Solution

By

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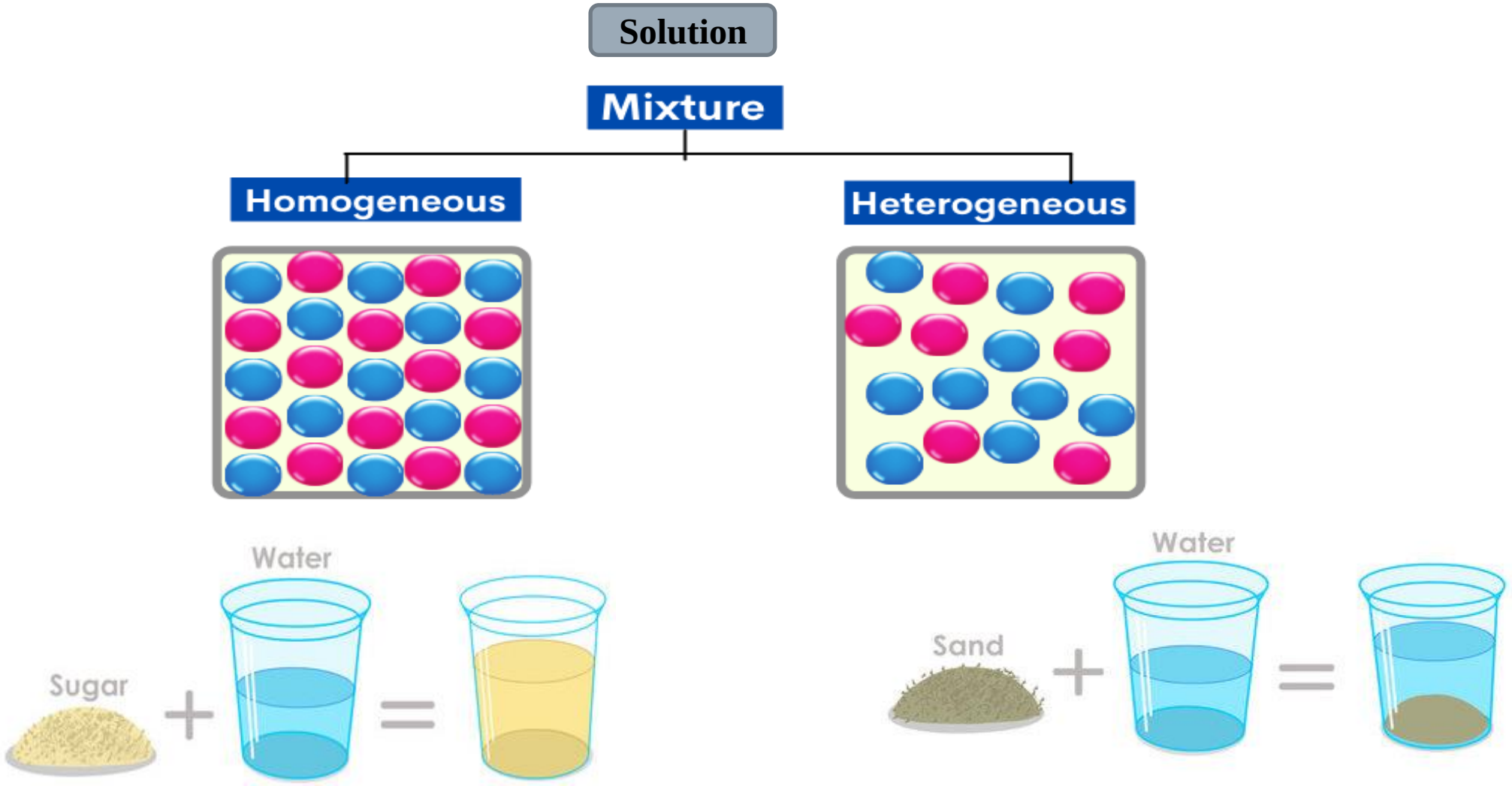
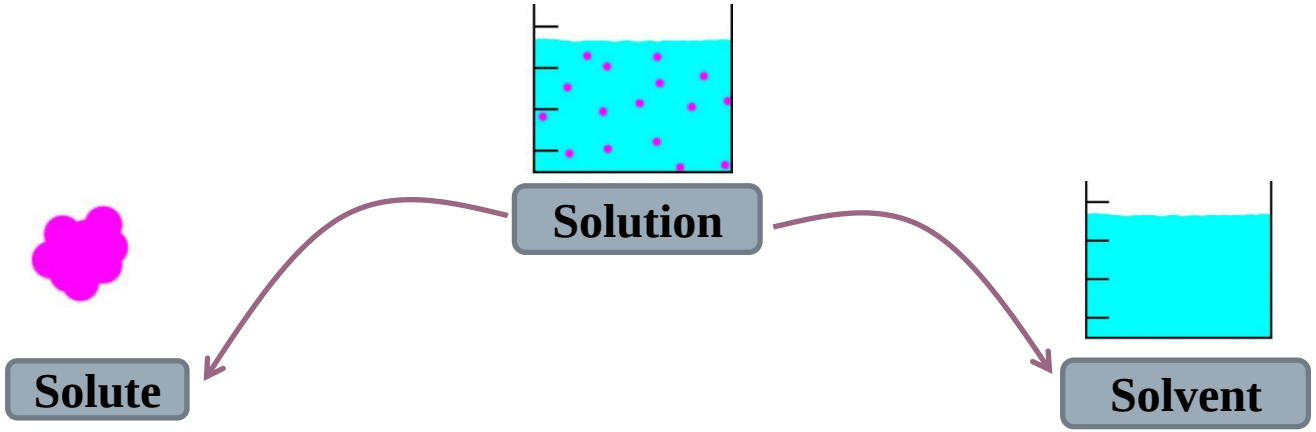
What Is a Solution?

A solution is a mixture of one or more solutes dissolved in a solvent.



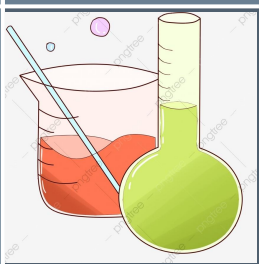
What Solution consists of ?



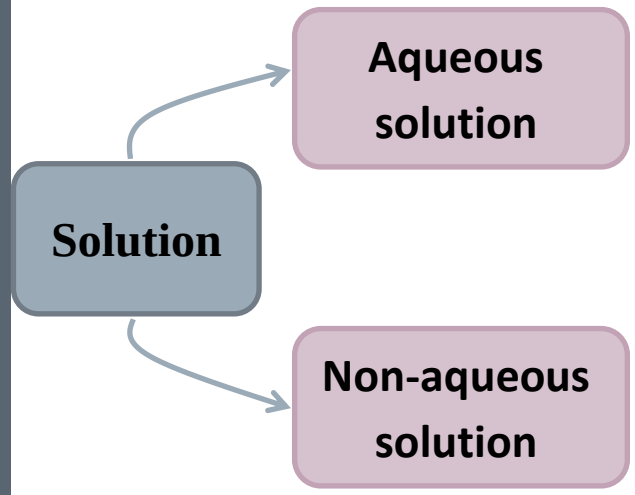
The substance that dissolves in a solvent to produce a homogeneous mixture.

The substance in which a solute dissolves to produce a homogeneous mixture. Solvent is the substance that is present in the greatest amount

Solids, Liquids or Gases

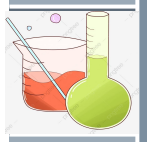


The solutions are of two forms, depending on the solvent:

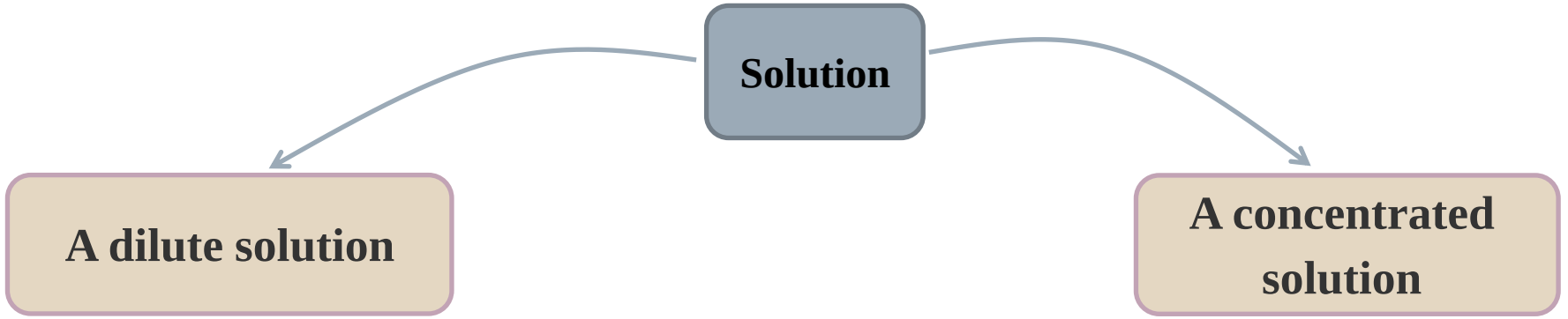


A solution in which **water** is a solvent such as a solution of sugar in water and a solution of sodium chloride

A solution in which a **liquid other than water** is solvent such as a solution of sulfur in disulfide Carbon and a solution of naphthalene in gasoline.



Classification of the solution depends on the amount of solute added to the solvent:



Different Types of Solutions depending on the dissolution of the solute in the solvent:

Solution

Saturated solution

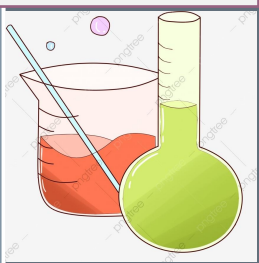
A solution in which an additional amount of solute could not dissolved, at a certain temperature.

Unsaturated solution

A solution in which a greater amount of solute can dissolved, at a certain temperature.

Supersaturated solution

A solution that contains an additional amount of solute than that calculated at equilibrium.

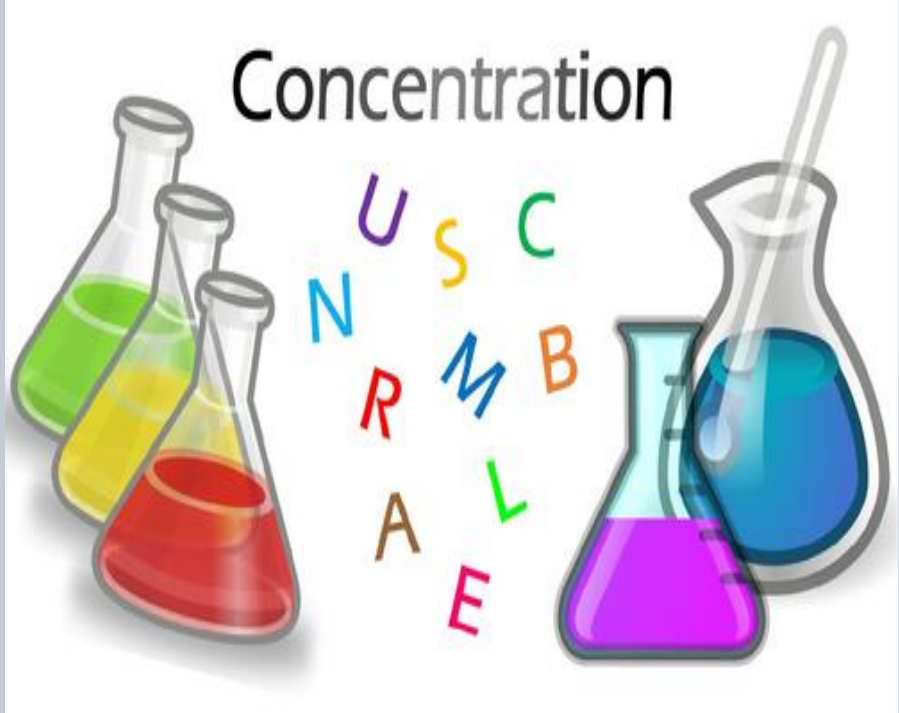


1- Mass of the solute in the mass of the solvent: (m/m%)

Expression of the chemical concentration

A- Mass percentage of solute: *(the number of grams of solute in 100 g of a solution.)*

$$\text{percent by mass} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 100\%$$

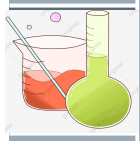


B-Mole Fraction (x): *The number of moles of one component divided by the total number of moles of solution.*

$$X = \frac{\text{mole of component}}{\text{total moles of solution}}$$

2-mass of the solute per volume of the solvent: (m/v%)

A- Molarity (M): ***The number of moles of solute contained in one liter of solution.***



$$M = \frac{moles\ of\ solute}{liter\ of\ solution}$$

$$M = \frac{wt \quad x \quad 1000}{Mwt.\ x \quad Vml}$$

M_1 = *initial molarity (Stock solution)*

M_2 = *Final (desired) molarity*

V_1 = *initial volume(L)*

V_2 = *Final volume*

The Dilution Equation

$$M_1\ V_1 = M_2\ V_2$$

B- Normality (N): ***The number of gram equivalent present in per liter solution.***

$$N = \frac{Gram\ eq.of solute}{Volume\ of\ solution}$$

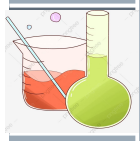
$$N = \frac{wt \quad x \quad 1000}{Eq.wt.\ x \quad Vml}$$

The Dilution Equation

$$N_1\ V_1 = N_2\ V_2$$

Preparing Solutions and Dilutions: (Molarity (M))

What are the tools we need to Preparing and Diluting a solution in this experiment?



1•Blance 2• volumetric flask 3• Funnel 4• Spatula

5• Stirrer 6• Watch Glass 7• Washing bottle 8•Pippete

9• Beaker 10• Dropper 11•Graduated Cylinder

Prepare 0.5 M of NaCl (Stock Solution) in 100ml

• *at.wt (Na=23,Cl=35.5)*

Calculate:

M.wt of NaCl= 23+35.5= 58.5 g/mol

$$\mathbf{M} = \frac{\mathbf{wt \ \ x \ \ 1000}}{\mathbf{Mwt. \ x \ \ \ Vml}} \longrightarrow \mathbf{0.5} = \frac{w_t \ * \ 1000}{58.5 \ * \ 100}$$

Wt = 2.9g (weight of NaCl which will be dissolved in 100ml)

Procedure:

1- Put the Watch Glass in Balance and weigh the NaCl.

2- Use the funnel to add the NaCl solute to the volumetric flask.

3- Fill the flask about halfway with distilled water (solvent).

4- Add solvent carefully to the marked line on the neck of the flask.

5- Invert the flask several times for final mixing.

Diluting a Stock Solution to a New Concentration (0.03 NaCl):

Calculate:

(Conc.) (dilute)

$M_1 \quad V_1 = \quad M_2 \quad V_2$

$0.5 \quad V_1 = 0.03 \quad 100ml$

V_1 = 6 ml (solute) + 94ml (solvent)

Procedure:

1• Adding 1.2ml of **NaCl** (stock solution) to the volumetric flask.

2• Add solvent carefully to the marked line on the neck of the flask.

3• Invert the flask several times for final mixing.

Home Work

A-Prepare 0.1M of Na_2CO_3 in 250ml

- *at.wt (Na=23, O=16 ,C=12)*

B-How many ml of 0.1 M Na_2CO_3 solution must be diluted with water to prepare 250ml of 0.01M NaCl?

C-Prepare 0.1N of Na_2CO_3 in the same volume above

$\eta Na_2CO_3 = 2$