A NEW UNIT OF MEASURMENT THE MOLE

6.02 x 10²³



ATOMS ARE REALLY SMALL!!

•We can't work with individual atoms or amu's in the LAB

• Because we can't see things that small





•A counting unit

Similar to a dozen, except instead of 12, it's 602 billion trillion

602,000,000,000,000,000,000,000

o6.02 X 10²³ (in scientific notation)



Avogadro's Number

o Amedeo Avogadro 1776 – 1856

• The number of atoms in 1 mole



JUST HOW BIG IS A MOLE?



- Enough soft drink cans to cover the surface of the earth to a depth of over 200 miles.
- If you had Avogadro's number 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 9 miles.
- 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.

THE MOLE

- 1 dozen cookies = 12 cookies
 1 mole of cookies = 6.02 X 10²³ cookies
- 1 dozen cars = 12 cars
 1 mole of cars = 6.02 X 10²³ cars
- 1 dozen Al atoms = 12 Al atoms
 1 mole of Al atoms = 6.02 X 10²³ atoms

The NUMBER is always the same, but the MASS is very different!

MOLAR MASS

• The Mass of 1 mole (in grams)

- Equal to the numerical value of the average atomic mass (get from periodic table)
 - **1 mole of C atoms** = 12.0 g
 - **1 mole of Mg atoms** = 24.3 g
 - 1 mole of Cu atoms = 63.5 g

LEARNING CHECK!

Find the molar mass (usually we round to the tenths place)

A.1 mole of Br atoms = 79.9 g/mole B.1 mole of Sn atoms = 118.7 g/mole

A MOLE OF PARTICLES CONTAINS 6.02 X 10²³ PARTICLES

- 1 mole C = 6.02×10^{23} C atoms
- 1 mole $H_2O = 6.02 \times 10^{23} H_2O$ molecules
- 1 mole NaCI = 6.02 x 10²³ NaCI compounds

6.02 x 10²³ Na⁺ ions and 6.02 x 10²³ Cl⁻ ions MOLAR MASS OF MOLECULES & COMPOUNDS Add up the mass for each part of the molecule

1 mole of CaCl_2 = 1 Ca + 2 Cl

Ca = 40.1 g/mol Cl = 35.5 g/mol 1Ca + 2Cl =

(1*40.1) + (2*35.5) = 111.1 g/mol

Molar Mass of $N_2O_4 = ?$ N = 14.0 g/mol O = 16.0 g/mol 2N + 4O =(2* 14.0) + (4*16.0) = 92 g/mol

LEARNING CHECK! A. Molar Mass of $K_2O = ?$ Grams/mole 2K + 1 O K = 39.1 g/mol O = 16 g/mol $(2^* 39.1 \text{g/mol}) + (1^*16.0 \text{g/mol}) = 94.2 \text{g/mol}$

B. Molar Mass of antacid $AI(OH)_3 = ?$ 1AI + 3 O + 3H AI = 27.0 g/mol O = 16 g/mol H = 1.0 g/mol (1* 27.0g/mol)+(3*16.0g/mol) + (3*1.0)= 78g/mol