text{CH}_2\text{CO}_2)_2\text{C}_6\text{H}_4} \times \frac{6.022 \times 10^{23} \text{ atoms C}}{1 \text{ mol C}} = 4.44 \times 10^{17} \text{ atoms C}$$

- 4) How many moles of Ra(CN)₂ are present if you have 8.34×10^{27} atoms of N

$$8.34 \times 10^{27} \text{ atoms N} \times \frac{1 \text{ mol N}}{6.022 \times 10^{23} \text{ atoms N}} \times \frac{1 \text{ mol Ra(CN)}_2}{2 \text{ mol N}} = 6920 \text{ mol Ra(CN)}_2$$

- 5) How many atoms of hydrogen are there in 1.23×10^{-4} moles of Aspartame, C₁₄H₁₈N₂O₅

$$1.23 \times 10^{-4} \text{ mol C}_{14}\text{H}_{18}\text{N}_2\text{O}_5 \times \frac{18 \text{ mol H}}{1 \text{ mol C}_{14}\text{H}_{18}\text{N}_2\text{O}_5} \times \frac{6.022 \times 10^{23} \text{ atoms H}}{1 \text{ mol H}} = 1.33 \times 10^{21} \text{ atoms H}$$

- 6) Calculate the mass of 4.97×10^{24} molecules of sulfur dioxide.

$$4.97 \times 10^{24} \text{ molecules SO}_2 \times \frac{1 \text{ mol SO}_2}{6.022 \times 10^{23} \text{ molecules SO}_2} \times \frac{64.07 \text{ g SO}_2}{1 \text{ mol SO}_2} = 529 \text{ g SO}_2$$

NEXT SECTION

- 1) What mass of rubidium is in 2.39×10^{20} molecules of Rb_2SO_4 ?

$$2.39 \times 10^{20} \text{ molecules } \text{Rb}_2\text{SO}_4 \times \frac{1 \text{ mol } \text{Rb}_2\text{SO}_4}{6.022 \times 10^{23} \text{ molecules } \text{Rb}_2\text{SO}_4} \times \frac{2 \text{ mol Rb}}{1 \text{ mol } \text{Rb}_2\text{SO}_4} \times \frac{85.47 \text{ g Rb}}{1 \text{ mol Rb}} = 0.0678 \text{ g Rb}$$

- 2) How many sodium atoms are there in 6.53 kg of NaHCO_3 ?

$$6.53 \text{ kg } \text{NaHCO}_3 \times \frac{1 \times 10^3 \text{ g } \text{NaHCO}_3}{1 \text{ kg } \text{NaHCO}_3} \times \frac{1 \text{ mol } \text{NaHCO}_3}{84.01 \text{ g } \text{NaHCO}_3} \times \frac{1 \text{ mol Na}}{1 \text{ mol } \text{NaHCO}_3} \times \frac{6.022 \times 10^{23} \text{ atom Na}}{1 \text{ mol Na}} = 4.68 \times 10^{25} \text{ atom Na}$$

- 3) What is the mass of iodine in 8.52×10^{20} molecules of CeI_3 ?

$$8.52 \times 10^{20} \text{ molecules } \text{CeI}_3 \times \frac{1 \text{ mol } \text{CeI}_3}{6.022 \times 10^{23} \text{ molecules } \text{CeI}_3} \times \frac{3 \text{ mol I}}{1 \text{ mol } \text{CeI}_3} \times \frac{126.90 \text{ g I}}{1 \text{ mol I}} = 0.539 \text{ g I}$$

- 4) How many oxygen atoms are in 1.2×10^{-3} grams of testosterone, $\text{C}_{19}\text{H}_{28}\text{O}_2$?

$$1.2 \times 10^{-3} \text{ g } \text{C}_{19}\text{H}_{28}\text{O}_2 \times \frac{1 \text{ mol } \text{C}_{19}\text{H}_{28}\text{O}_2}{288.47 \text{ g } \text{C}_{19}\text{H}_{28}\text{O}_2} \times \frac{2 \text{ mol O}}{1 \text{ mol } \text{C}_{19}\text{H}_{28}\text{O}_2} \times \frac{6.022 \times 10^{23} \text{ atom O}}{1 \text{ mol O}} = 5.0 \times 10^{18} \text{ atom O}$$

- 5) What is the mass of a snowflake (think) containing 2.67×10^{19} atoms of hydrogen?

$$2.67 \times 10^{19} \text{ atoms H} \times \frac{1 \text{ mol H}}{6.022 \times 10^{23} \text{ atoms H}} \times \frac{1 \text{ mol } \text{H}_2\text{O}}{2 \text{ mol H}} \times \frac{18.02 \text{ g } \text{H}_2\text{O}}{1 \text{ mol } \text{H}_2\text{O}} = 3.99 \times 10^{-4} \text{ g } \text{H}_2\text{O}$$

- 6) How many nitrogen atoms in 1.05×10^{21} molecules of caffeine, $\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2$?

$$1.05 \times 10^{21} \text{ molec. } \text{C}_8\text{H}_{10}\text{N}_4\text{O}_2 \times \frac{1 \text{ mol } \text{C}_8\text{H}_{10}\text{N}_4\text{O}_2}{6.022 \times 10^{23} \text{ molec. } \text{C}_8\text{H}_{10}\text{N}_4\text{O}_2} \times \frac{4 \text{ mol N}}{1 \text{ mol } \text{C}_8\text{H}_{10}\text{N}_4\text{O}_2} \times \frac{6.022 \times 10^{23} \text{ atoms N}}{1 \text{ mol N}} = 4.20 \times 10^{21} \text{ atoms N}$$

OR

$$1.05 \times 10^{21} \text{ molecules } \text{C}_8\text{H}_{10}\text{N}_4\text{O}_2 \times \frac{4 \text{ atoms N}}{1 \text{ molecules } \text{C}_8\text{H}_{10}\text{N}_4\text{O}_2} = 4.20 \times 10^{21} \text{ atoms N}$$

(Notice that the atom-to-molecule ratio is EXACTLY the same as the mole-to-mole ratio. This is always true.)

- 7) What is the mass of a Vitamin C tablet that has 5.13×10^{21} atoms of oxygen? The formula for Vitamin C is $\text{C}_6\text{H}_8\text{O}_6$.

$$5.13 \times 10^{21} \text{ atoms O} \times \frac{1 \text{ mol O}}{6.022 \times 10^{23} \text{ atoms O}} \times \frac{1 \text{ mol } \text{C}_6\text{H}_8\text{O}_6}{6 \text{ mol O}} \times \frac{176.14 \text{ g } \text{C}_6\text{H}_8\text{O}_6}{1 \text{ mol } \text{C}_6\text{H}_8\text{O}_6} = 0.250 \text{ g } \text{C}_6\text{H}_8\text{O}_6$$

- 8) A sample of calcium acetate contains 5.98×10^{23} atoms of oxygen. What mass of hydrogen does it contain?

$$5.98 \times 10^{23} \text{ atoms O} \times \frac{1 \text{ mol O}}{6.022 \times 10^{23} \text{ atoms O}} \times \frac{6 \text{ mol H}}{4 \text{ mol O}} \times \frac{1.01 \text{ g H}}{1 \text{ mol H}} = 1.50 \text{ g H}$$

- 9) How many iodine atoms are there in 28.3 mg of carbon tetraiodide?

$$28.3 \text{ mg } \text{CI}_4 \times \frac{1 \times 10^{-3} \text{ g } \text{CI}_4}{1 \text{ mg } \text{CI}_4} \times \frac{1 \text{ mol } \text{CI}_4}{519.61 \text{ g } \text{CI}_4} \times \frac{4 \text{ mol I}}{1 \text{ mol } \text{CI}_4} \times \frac{6.022 \times 10^{23} \text{ atoms I}}{1 \text{ mol I}} = 1.31 \times 10^{20} \text{ atoms I}$$