The Mole

- What is a mole?
- A mole is simply a very large number of "things"
- Also known as Avogadro's number
- In the same way that 1 pair = 2 things, 1 dozen = 12 things, and 1 mole = 6.022×10^{23} things

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How big is a MOLE?

mole of rice grains: would cover the earth to depth of 75 meters

mole of hockey pucks: would be equal to mass of the moon

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mole of basketballs: would need a ball bag the size of the earth

mole of raindrops: would fill a pool 50 m to a depth of 280 times the distanc of the earth from the sun

Click here:

And yet….1 mole of water molecules = 18 mL

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A mole is such a large number because atoms (and molecules and formula units) are so small!

In order to be able have useful masses in the lab, we have to use moles of substances (which can be converted into grams)

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Atomic mass: mass of an atom

1 Na atom = 22.98977 amu = 22.98977μ

1 mole Na atoms = 22.98977 grams!

Molecular mass: mass of 1 molecule

HCl (1.00794+35.453) amu = 36.461 μ

1 mole HCl molecules = 36.461 grams

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Formula unit mass: Mass of 1 formula unit

$Na^{+}Cl^{-}$ (22.990 +35.453)amu = 58.443 μ

1 mole NaCl = 58.443 grams

$Fe^{+3}_2(SO_4^{2-})_3$

(2 x 55.845 + 3 [(32.065 + (4 x 15.999)])
= 399.873 μ

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But……..

1 mole is also equal to the atomic weight in GRAMS for a substance!

$Fe^{+3}_2(SO_4^{2-})_3$

(2 x 55.845 + 3 (32.065 + 4 x 15.999) g

= 399.873 g

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Here are the 2 identity statements you will need:

1 *mole* = atomic weight in grams

1 *mole* = 6.022×10^{23} (atoms, molecules or FU)

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5.35×10^{25} molecules water = ? moles = ? grams

$$\frac{5.35 \times 10^{25} \text{ molecules}}{} \quad \frac{1 \text{ mole}}{6.02 \times 10^{23} \text{ molecules}} = 88.8 \text{ mole}$$

$$\frac{88.8 \text{ mole } H_2O}{} \quad \frac{18.015 \text{ grams}}{1 \text{ mole}} = 1.60 \times 10^3 \text{ g}$$

.00465 mole of sodium atoms = ? grams

$$.00465 \text{ mole Na} \times \frac{22.990 \text{ g}}{1 \text{ mole Na}} = .106 \text{ g Na}$$

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790.2 grams of CO_2 = ? moles
= ? molecules

$$790.2 \text{ g} \times \frac{1 \text{ mole}}{44.009 \text{ grams}} = 18.0 \text{ moles}$$

$$\frac{6.022 \times 10^{23} \text{ molecules}}{1 \text{ mole}} = 1.08 \times 10^{25} \text{ molecules}$$

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Remember, you will be using
2 identity statements:

1 mole of "x" = 6.022×10^{23} atoms, molecules or FU

1 mole of "x" = atomic weight of "x"in g

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