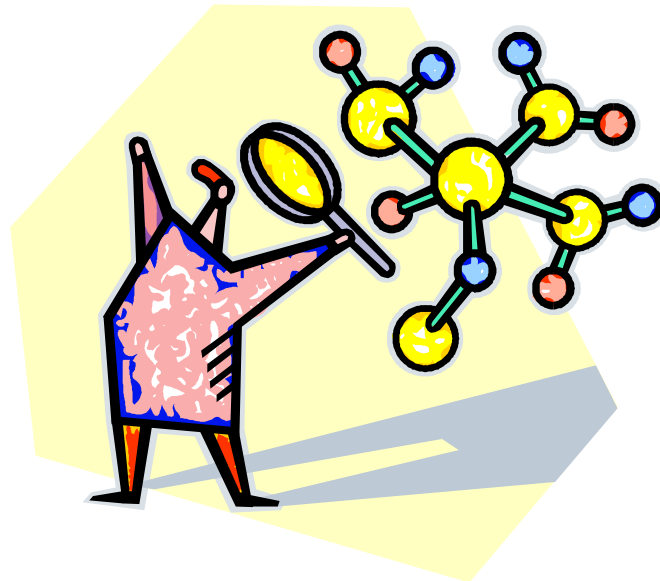# TARGET:
I CAN CONVERT FROM MOLES ←→ GRAMS

A NEW UNIT OF MEASURMENT THE MOLE

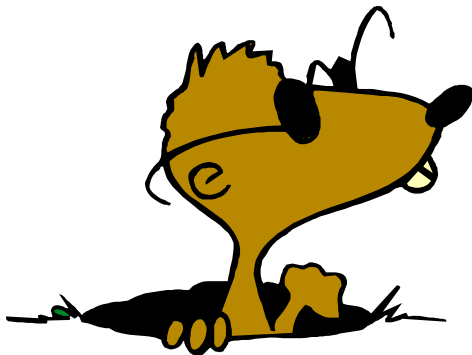$$6.02 \times 10^{23}$$
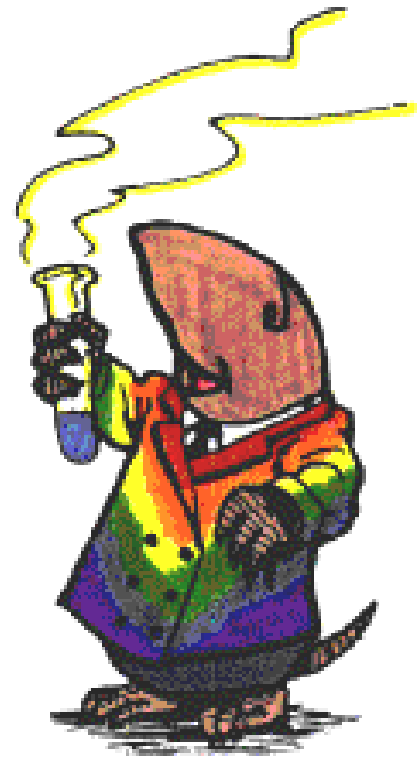
ATOMS ARE REALLY SMALL!!

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

- Because we can't see things that small

THE MOLE

- A counting unit

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

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

Avogadro's Number

o **Amedeo Avogadro 1776 – 1856**

o **The number of atoms in 1 mole**

Just How Big is a Mole?

- Soda cans to cover the surface of the earth over 200 miles deep.

- Avogadro's number of unpopped popcorn kernels spread across the USA…over 9 miles deep.

- Count atoms at the rate of 10 million per second, it would take about 2 billion years to count the atoms in one mole.
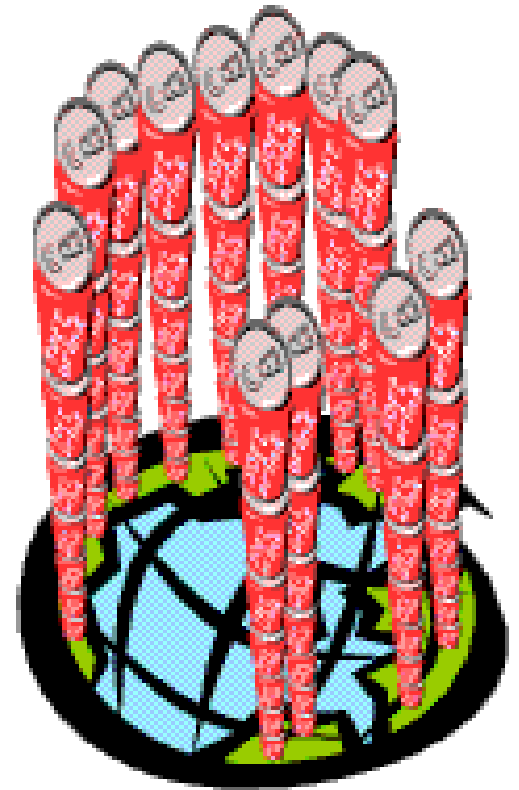
COUNTING VERSUS WEIGHING!

- **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**

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

MASS OF AN ATOM

- **TINY TINY TINY!!!! -** USE A SPECIAL UNIT:

> **Atomic mass unit = "amu"**
>
> **1 amu = $1.66053892 \times 10^{-24}$ grams**

1 atom of H = 1 amu

1 atom of C = 12.01 amu

1 atom of O = 16 amu

- **How much does a mole of something weigh???**

1 mole of C atoms   =   12.0 g

1 mole of Mg atoms   =   24.3 g

1 mole of Cu atoms   =   63.5 g

MOLAR MASS - **HOW MANY GRAMS PER MOLE?**

Molar Mass of C = 12.01 g/mol

Molar Mass of Mg = 24.3 g/mol

THE CONVERSION FACTOR VERSION!

Like saying 12in/ft

LEARNING CHECK!

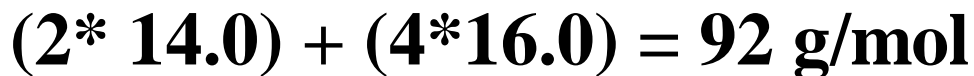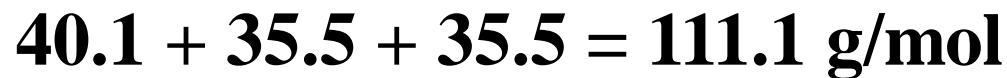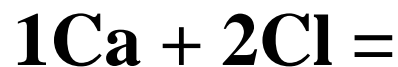**Find the molar mass**

(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**

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 =

40.1 + 35.5 + 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* 39.1g/mol)+(1*16.0g/mol) = 94.2g/mol

B. **Molar Mass** of antacid $Al(OH)_3$ = ?

1Al + 3 O + 3H

Al = 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

A MOLE OF PARTICLES

CONTAINS 6.02×10^{23} PARTICLES

1 mole C $\quad = \quad 6.02 \times 10^{23}$ C atoms

1 mole $H_2O \quad = \quad 6.02 \times 10^{23}$ H_2O molecules

1 mole $CaCl_2 = \quad 6.02 \times 10^{23}$ $CaCl_2$ compounds

6.02×10^{23} Ca^{2+} ions and

1.204×10^{24} Cl^- ions

The Mole is a Unit Song

https://www.youtube.com/watch?v=1R7NiIum2TI