Name, Date, Hour: 2/23/15

The Mole

I Can… determine molar mass + convert units (moles → grams → molecules)

Key Vocabulary:

Science Starter:
Using your conversions, what is 6.26 cm equivalent to in nm? ($\times 10^{-2}$, $\times 10^{9}$)

$6.26 \times 10^{-2} = 0.0626$ m

$0.0626 \times 10^{9} = 62,600,000$ nm

Box 1:

- Counting units are simply a name given to a set number of items.
    - When you look at eggs, they come in a dozen. A dozen is 12.
    - What are some other units that you can think of?

Why do we use the mole? Not a unit like dozen, pair, ream, etc?

Box 2

•1 dozen cookies = 12 cookies
•1 mole of cookies = 6.02×10^{23} cookies
•1 dozen cars = 12 cars
•1 mole of cars = 6.02×10^{23} cars
•1 dozen Al atoms = 12 Al atoms
•1 mole of Al atoms = 6.02×10^{23} atoms

Note that the NUMBER is always the same, but the MASS is very different!

Special Relationships!!!

1. It is a counting unit.
   1 mole = 6.02×10^{23} things
2. It connects mass the counting unit.
   one aluminum atom masses 26.98 amu, but if you have a mole of them, the mass is 26.98 g.
   In a mole of S, the mass would be 32.06.
   In a mole of S, there would be 1 S atoms.

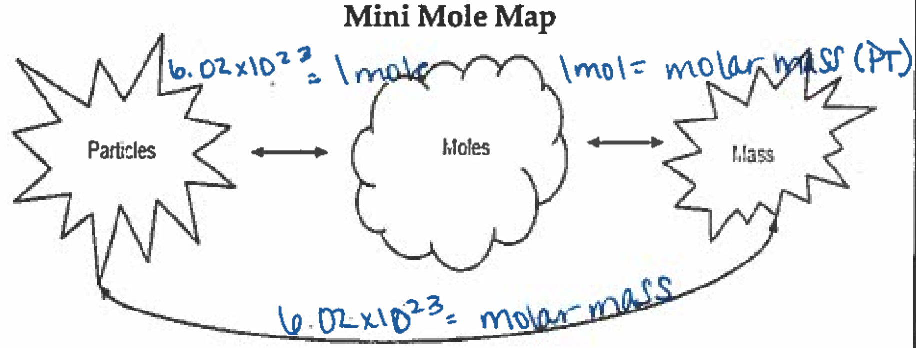
Box 3

Molecular mass: a single molecule measured in amu's instead of grams.

Molar Mass: the mass of a mole of items

Formula Mass: the mass of all molecules in a compound

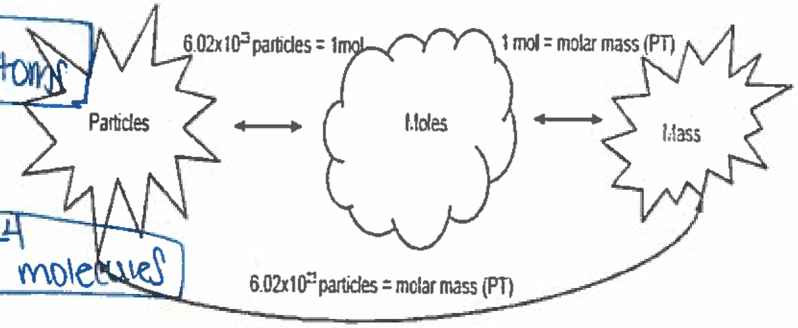
Mini Mole Map



Box 4

How many atoms of carbon does it take to equal 23.5 g?

$\frac{23.5\,g}{} \left| \frac{1\ mole\ C}{12.01\,g} \right| \frac{6.02 \times 10^{23}\ atoms}{1\ mole} = 1.17 \times 10^{24}$ atoms



How many molecules of carbon monoxide gas does it take to equal 50.0 g?

12.01g + 15.99g = 28.0g (1 mole of CO)

$\frac{50.0\,g}{} \left| \frac{1\ mole\ CO}{28.0\,g} \right| \frac{6.02 \times 10^{23}\ molecules}{1\ mole} = 1.075 \times 10^{24}$ molecules

Consider 210 g of N_2O_5. How many molecules are present?

14g x 2 = 28g
16g x 5 = 80g
1 mole N_2O_5 = 108g

$\frac{210\,g}{} \left| \frac{1\ mole\ N_2O_5}{108\,g} \right| \frac{6.02 \times 10^{23}}{1\ mole} = 1.17 \times 10^{24}$ molecules

Box 5

If you exhale 7.25 x 10^{24} molecules of CO_2…

a) How many moles of CO_2 do you exhale?

$\frac{7.25 \times 10^{24}\ molecules}{} \left| \frac{1\ mole}{6.02 \times 10^{23}\ molecules} \right. = 12.04\ moles\ CO_2$

b) How many grams of CO_2 do you exhale? (Hint: find how many grams are in a mole by finding the molar mass of CO_2. Use this as a conversion factor.)

(16x2) = 32 + 12.01 = 44g / 1mole CO_2

$\frac{12.04\ mol}{} \left| \frac{44.00\,g}{1\ mol} \right. = 529.9\,g\ CO_2$

Box 6

In a bag full of pennies, you may have 2.15 moles of copper. 1mol Cu = 63.54g

a. How many grams do you have?

$\frac{2.15\ moles}{} \left| \frac{63.54\,g}{1\ mole} \right. = 136.6\,g\ Cu$

b. How many atoms of Cu do you have?

$\frac{2.15\ moles}{} \left| \frac{6.02 \times 10^{23}\ atoms}{1\ mole} \right. = 1.29 \times 10^{24}$ atoms