

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 distance 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 = 22.98977 μ

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

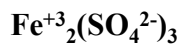
Fe⁺³₂(SO₄²⁻)₃

(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!



$$(2 \times 55.845 + 3 (32.065 + 4 \times 15.999)) \text{ g} = 399.873 \text{ g}$$

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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

5.35×10^{25} molecules	1 mole	= 88.8 mole
	6.02×10^{23} molecules	

88.8 mole H ₂ O	18.015 grams	= 1.60×10^3 g
	1 mole	

.00465 mole of sodium atoms = ? grams

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

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**790.2 grams of CO₂ = ? moles
= ? molecules**

$$\frac{790.2 \text{ g}}{44.009 \text{ grams}} \times \frac{1 \text{ mole}}{1 \text{ mole}} = 18.0 \text{ moles}$$
$$\frac{6.022 \times 10^{23} \text{ molecules}}{1 \text{ mole}} \times 18.0 \text{ moles} = 1.08 \times 10^{25} \text{ molecules}$$

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**Remember, you will be using
2 identity statements:**

**1 mole of "x" = 6.022 x 10²³ atoms,
molecules or FU**

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

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