Finding the molar mass:

1)	H_2O	$18.02\ g/mol$	water
2)	HgO	$216.59\ g/mol$	mercury (II) oxide
3)	Hg_2O	$417.18\ g/mol$	mercury (I) oxide
4)	I_2	$253.80\ g/mol$	iodine
5)	I^-	$126.90\ g/mol$	iodide
6)	CH_3OH	$32.05\ g/mol$	(methanol)
7)	$Ca(NO_3)_2$	$164.10\ g/mol$	calcium nitrate
8)	$Al(OH)_3$	$78.01\ g/mol$	aluminum hydroxide
9)	$C_{12}H_{22}O_{11}$	$342.32\ g/mol$	(sucrose)
10)	$Ba_3(PO_4)_2$	$601.93\ g/mol$	barium phosphate
11)	$Sr(MnO_4)_2$	$325.50\ g/mol$	strontium permanganate
12)	$(NH_4)_2Cr_2O_7$	$252.10\ g/mol$	ammonium dichromate
13)	$PtCl_2(NH_3)_2$	$300.06\ g/mol$	(cisplatin)
14)	$C_{23}H_{40}N_7O_{17}P_3S$	$811.68\ g/mol$	(acetyl coenzyme A)

Dealing with moles:

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

$$1\ mol\ \text{mole} \times \frac{6.022\times10^{23}\ \text{moles}}{1\ mol\ \text{mole}} = 6\times10^{23}\ \text{moles}$$

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

$$7.42\ mol\ \text{Sn} \times \frac{6.022\times10^{23}\ atoms\ \text{Sn}}{1\ mol\ \text{Sn}} = 4.47\times10^{24}\ atoms\ \text{Sn}$$

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

$$3.14\ mol\ H_2O \times \frac{6.022\times10^{23}\ molecules\ H_2O}{1\ mol\ H_2O} = 1.89\times10^{24}\ molecules\ H_2O$$

4) How many ATOMS are there in 8.22 moles of H_2 molecules?

$$8.22\ mol\ H_2 \times \frac{2\ mol\ H}{1\ mol\ H_2} \times \frac{6.022\times10^{23}\ atom\ H}{1\ mol\ H} \times = 9.90\times10^{24}\ atom\ H$$

5) How many moles are there in $5.87\text{x}10^{24}$ molecules of NaCl

$$5.89\times10^{24}\ molecules\ NaCl \times \frac{1\ mol\ NaCl}{6.022\times10^{23}\ molecules\ NaCl} = 9.78\ mol\ NaCl$$

6) How many moles are there in $9.46\text{x}10^{18}$ molecules of $AgNO_3$?

$$9.46\times10^{18}\ molecules\ AgNO_3 \times \frac{1\ mol\ AgNO_3}{6.022\times10^{23}\ molecules\ AgNO_3} = 1.57\times10^{-5}\ mol\ AgNO_3$$

NEXT SECTION

1) If a 1 liter flask contains 55.4 moles of H_2O, how many atoms of hydrogen are in the flask?

$$55.4\ mol\ H_2O \times \frac{2\ mol\ H}{1\ mol\ H_2O} \times \frac{6.022\times10^{23}\ atoms\ H}{1\ mol\ H} = 6.67\times10^{25}\ atoms\ H$$

OR

$$55.4\ mol\ H_2O \times \frac{6.022\times10^{23}\ molecules\ H_2O}{1\ mol\ H_2O} \times \frac{2\ atoms\ H}{1\ molecules\ H_2O} = 6.67\times10^{25}\ atoms\ H$$

2) A sample has $1.93\text{x}10^{20}$ atoms of Iron. How many moles of Fe_2O_3 would this make?

$$1.93\times10^{20}\ atoms\ Fe \times \frac{1\ mol\ Fe}{6.022\times10^{23}\ atoms\ Fe} \times \frac{1\ mol\ Fe_2O_3}{2\ mol\ Fe} = 1.60\times10^{-4}\ mol\ Fe_2O_3$$

OR

$$1.93\times10^{20}\ atoms\ Fe\times\frac{1\ molecule\ Fe_2O_3}{2\ atoms\ Fe}\times\frac{1\ mol\ Fe_2O_3}{6.022\times10^{23}\ molecule\ Fe_2O_3}=1.60\times10^{-4}\ mol\ Fe_2O_3$$

3) How many atoms of carbon are there in $6.15\text{x}10^{-8}$ moles of $(CH_3CH_2CO_2)_2C_6H_4$

$$6.15\times10^{-8}\ mol\ (CH_3CH_2CO_2)_2C_6H_4\times\frac{12\ mol\ C}{1\ mol\ (CH_3CH_2CO_2)_2C_6H_4}\times\frac{6.022\times10^{23}\ atoms\ C}{1\ mol\ C}=4.44\times10^{17}\ atoms\ H$$

OR

$$6.15\times10^{-8}\ mol\ (CH_3CH_2CO_2)_2C_6H_4\times\frac{6.022\times10^{23}\ molecules\ (CH_3CH_2CO_2)_2C_6H_4}{1\ mol\ (CH_3CH_2CO_2)_2C_6H_4}\times\frac{12\ atoms\ C}{1\ molecules\ (CH_3CH_2CO_2)_2C_6H_4}=4.44\times10^{17}\ atoms\ H$$

4) How many moles of $Ra(CN)_2$ are present if you have $8.34\text{x}10^{27}$ atoms of N

$$8.34\times10^{27}\ atoms\ N\times\frac{1\ mol\ N}{6.022\times10^{23}\ atoms\ N}\times\frac{1\ mol\ Ra(CN)_2}{2\ mol\ N}=6920\ mol\ Ra(CN)_2$$

OR

$$8.34\times10^{27}\ atoms\ N\times\frac{1\ molecule\ Ra(CN)_2}{2\ atoms\ N}\times\frac{1\ mol\ Ra(CN)_2}{6.022\times10^{23}\ molecule\ Ra(CN)_2}=6920\ mol\ Ra(CN)_2$$

5) How many atoms of hydrogen are there in $1.23\text{x}10^{-4}$ moles of Aspartame, $C_{14}H_{18}N_2O_5$

$$1.23\times10^{-4}\ mol\ C_{14}H_{18}N_2O_5\times\frac{6.022\times10^{23}\ molecules\ C_{14}H_{18}N_2O_5}{1\ mol\ C_{14}H_{18}N_2O_5}\times\frac{18\ atoms\ H}{1\ molecules\ C_{14}H_{18}N_2O_5}=1.33\times10^{21}\ atoms\ H$$

OR

$$1.23\times10^{-4}\ mol\ C_{14}H_{18}N_2O_5\times\frac{18\ mol\ H}{1\ mol\ C_{14}H_{18}N_2O_5}\times\frac{6.022\times10^{23}\ atoms\ H}{1\ mol\ H}=1.33\times10^{21}\ atoms\ H$$

6) Calculate the mass of $4.97\text{x}10^{24}$ molecules of sulfur dioxide. (Here is a curveball for you, but think about it and see if you can figure it out!)

$$4.97\times10^{24}\ molecules\ SO_2\times\frac{1\ mol\ SO_2}{6.022\times10^{23}\ molecules\ SO_2}\times\frac{64.07\ g\ SO_2}{1\ mol\ SO_2}=529\ g\ SO_2$$

NEXT SECTION

Like the last section, most of these can be done one of two ways. For time and space reasons, I am only putting on way on here, but convince yourself that it can be done the other way too…

1) What mass of rubidium is in $2.39\text{x}10^{20}$ molecules of Rb_2SO_4?

$$2.39\times10^{20}\ molecules\ Rb_2SO_4\times\frac{1\ mol\ Rb_2SO_4}{6.022\times10^{23}\ molecules\ Rb_2SO_4}\times\frac{2\ mol\ Rb}{1\ mol\ Rb_2SO_4}\times\frac{85.47\ g\ Rb}{1\ mol\ Rb}=0.0678\ g\ Rb$$

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

$$6.53\ kg\ NaHCO_3\times\frac{1\times10^3\ g\ NaHCO_3}{1\ kg\ NaHCO_3}\times\frac{1\ mol\ NaHCO_3}{84.01\ g\ NaHCO_3}\times\frac{1\ mol\ Na}{1\ mol\ NaHCO_3}\times\frac{6.022\times10^{23}\ atom\ Na}{1\ mol\ Na}=4.68\times10^{25}\ atom\ Na$$

3) What is the mass of iodine in $8.52\text{x}10^{20}$ molecules of CeI_3?

$$8.52\times10^{20}\ molecules\ CeI_3\times\frac{1\ mol\ CeI_3}{6.022\times10^{23}\ molecules\ CeI_3}\times\frac{3\ mol\ I}{1\ mol\ CeI_3}\times\frac{126.90\ g\ I}{1\ mol\ I}=0.539\ g\ I$$

4) How many oxygen atoms are in $1.2\text{x}10^{-3}$ grams of testosterone, $C_{19}H_{28}O_2$?

$$1.2\times10^{-3}\ g\ C_{19}H_{28}O_2\times\frac{1\ mol\ C_{19}H_{28}O_2}{288.47\ g\ C_{19}H_{28}O_2}\times\frac{2\ mol\ O}{1\ mol\ C_{19}H_{28}O_2}\times\frac{6.022\times10^{23}\ atom\ O}{1\ mol\ O}=5.0\times10^{18}\ atom\ O$$

5) What is the mass of a snowflake (think) containing $2.67\text{x}10^{19}$ atoms of hydrogen?

$$2.67\times10^{19}\ atoms\ H\times\frac{1\ mol\ H}{6.022\times10^{23}\ atoms\ H}\times\frac{1\ mol\ H_2O}{2\ mol\ H}\times\frac{18.02\ g\ H_2O}{1\ mol\ H_2O}=3.99\times10^{-4}\ g\ H_2O$$

6) How many nitrogen atoms in $1.05\text{x}10^{21}$ molecules of caffeine, $C_8H_{10}N_4O_2$?

$$1.05\times10^{21}\ molecules\ C_8H_{10}N_4O_2 \times \frac{1\ mol\ C_8H_{10}N_4O_2}{6.022\times10^{23}\ molecules\ C_8H_{10}N_4O_2} \times \frac{4\ mol\ N}{1\ mol\ C_8H_{10}N_4O_2} \times \frac{6.022\times10^{23}\ atoms\ N}{1\ mol\ N} = 4.20\times10^{21}\ atoms\ N$$

OR

$$1.05\times10^{21}\ molecules\ C_8H_{10}N_4O_2 \times \frac{4\ atoms\ N}{1\ molecules\ C_8H_{10}N_4O_2} = 4.20\times10^{21}\ atoms\ N$$

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 $5.13\text{x}10^{21}$ atoms of oxygen? The formula for Vitamin C is $C_6H_8O_6$.

$$5.13\times10^{21}\ atoms\ O \times \frac{1\ mol\ O}{6.022\times10^{23}\ atoms\ O} \times \frac{1\ mol\ C_6H_8O_6}{6\ mol\ O} \times \frac{176.14\ g\ C_6H_8O_6}{1\ mol\ C_6H_8O_6} = 0.250\ g\ C_6H_8O_6$$

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

$$5.98\times10^{23}\ atoms\ O \times \frac{1\ mol\ O}{6.022\times10^{23}\ atoms\ O} \times \frac{1\ mol\ Ca(C_2H_3O_2)_2}{4\ mol\ O} \times \frac{6\ mol\ H}{1\ mol\ Ca(C_2H_3O_2)_2} \times \frac{1.01\ g\ H}{1\ mol\ H} = 1.50\ g\ H$$

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

$$28.3\ mg\ CI_4 \times \frac{1\times10^{-3}\ g\ CI_4}{1\ mg\ CI_4} \times \frac{1\ mol\ CI_4}{519.61\ g\ CI_4} \times \frac{4\ mol\ I}{1\ mol\ CI_4} \times \frac{6.022\times10^{23}\ atoms\ I}{1\ mol\ I} = 1.31\times10^{20}\ atoms\ I$$