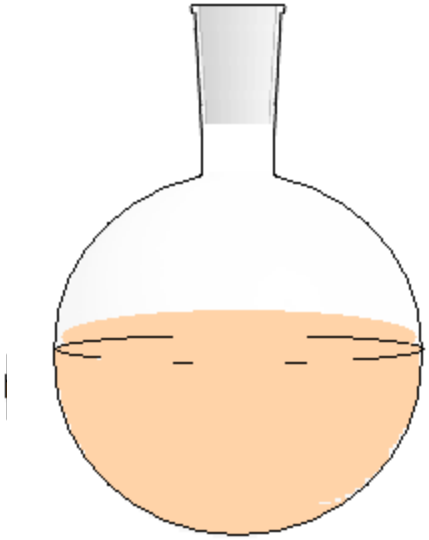
Molarity

What is it, and how do I find it?

Molarity is a measure of concentration.

- ***What is concentration?***
- ***If I have frozen orange juice, let it thaw and I don't add any water to it, it is concentrated.***
- ***By adding water, I dilute it, and it is no longer as concentrated.***
- ***The more water I add, the less concentrated it becomes.***



H Padleckas created this image file, completing it on September 15, 200
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Calculating concentration

- **Molarity is simply the number of moles of a solute dissolved per liter of solvent.**
- **Or** $\frac{\text{Moles}}{\text{Liter}}$

Here is an example:

A 0.25 M NaOH solution (read as 0.25 molar) contains 0.25 moles of sodium hydroxide in every liter of solution. Anytime you see the abbreviation M you should immediately think of it as mol/L.

Calculating concentration

To calculate molarity:

- **Calculate the number of moles of solute present.**
- **Calculate the number of liters of solution present.**
- **Divide the number of moles of solute by the number of liters of solution**

Lets look at a typical problem. . .

- **If 50g of sodium chloride is dissolved in 500 mLs of water, what is the molarity of this solution.**
- **First, how many moles are there in 50g of sodium chloride?**

How many moles are there in 50g of sodium chloride?

Find the molar mass of NaCl. (from the Periodic Table)

11		17		
Na	+	Cl	=	Molar Mass in g/mol
22.990 Sodium		35.453 Chlorine		

22.99 + 35.45 = 58.44 g/mol

Now divide by the amount of NaCl

$$50\ \text{g NaCl} \times \frac{1\ \text{mole}}{58.44\ \text{g}} = 0.85\ \text{moles}$$

Now, how many liters do we have?

$$500\text{mL NaCl} \times \frac{1\ \text{liter}}{1000\ \text{mLs}} = 0.5\ \text{L}$$

Put it together and solve!

$$\frac{0.85 \text{ moles NaCl}}{0.50 \text{ L}} = 1.7 \text{ M}$$

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- **Molarity is simply the number of moles of a solute dissolved per liter of solvent.**
- **Or** $\frac{\text{Moles}}{\text{Liter}} = \text{M}$

What if I know how much I have and the molarity I want?

Let's look at another problem

- *You need a 2M sugar solution to feed the hummingbirds out in your yard. If you have 250 g of sugar, how much water should you add?*

Sugar is $C_{12}H_{22}O_{11}$

How many moles are in 250g of sugar?

$$250\text{g } C_{12}H_{22}O_{11} \times \frac{1 \text{ mole}}{342 \text{ g (molar mass)}} = .73 \text{ moles}$$

We want a 2M solution. Solve for the missing liters.

$$2M = \frac{0.73 \text{ moles}}{? \text{ L}} \quad \text{or} \quad \frac{0.73 \text{ moles}}{2 \text{ moles/L}} = 365\text{L}$$

Dilutions from known concentrations. . .

- ***What if you have a known concentration, and want to make more of it, but less concentrated?***
- ***Simply figure out either how much you want, or the new concentration you want.***

$$M_1V_1 = M_2V_2$$

Try it!

- You have 12M H_2SO_4 and you need 250 mLs of a 1M solution of H_2SO_4. How much of the sulfuric acid do you need?

$$12M \times V_1 = 250\ mLs \times 1M$$

$$V_1 = \frac{250mLs \times 1M}{12M}$$

= 20.8 mLs (into 229.2 mLs water)