

Science Starter

Using your conversions, what is 6.26 cm equivalent to in nm?



The Mole

Arbor Prep Chemistry

Counting Units

- 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?

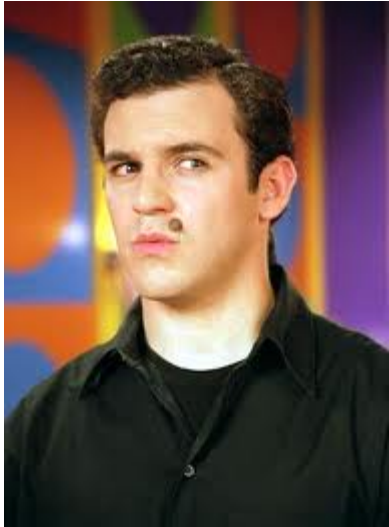


Chemistry and Moles

- In chemistry, the individual particles are so small, we need a counting unit to describe them.
 - For example, there are more atoms in one gram of salt than grains of sand on all the beaches of all the oceans in all the world. How could we measure something so small? Our world requires much more massive measurements.
- But what 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 is abbreviated as mol. NEVER M or m. Don't do it. :)

Moles-Another Counting



- 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!**

So...why do we care?!?!??

- The unit the mole was not just picked, it was actually measured.
- Amedeo Avogadro found the relationship that held true with a mole of atoms made the atomic mass that mass in units of grams.
 - 1 C-12 atom has a mass of 12.01 amu
 - 1 mole of C-12 atoms masses 12.01 g.



Recap-The Mole is Special Because...

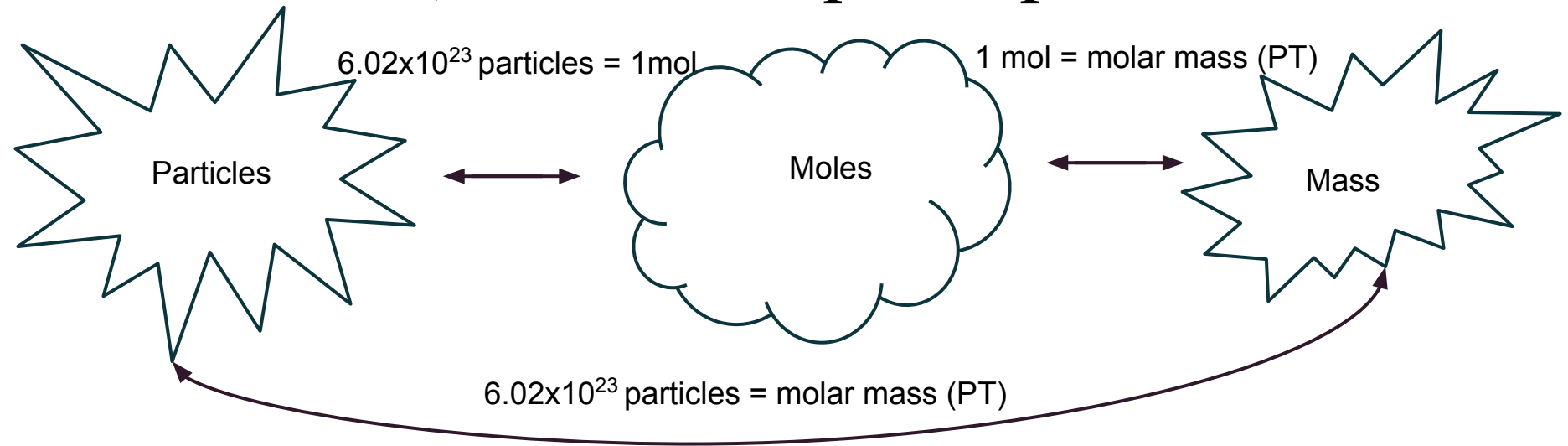
1. It is a counting unit.
 - a. a mole of items = 6.02×10^{23} things
2. It connects mass the counting unit.
 - a. one aluminum atom masses 26.98 amu, but if you have a mole of them, the mass is 26.98 g.
 - b. In a mole of S, the mass would be _____.
 - c. In a mole of S, there would be _____ S atoms.

Common Terms With The Same Meaning

- **Molecular Mass/Formula Mass:** If you have a single molecule (covalent) or a single formula unit (ionic), which is measured in amu's instead of grams.
- **Molar Mass:** This is the mass of a mole of items.
- **THE POINT:** You may hear all of these terms which mean the *SAME NUMBER*... just different units

Using the Mole

Since we know the two connections that the mole makes, we can set up a map.



Mole Conversion Practice

1. How many atoms of carbon does it take to equal 23.5 g?
2. How many molecules of carbon monoxide gas does it take to equal 50.0 g?
3. Consider 210 g of N_2O_5 . How many molecules are present?

Your Turn

If you exhale 7.25×10^{24} molecules of CO_2 ...

a) How many moles of CO_2 do you exhale?



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.)

STAMP IT!

In a bag full of pennies, you may have 2.15 moles of copper.

a. How many grams do you have?

b. How many atoms of Cu do you have?

