The Mole

Get a clicker!
What's a zarg? and What's a mole?

• The "zarg" was an imaginary **unit** that measured the amount of matter in a sample of rice (R), beans (B), and lentils (L)
  > 1 zarg = _________ particles.
  > In the activity, how could you figure out the # of zargs or # of particles *without counting each particle*?
  > Did 1 zarg of particles have the same mass for R, B, and L? Why or why not?
The Mole

- A **mole** is a unit used to measure amount of atoms, molecules, ions, etc. *(particles that are very small, but can be applied to other things)*
- Abbreviated as mol
- 1 mole = $6.022 \times 10^{23}$ particles *(Avogadro's number)*

- Example 1:
  - 2 mol C = _____ atoms C
  - 0.5 mol H$_2$O = _____ molecules H$_2$O
  - $18.066 \times 10^{23}$ atoms Na = _____ mol Na
The Mole

• Remember in the zarg, 1 zarg of R, B, and L had different masses because each particle had a different mass. The same concept applies to atoms as well.
• 1 mole of atoms has a mass equal to the average mass in grams of an element on the periodic table (molar mass)

Example: 1 mole of H has a mass of 1.01 g
1 What is the mass in grams of 1 mole of sulfur?

A 16 g
B 2.5 g
C 32.07 g
D 10.1 g
2 What is the mass in grams of 1 mole of Neon

A 16 g
B 58.69 g
C 1 g
D 20.18 g
Example 2:

- 2 mol of Ni = _______ g
- 4.1 mol of Be = _______ g

- Which one has more mass: 1 mol of Ar or 1 mol of Xe?
- What is the mass of 0.7 mol of Au?
What about the mass of 1 mole of a compound?

- The molar mass for a compound is equal to the sum of the molar mass for the atoms that make up the compound.
- Example 3: Molar mass of H₂O and CH₄
Example 4:

• 1 mole of NaCl = ______g

• 2 mole of NaCl = ______ g

• What is the mass of 1 mole of CuCl₂

• What is the mass of 0.5 mole of CuCl₂

• What is the mass of 1.3 mole of NaCl?
Dimensional Analysis

- We can use **dimensional analysis** to convert between moles, mass, and # of particles.
- Allows you to change from one unit to another.
- Remember, just because you change the unit, the amount doesn't change.
- How to do unit conversions via dimensional analysis:
  1. Set up an equality from the unit you have to the unit you want.
  2. Set up the equality as a fraction so that the unit you have is on the bottom, and the unit you want is on top.
  3. Multiply the measurement with the fraction. **Units should cancel.**
3 If you want to convert from moles to grams, what conversion factor do you use?

A molar mass

B avogadro's number
Example 5:

• $4.3 \text{ g F} = \underline{\text{____}} \text{ moles F}$

• $0.889 \text{ mol Na} = \underline{\text{____}} \text{ atoms of Na}$

• $5.4 \times 10^{23} \text{ atoms of Cl} = \underline{\text{____}} \text{ moles of Cl}$
4 What is the mass in grams of 2 moles of helium?

A 4.00 g
B 8.00 g
C 13.11 g
D 2.00 g
5 How many atoms of zinc are in 20 g of zinc?

A 1.84 x 10^23
B 8.0 x 10^22
C 1.0 x 10^7
D 2.1 x 10^1