The Mole
The Basics

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Presented by
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The mole

"A mole is defined as the amount of substance that contains the same number of specified particles as there are atoms in 12 g of carbon-12."

From Heineman Chemistry 1 (Lukins et al)

Avogadro's number (N_A):

1 mole contains 6.02×10^{23} particles

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The mole

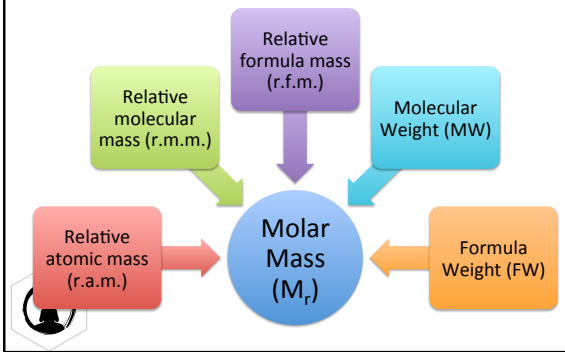
"A mole is defin… …bstance that c… …d partic… …s et al)

WHAT THE…?

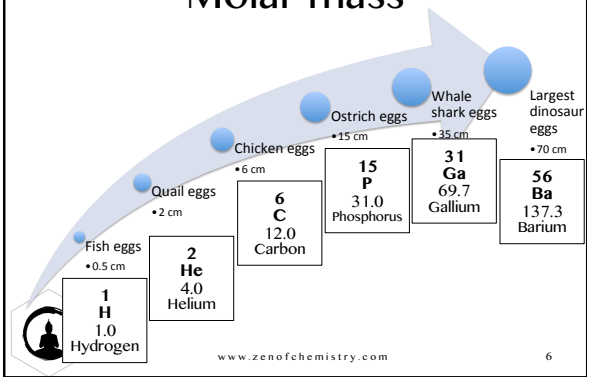
Avoga…

1 mole contains 6.02 x 10^{23} particles

Molar Mass



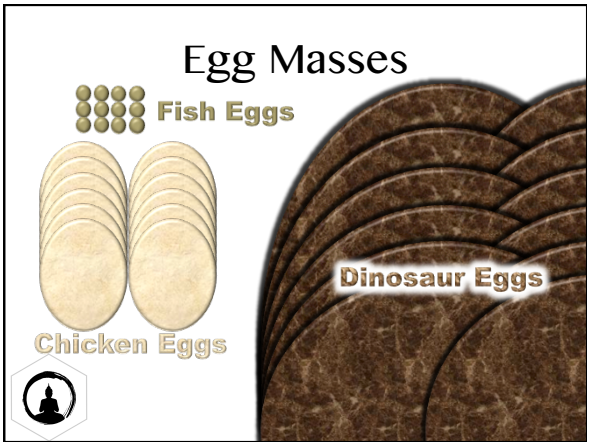
Molar mass



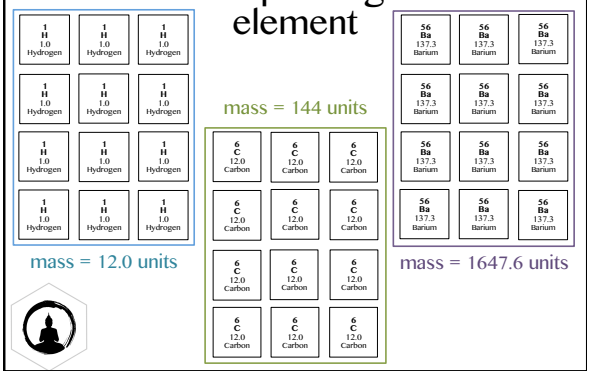
Egg Masses

...for the purposes of the example, let's assume that all eggs came in dozens (i.e. 12 eggs)

Egg Masses

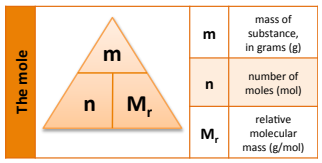


1 dozen atoms have different masses depending on the element



Molar Mass

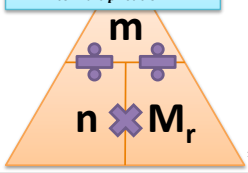
- The mass of 1 mol of atoms/molecules/particles
  1 mol is NOT a dozen particles but 6.02 x 10^{23} particles!!
  602,000,000,000,000,000,000,000
- Units: grams per mol (g/mol)



How to use equation triangles:

1. Write down the term you wish to calculate (e.g. n =).
2. Cover the term you wish to calculate with your hand.
3. What remains is your equation on the other side of the = sign, working from the top down and/or left to right, and include all multiplication/division signs linking the two remaining terms.
4. The three equations derived from this triangle are:
   - $n = m \div M_r$
   - $m = n \times M_r$
   - $M_r = m \div n$

The horizontal line corresponds to division; the vertical line corresponds to multiplication.



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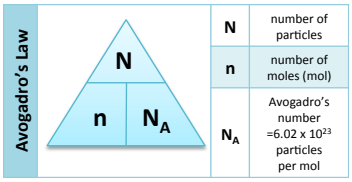
Avogadro's Number

Eggs

- 1 dozen eggs = 12 eggs
- ½ dozen eggs = 6 eggs
- 2 dozen eggs = 24 eggs
- 3 dozen eggs = 36 eggs

Moles

- 1 mole atoms = 6.02 x 10^{23} atoms
- ½ mole atoms = 3.01 x 10^{23} atoms
- 2 moles atoms = 12.04 x 10^{23} atoms
- 3 moles atoms = 18.06 x 10^{23} atoms



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Empirical & Molecular Formulae

Molecular formula:
Exact number of atoms in a molecule

e.g. Ethane: C_2H_6
M = 30 g/mol

e.g. glucose: $C_6H_{12}O_6$
M = 180 g/mol

Empirical formula:
Lowest whole number ratio of atoms in a molecule

e.g. Ethane: CH_3
M = 15 g/mol

e.g. glucose: CH_2O
M = 30 g/mol

Percentage by mass

$$\% \text{ by mass} = \frac{\text{mass of one component}}{\text{mass of the total}} \times 100\%$$

This can be used for:
- % w/w
- % yield
- % by mass of one element in a compound
- % by mass of water

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