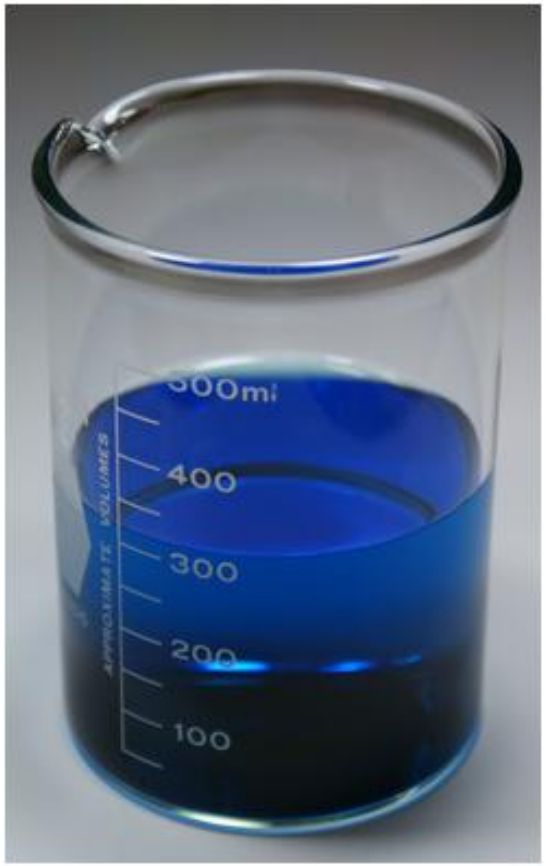
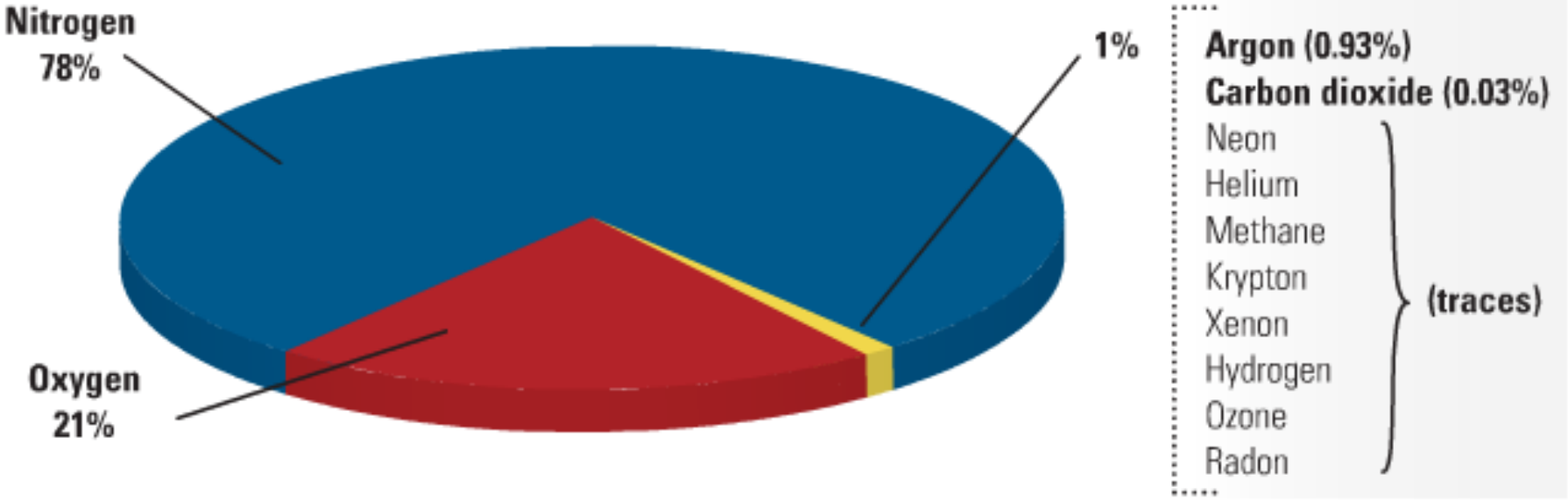
THE CONCENTRATION OF SOLUTIONS

Solutions can be found in any state:

- liquid
- solid

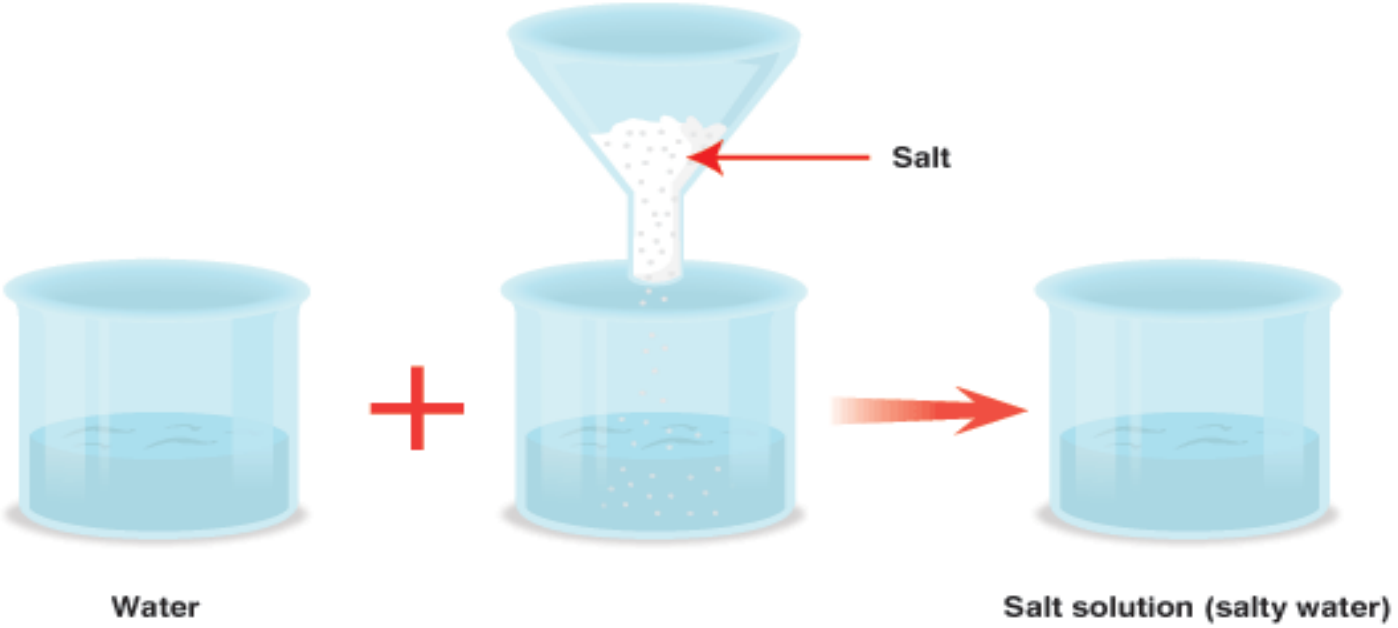


- gaseous


Nitrogen
78%
Oxygen
21%
1%
Argon (0.93%)
Carbon dioxide (0.03%)
Neon
Helium
Methane
Krypton
Xenon
Hydrogen
Ozone
Radon
(traces)

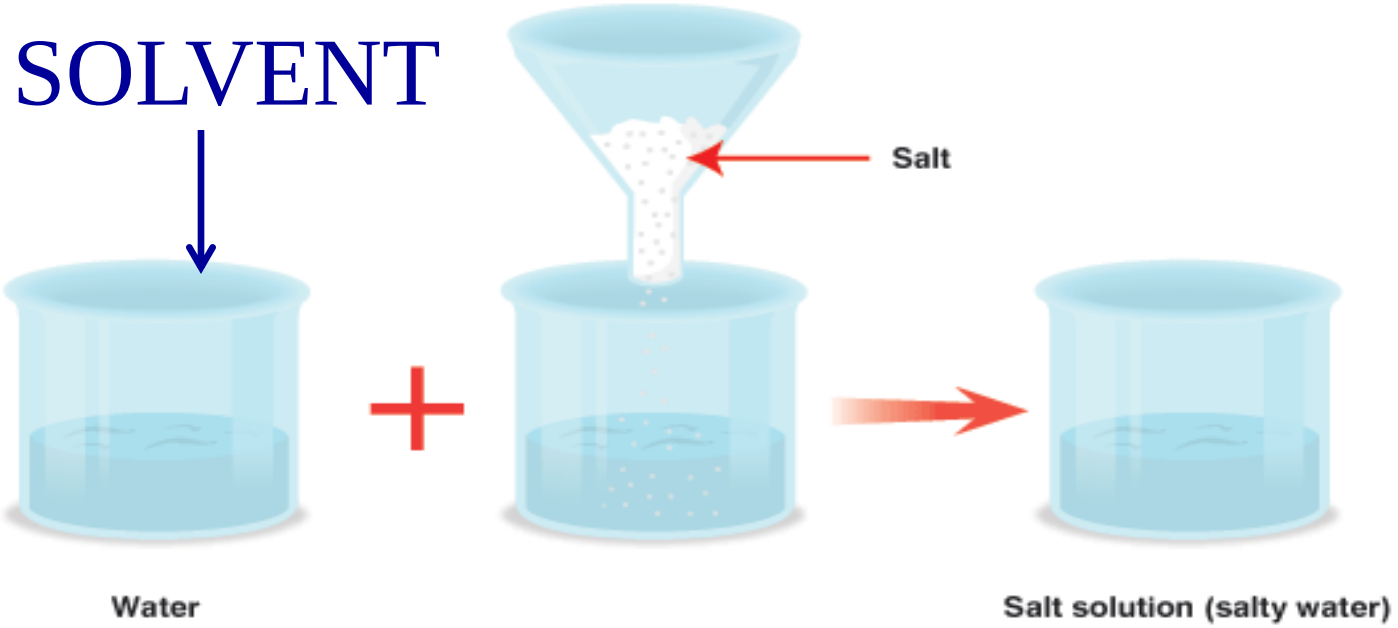
SOLUTION

- A solution is a homogenous mixture made up of a ***solute*** and a ***solvent (salt and water)***



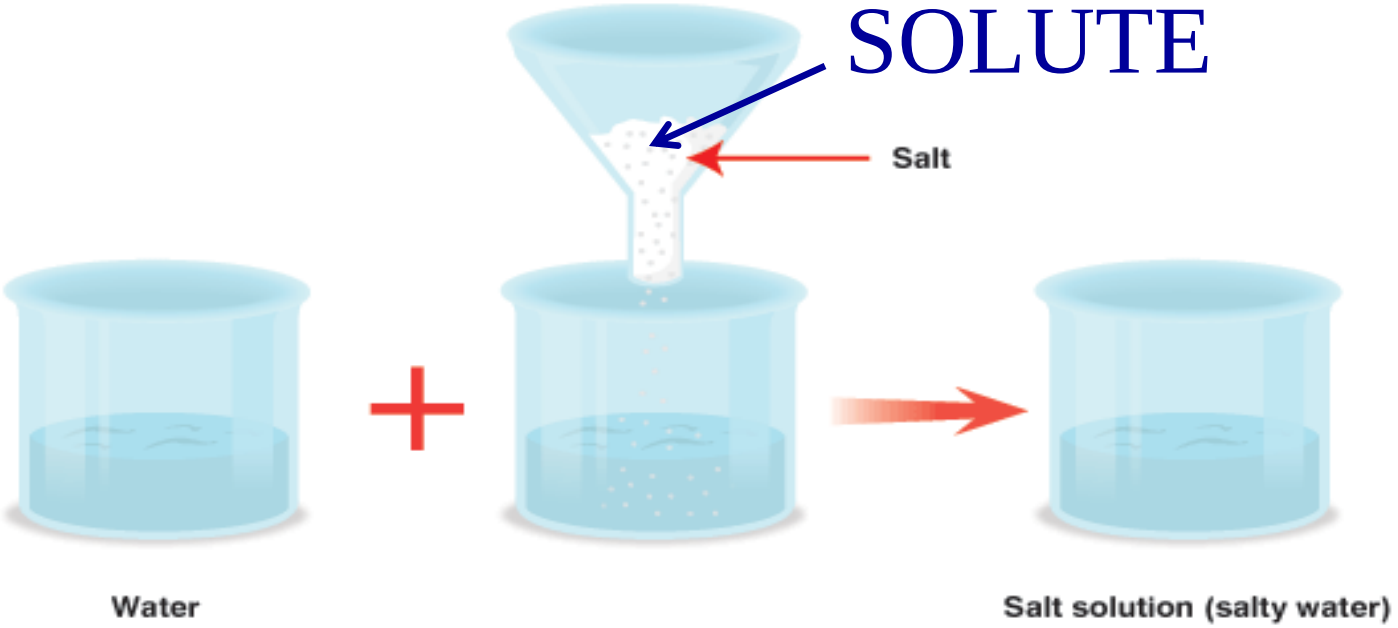
SOLVENT

- The solvent is the substance to which ***the solute is added***, ***the bigger quantity*** (ex. water)



SOLUTE

- the solute is the substance ***that is dissolved, the smaller quantity*** (salt)



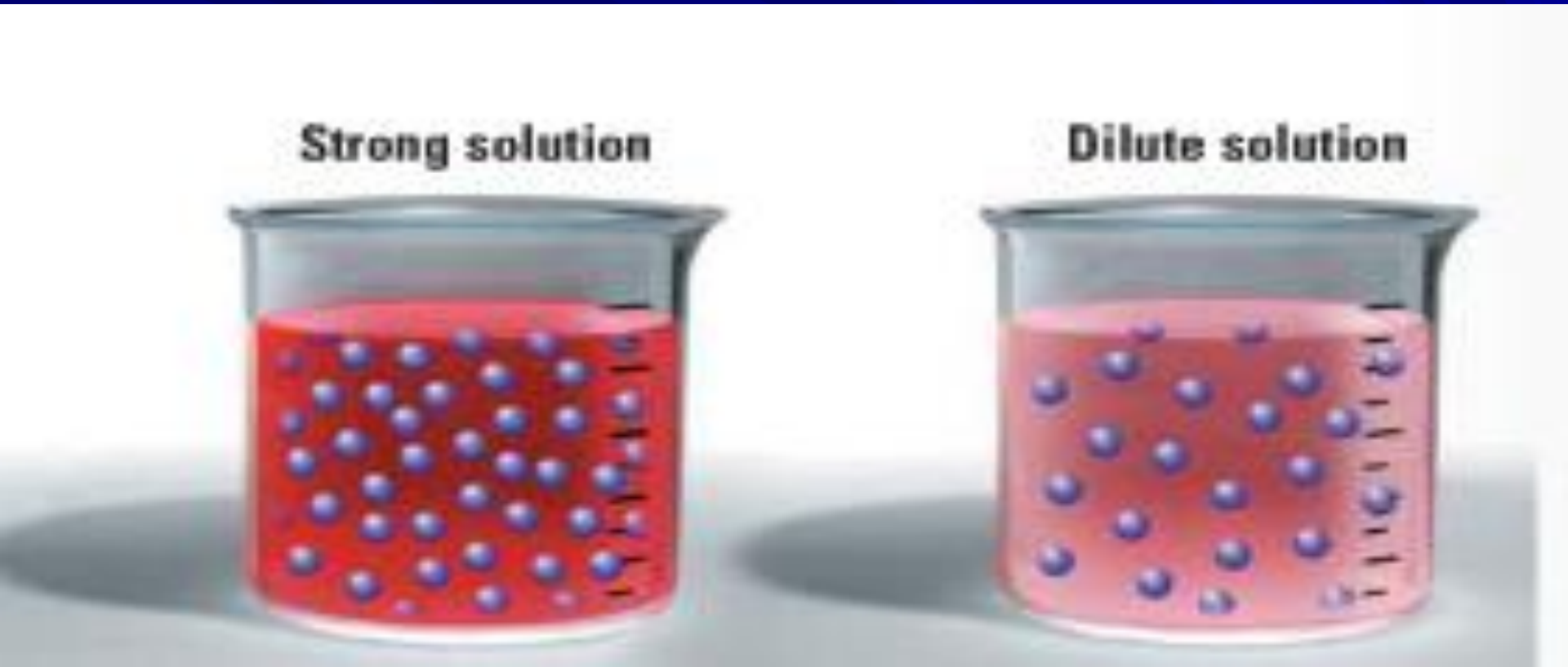
AQUEOUS SOLUTION

- An aqueous solution is the solution in which the solvent is ***water***.

We encounter aqueous solutions everyday.
Ex: tea, coffee, soup etc

- Not all solutions are alike.
- Some solutions are strong (***concentrated***), other solutions are weak (***dilute***).

- The amount of solute dissolved in a certain amount of solution determines how strong the solution is.



THE CONCENTRATION OF AQUEOUS SOLUTIONS

- In order to be able to analyze and compare solutions, scientists have designed special concepts.

- The most important physical quantity describing the strength of a solution is its ***concentration.***
- The most general formula for this concept is:

$$\text{Concentration} = \frac{\text{amount of solute}}{\text{amount of solution}}$$

Concentration in *GRAMS per LITRE (g/L)*

$$\text{Concentration}\ (g/L) = \frac{\text{mass of a solute (g)}}{\text{volume of solution (L)}}$$

$$C = \frac{m}{V}$$

- where ***C*** is the concentration of a solution
- m is ***mass*** of a solute
- V is ***volume*** of the solution.

Example:

A solution of 5 g/L sugar concentration will contain 5 g of sugar for every 1 litre or 1000 mL of solution.

$$\mathrm{C}\,(g/L) = \frac{5\,\mathrm{g\ of\ a\ solute}}{1\mathrm{L\ of\ solution}}$$

Concentration in *PERCENT MASS/VOLUME*

$$\%\ \mathrm{m/V} = \frac{\text{mass of a solute (g)}}{\text{100 mL of solution}}$$

Example:

A solution labelled 15% sodium hydroxide **m/V** contains 15 g of sodium hydroxide for every 100 mL of solution:

$$15\%\,\text{m/V} = \frac{15\,\text{g of sodium hydroxide}}{100\,\text{mL of solution}}$$

Concentration in *PERCENT VOLUME/VOLUME*

$$\%\ \mathrm{V/V} = \frac{\text{volume of a solute (mL)}}{\text{100 mL of solution}}$$

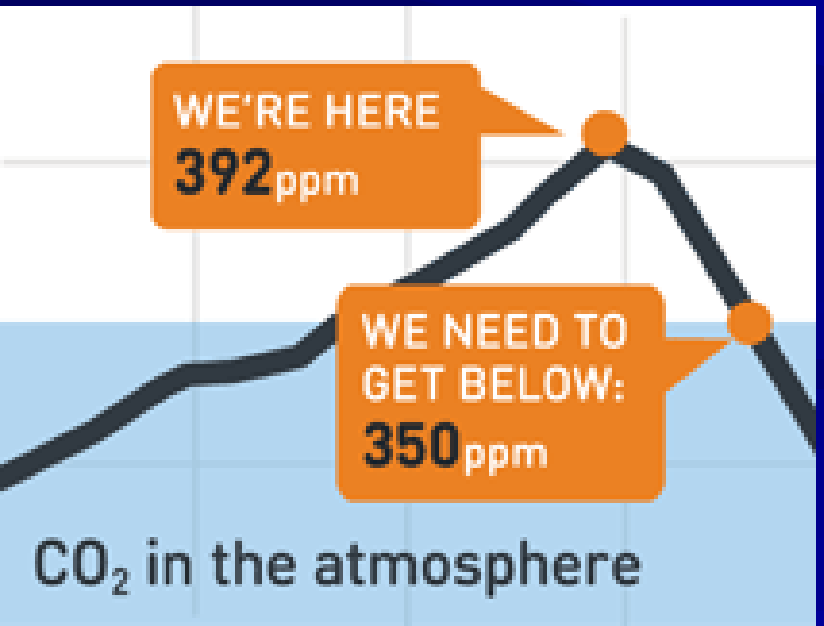
Example:

- A solution labelled 15% V/V alcohol contains 15mL of alcohol for every 100 mL of solution:

$$15\%\,\text{V/V} = \frac{15\,\text{mL of alcohol}}{100\,\text{mL of solution}}$$

CONCENTRATION IN PPM

- When the amount of solute in a solution is extremely small, the concentration can be expressed in ***parts per million (ppm).***



The CONCENTRATION IN PPM (parts per million) is the number of parts of solute in one million parts of solution.

- Thus, 1 ppm is equivalent to 1 g of solute in 1 000 000 g of solution or to 1 mg of solute in 1000 g or 1 kg of solution.

$$1\,\text{ppm} = \frac{1\,\text{mg of solute}}{1\,000\,000\,\text{mg of solution}}$$

$$1\,ppm = \frac{1\,\text{mg of solute}}{1\,000\,\text{g of solution}}$$

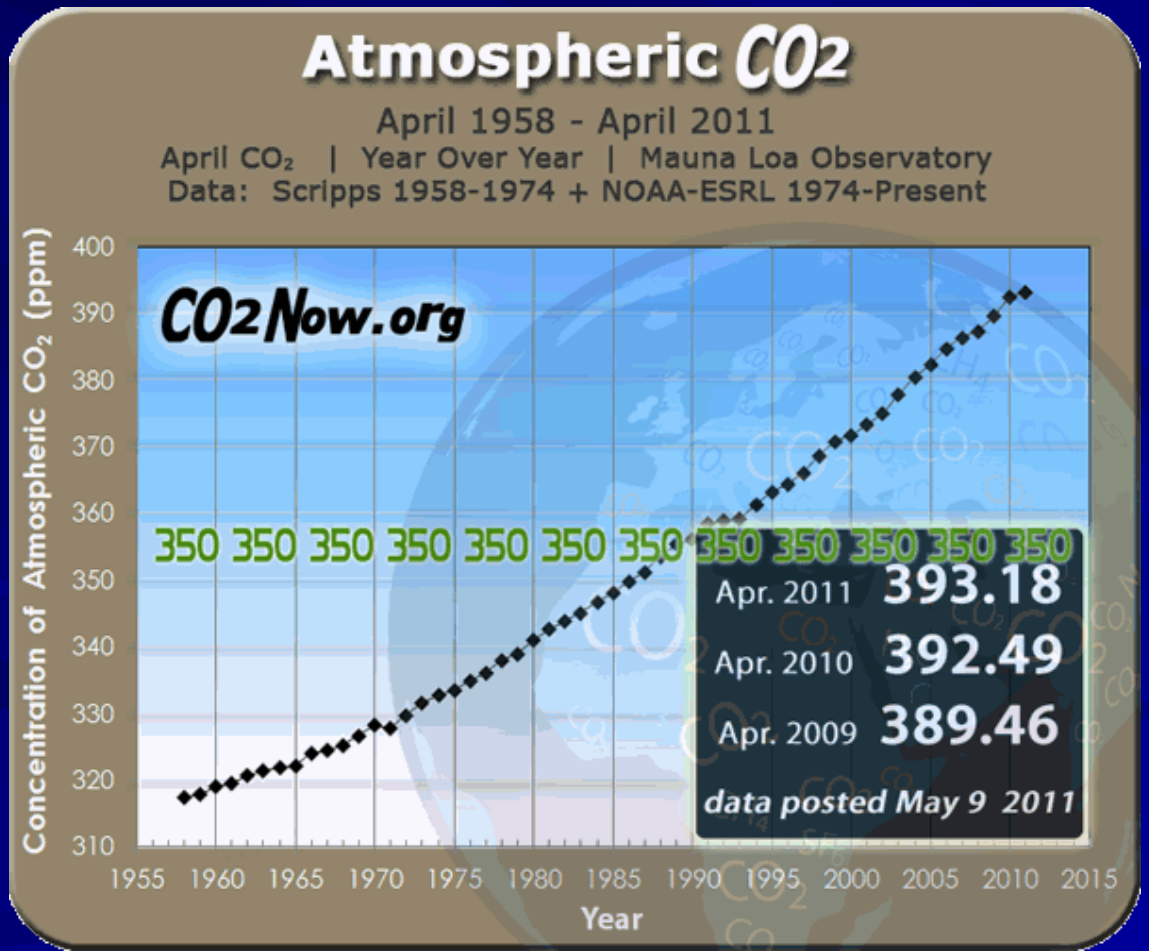
$$1\,ppm = \frac{1\,\text{mg}}{\text{kg}}$$

- In aqueous solutions, 1 ppm corresponds to approximately 1 mg of solute per litre of solution.
- Since 1000 g of water = 1L

$$1\,\text{ppm} = \frac{1\,\text{mg of solute}}{1000\ \text{g of solution}} = \frac{1\,\text{mg of solute}}{1\,\text{L of solution}}$$

$$1\,ppm = \frac{1\,\text{mg}}{\text{kg}} = \frac{1\,\text{mg}}{\text{L}}$$

- ***The CONCENTRATION IN PPM (parts per million) is the number of parts of solute in a million parts of solution.***



- Water in public swimming pools usually contains about 1 ppm of chlorine, to control bacterial growth.

THE END

You are amazing!

Thank You