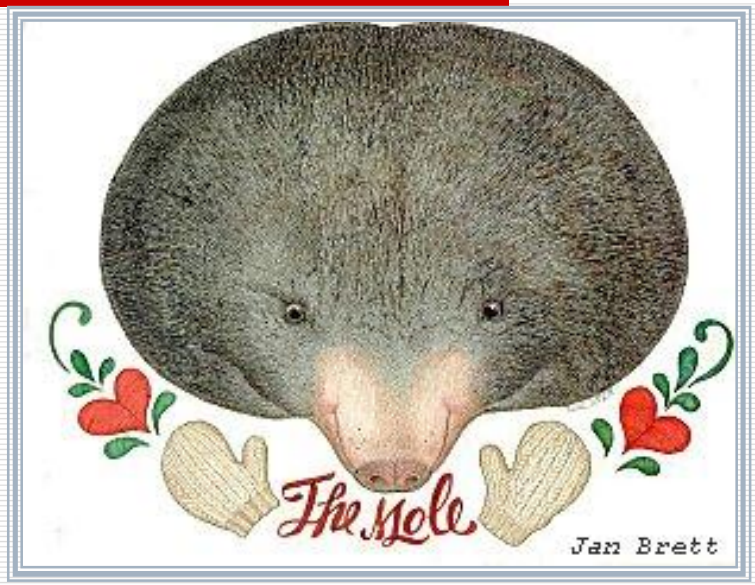
The Mole

So what is a mole?

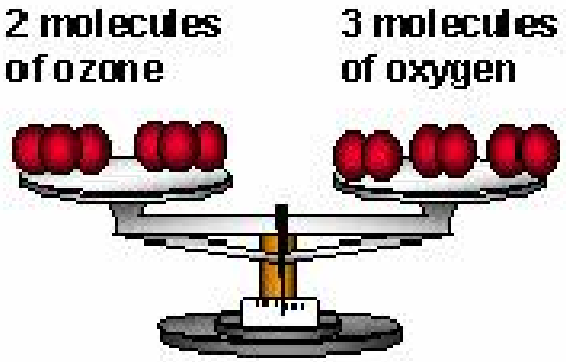


Not a furry creature

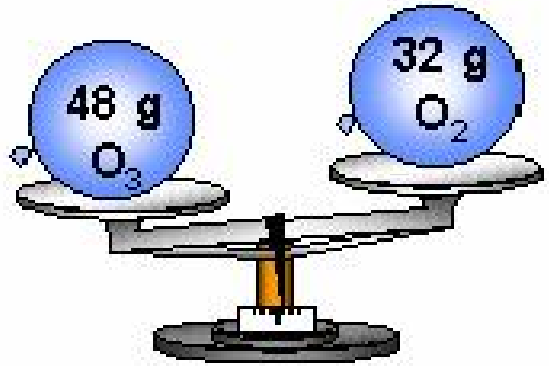
Not a naked rat

Not a dark spot on your skin

Amount of Substance



same mass
different amounts of substance



different mass
same amount of substance

A mole is a number of something

Like……

A Dozen is 12 of something

A Gross is 144 ……..

A Ream is 500 ……..

A Baker's Dozen is 13 …….

A Mole is 6.02×10^{23} ……..

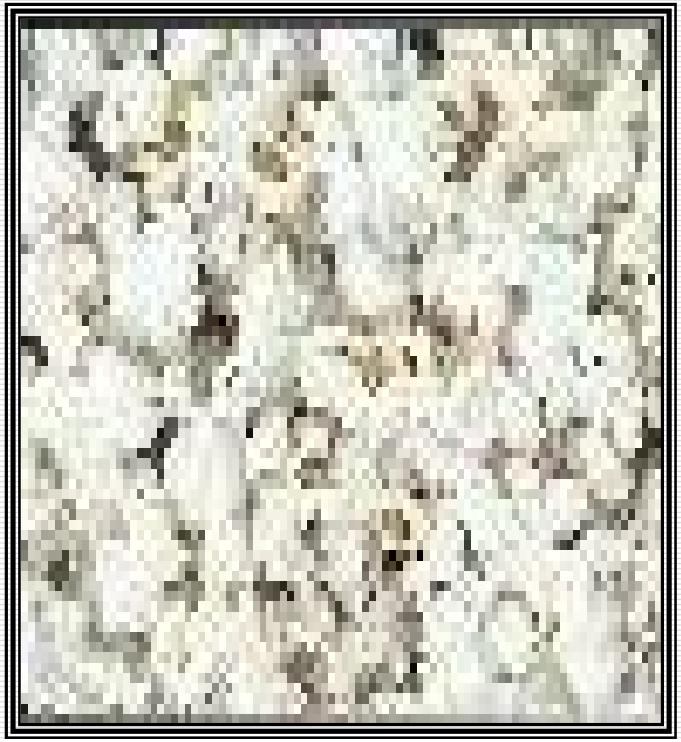
A Big Number

A Mole is just a very,very, **BIG NUMBER**

A Mole of Coke Cans

An Avogadro's number of standard soft drink cans would cover the surface of the earth to a depth of over 200 miles.

Imagine Popped Popcorn

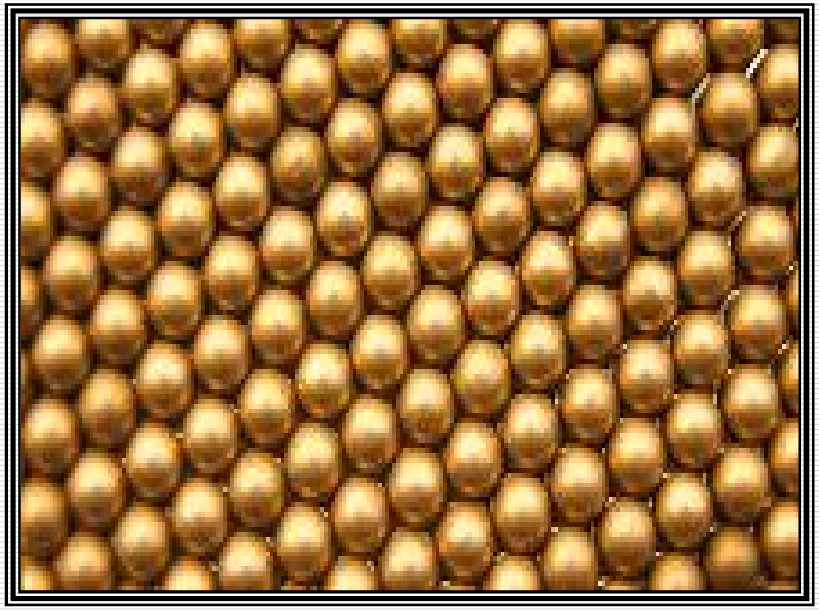


If you had Avogadro's number of unpopped popcorn kernels,

and spread them across the United States of America,

the country would be covered in popcorn to a depth of over 9 miles.

Do You Have Time?



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.

Avogadro's Principle

Equal volumes of all gases at the same temperature and pressure contain the same number of molecules.

One mole at STP has a volume of 22.4 L.

Avogadro's Number

The number of molecules in one mole is now called **Avogadro's number**.

BUT

Avogadro had no knowledge of the MOLE

Nor of the Magnitude of the Number

Moles and molar mass came later…..after the Periodic Table was "discovered"

6.02×10^{23}.....

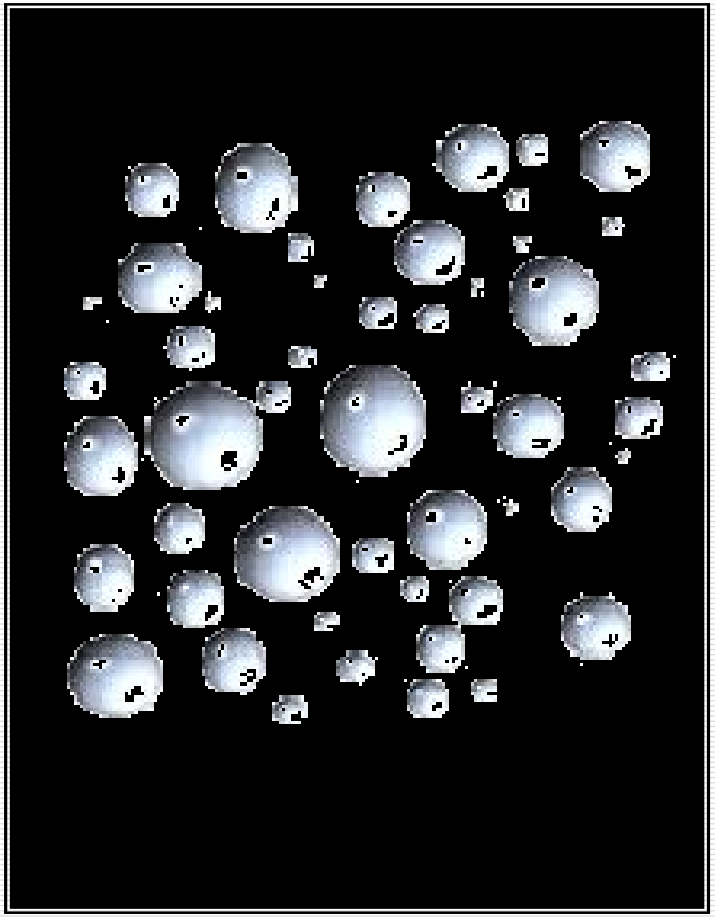
The number was never actually determined by Avogadro.

The "counters" just named the number after him!!!

If you want to know HOW TO COUNT the number…go to http://avogadro.che.hw.ac.uk/avoga.html

Compound	Molar Mass g	Particles in 1 Mole	Mass of 2 moles g	Particles in 2 moles	Mass of 0.5 Moles g	Particles in 0.5 moles
H_2O						
NaCl						

Raindrops: How many Moles



50 grams H_2O

How many moles H_2O

(2.78 moles H_2O)

How many H_2O molecules?

1.66×10^{24} molecules H_2O)

Some Problems

Determine the number of grams in 1 mole Antimony

121.80 g Sb

Determine the number of grams in 1 mole glucose ($C_6H_{12}O_6$)

180.12 g glucose

More Problems

Determine the number of moles in 107.87 g Silver

(This is very easy)

1 mole Ag

Determine the number of molecules in 1 mole glucose

(This is also easy)

6.02×10^{23} molecules glucose

MORE !!!

Determine the number of atoms in 21.62 g Boron

1.24×10^{24} atoms B

Determine the number of molecules in 12.00 moles water

7.22×10^{24} molecules H_2O

Even More !!!

Determine the number of moles in 58.45 g Sodium

2.54 moles Na

Determine the number of molecules in 0.25 moles NaCl

1.51×10^{23} molecules NaCl

This One Is Tricky

Determine the mass of 1 molecule of oxygen gas.

$$\frac{32.00\text{g } O_2 \;/\; 1 \text{ mole } O_2}{\text{mole } O_2 \;/\; 6.02 \times 0^{23} \text{ molecules } O_2}$$

5.32×10^{-23} g/molecule O_2

Some Rules

Mass to Moles~~~Divide by Molar Mass

Moles to Mass~~~Multiply by Molar Mass

Moles to Particles~~Multiply by Avogadro's Number

Particles to Moles~~Divide by Avogadro's Number

Two Steps !!

Grams to Particles

Divide by Molar Mass and Multiply by Avogadro's Number

Particles to Grams

Divide by Avogadro's Number and Multiply by Molar Mass

Sources

http://www.janbrett.com/postcards/1cardpick_mitten.html

http://avogadro.che.hw.ac.uk/avoga.html

http://antoine.frostburg.edu/chem/senese/101/tutorials/index.shtml

http://24.225.17.65/Math/count/num6.htm