Summary of Topics

1. Isotopes / Parts of the atom
2. The mole, Avogadros #
3. Molar Mass, Molar Volume
4. Empirical & Molecular Formulas

Isotopes

- When neutrons change we have varying isotopes.
  - Mass #: P + N
  - Atomic #: P

Helium atom, 1 Neutron

Atomic # = 2

Mass #: 3

Ex What element has a mass # of 18 and 8 neutrons?

M # = 18
- 8
10 P

A # = 10 (Neon) $^{18}_{10}Ne$

Avg Atomic Mass:

Avg Mass = (mass$_1$)(%$_1$) + (mass$_2$)(%$_2$)

2 Types of Problems
- Find Avg Mass
- Find Abundances

Ex: Using the table below, determine the avg. atomic mass:

Isotope	Mass	% abundance
H-1	1.01 u	89.4 %
H-2	2.02 u	6.6 %
H-3	1.97 u	4.0 %

Avg Mass = (1.01u)(0.894) + (2.02u)(0.066) + (1.97u)(0.040)

= 0.9029 + 0.133 + 0.0798

= 1.12 u

The avg. mass of an isotope is 19.47u. The mass of each isotope is 19.01u and 21.91 u. Determine the % abundance of each.

Isotope 1 = 84%
Isotope 2 = 16%

② The mole & Avogadro's

N
n | N_A

"molecules"
"atoms"

C_3H_8

- 1 molecule
- 2 atoms

1 molecule
- 11 atoms
- 3 C atoms
- 8 H atoms

Ex A sample of hexane, C_6H_{14}, contains 3.0 mol of hexane.

a) How many molecules are in the sample?

$N = n \cdot N_A = (3.0 mol)(6.02 \times 10^{23} \frac{molecules}{mol})$

$= 1.8 \times 10^{24}$ molecules of Hexane.

b) How many carbon atoms are in the sample?

Molecule: C_6H_{14}
- 6 carbon atoms
- 14 hydrogen atoms
- 20 atoms in total

Carbon Atoms = 1.8×10^{24} molecules $\times \frac{6 \text{ carbon atoms}}{1 \text{ molecule}}$

Ex The chemical Ozone, O_3, is in a sample of air. The air contains 4.91×10^{20} atoms of oxygen.

a) Find the # of Ozone molecules.

b) Find the moles of ozone.

molecule = O_3
- 3 atoms in 1 molecule

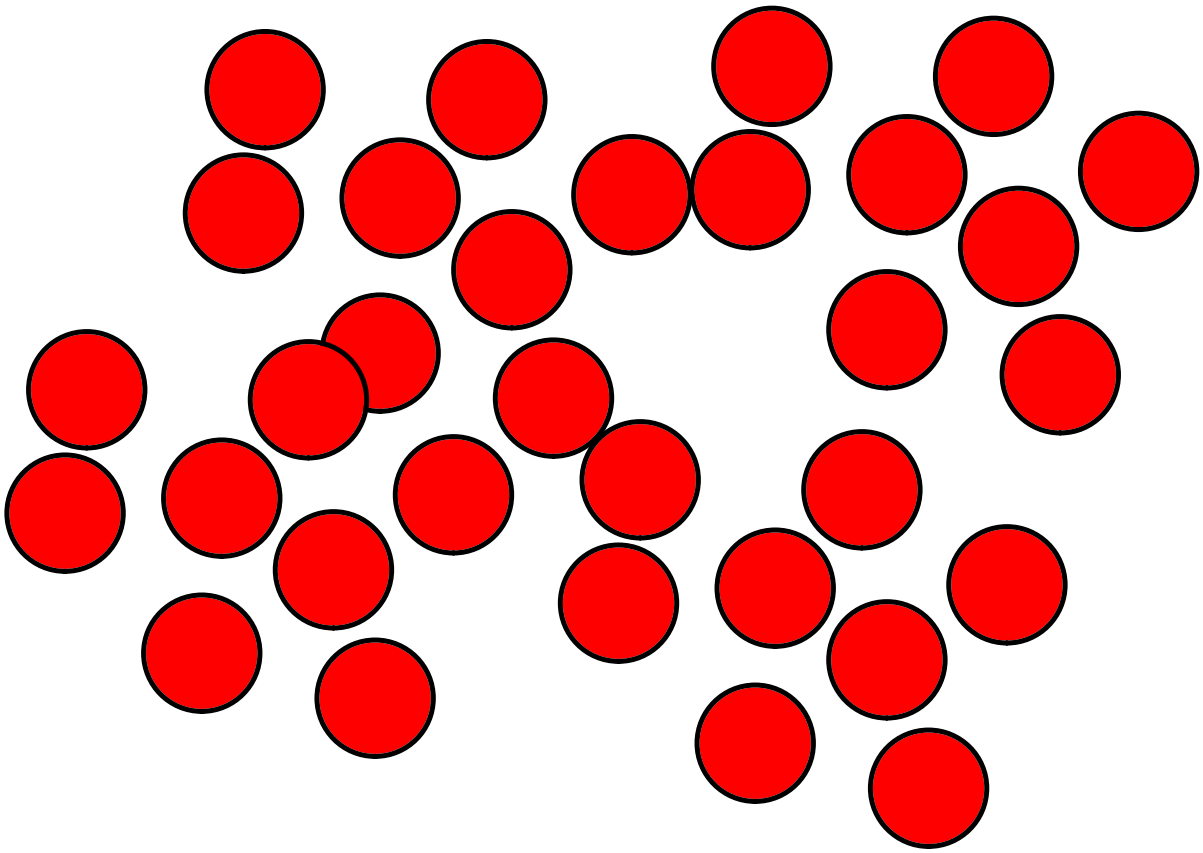
a) 4.91×10^{20} atoms ÷ 3

1.64×10^{20} molecules of Ozone

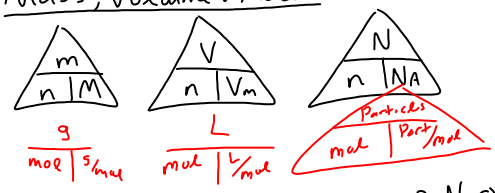
b) $n = \frac{N}{N_A} = \frac{(1.64 \times 10^{20}) \text{ molecules}}{(6.02 \times 10^{23}) \text{ molecules/mol}}$

$= 0.000272$ mol O_3

2.72×10^{-4}



Mass, Volume & Moles:



Ex For a 3.04 mol sample of N_2O Find the:

a) mass (134 g)

(68.1L) b) Volume at STP (22.4L/mol)

1.83×10^{24} molecules c) Number of N_2O molecules

5.49×10^{24} atoms d) Number of atoms

N_2O

c) $N = n \times N_A$

$= 1.83 \times 10^{24}$ molecules

d) $1.83 \times 10^{24} \times 3 = 5.49 \times 10^{24}$ atoms

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Empirical & Molecular Formulas

% Composition:

Ex $C_5H_{10}O$

① Find M for compound

5(12.01 g/mol)
+ 10(1.01 g/mol)
+ 1(16.00 g/mol)
86.15 g/mol

② Divide mass of element by M

C: $\frac{60.06 \text{ g/mol}}{86.15 \text{ g/mol}} \times 100\% = 69.7\%$

Determining EF:

17.6% Na, 39.7% Cr, 42.8% O

① Assume 100 g

② Find moles of each $n = \frac{m}{M}$

③ Divide by lowest mole value

$Na_2Cr_2O_7$

For Mol. Formulas you need:

① An empirical formula

② Molar Mass of MF.

A compound with an EF of CH_2O has a molar mass of 180.18 g/mol. What is its MF?

$\frac{\text{Molar Mass MF}}{\text{Molar Mass EF}}$

$\frac{180.18}{30.03} = 6$

$(CH_2O) \times 6 = C_6H_{12}O_6$

EF: CH_2O
1(12.01)
+ 1(16.00)
+ 2(1.01)
30.03 g/mol

Attachments

Tutorial for SMART Response 2013.notebook