Name:_____
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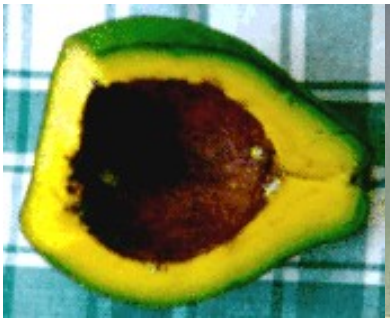
Chemistry 11
Calculating Molar Mass

Atoms are so small that in order to calculate mass, we will need a large number of them. Amedeo Avogadro **(1776 - 1856)**, a famous lawyer-turned-mathematician-physicist, concluded that **1 mole of a substance** is the number of atoms of ^{12}carbon in 12 grams of ^{12}carbon. Scientists have now calculated that the number of atoms in 12.0 grams of carbon was 6.02×10^{23} atoms. This became known as "Avogadro's Number".
Note: the picture on the left is NOT Avogadro – the picture on the right is!




HOW BIG IS A MOLE?

- **A mole of marbles spread over the Earth's surface would cover it to a depth of 80km!**
- **If you spent one billion dollars a day, you couldn't spend a mole of dollars in a trillion years!**
- **A mole of Coke cans would cover the surface of the earth to a depth of over 450km!**
- **If you had a mole of unpopped popcorn kernels, and spread them across the United States of America, the country would be covered in popcorn to a depth of over 15km!**
- **If we were able to count atoms at the rate of 10 million per second, it would take about 2 billion years to count the atoms in one mole!**

Molar Mass – the amount of mass (g) per mole of substance (units are **g/mol**)
Molar mass is calculated by using the mass values on the Periodic Table.
Look for the atomic mass and multiply by the number of atoms in the element or compound, then add the values together. Always expressed the answer to one decimal place with the units **g/mol.**
For example: H_2O
2 H = 2 (1.0) = 2.0
1 O = 1 (16.0) = 16.0
18.0 **g/mol H_2O**

Types of Molar Mass calculations:

There are 3 types of calculations that you will have to be able to do:

a. **molar mass** – you can do that now! (Remember: Periodic Table)
b. **number of moles** of a substance (when given the mass in g)
c.**the mass** of a substance (when given the number of moles)

Example B:

How many **moles** are in 200.0 g of NaOH?

First calculate the molar mass of NaOH

1 Na = 1 (23.0) = 23.0
1 O = 1 (16.0) = 16.0
1 H = 1 (1.0)= 2.0
40.0 g/mol NaOH

Then set up your expression to allow for unit conversions:

200. 0 g NaOH	1 mole NaOH	= 5.00 moles NaOH
	40.0 g	

Example C:
If you have 0.25 mol of calcium hydroxide, how many **grams** of calcium hydroxide would you have? (ie calculate **MASS (g)**

First calculate the molar mass of $Ca(OH)_2$

calcium hydroxide = $Ca(OH)_2$
1 Ca = 1 (40.1) = 40.1
2 O = 2 (16.0) = 32.0
2 H = 2 (1.0)= 2.0
74.1 g/mol $Ca(OH)_2$

Then set up your expression to allow for unit conversions:

0.25 mol $Ca(OH)_2$	74.1 g	= 19 grams $Ca(OH)_2$
	1 mole $Ca(OH)_2$	

Molar mass calculations

PART A: Calculate the molar mass of the following compounds.

1. CO_2

2. $SrCl_2 \cdot 4H\ O$

3. NH_4NO_3

4. PbO

5. Chromium II sulphate

6. phosphoric acid

7. zinc fluoride trihydrate

8. carbon dioxide

PART B: Calculate the mass (g) for the following substances.

1. 1.5 mol of sodium phosphate

2. 1.25 mol of iodine gas

3. 20.0 mol of phosphorus atoms (remember how to write phosphorus!)

4. 0.15 mol of barium chloride dihydrate

5. 0.0020 mol of nitrogen gas

PART C: Calculate the number of moles (mol) in each of the compounds.

1. 4.8 g of aluminum

2. 485 g of oxygen gas

3. 3.0 g of silver bromide

4. 34.0 g of sodium phosphate

5. 100.0 g of Cobalt II Chloride hexahydrate molecules