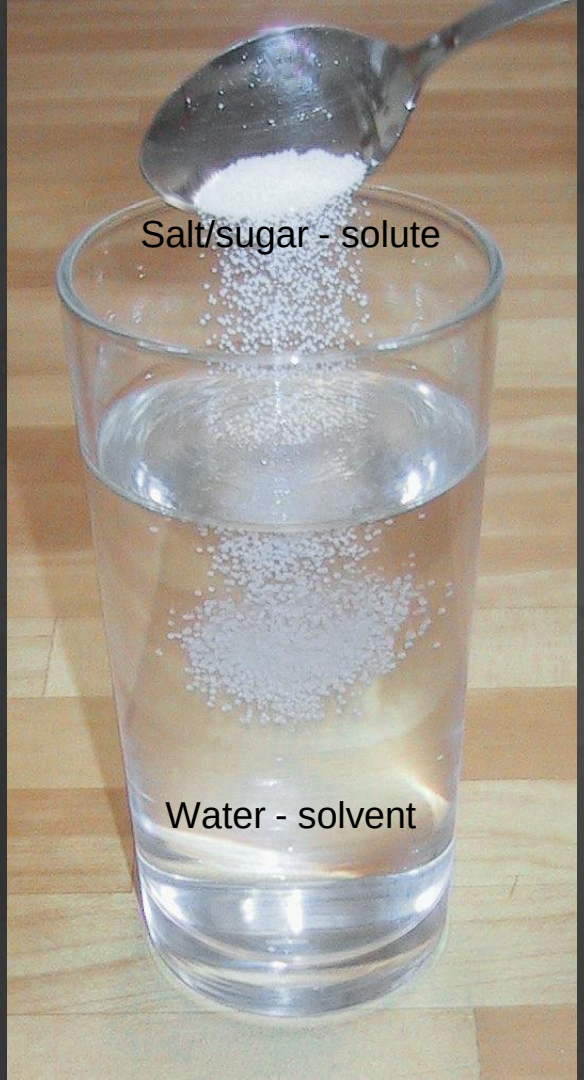
Chemistry

Solutions and their concentraitons

04/16/23

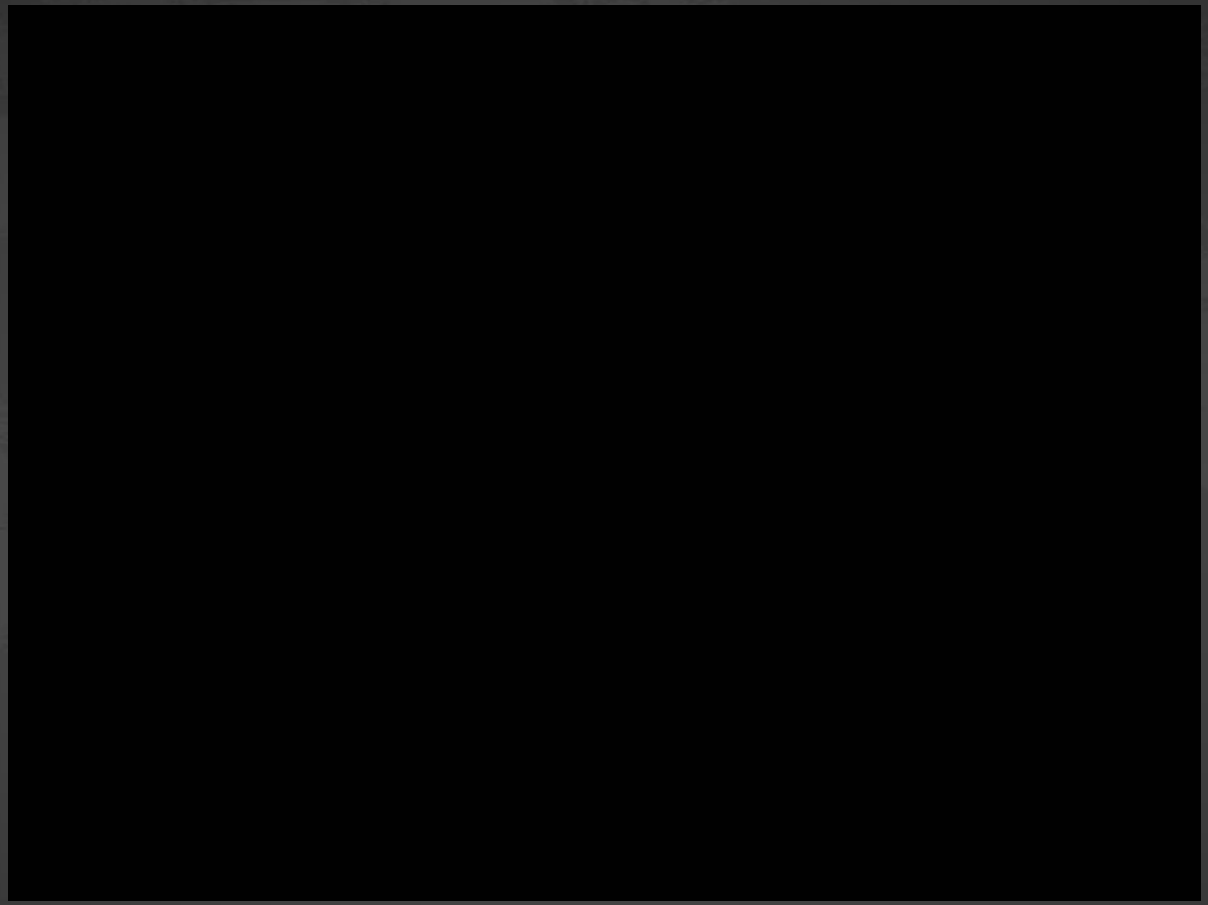


Dissolution, solutions

- Solution is a special type of homogeneous mixture composed of two or more substances. The most common state of solutions is liquid.
- The composition of a solution can change.
- In a solution a solvent is the one that is taken in a larger quantity and has the same aggregate state as the solution.
- The solute is the substance dissolved in a solvent.
- In the case of water – water is always a solvent.

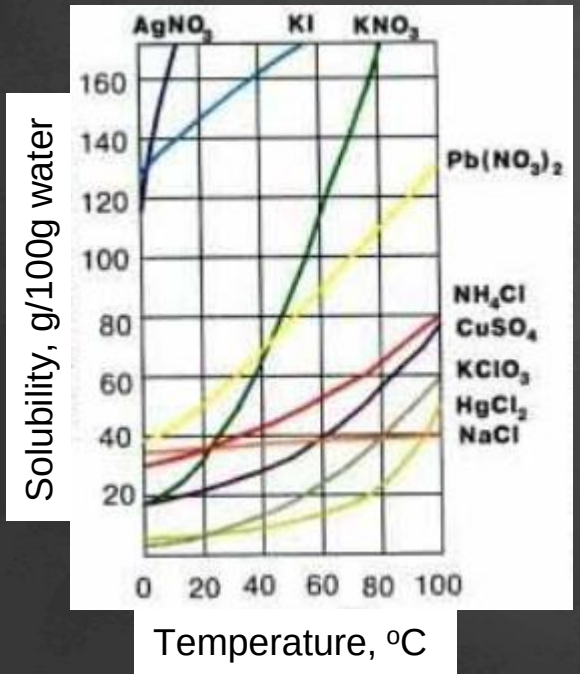
Solutions, dissolution

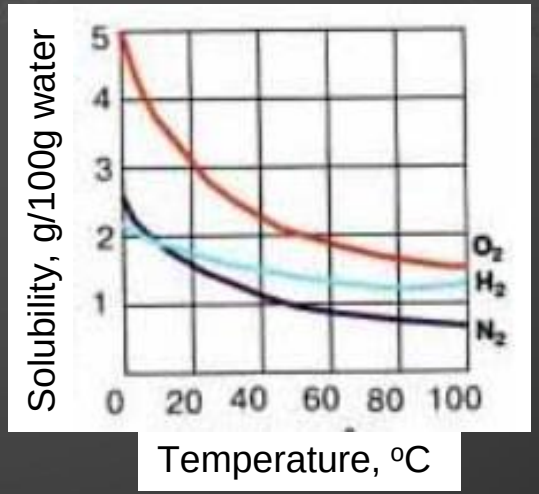
- Solutions can be solid (hydrogen dissolved in metals)
- There are no gas solutions because there are no interactions between gas molecules.



Solutions

- Solution where a given substance cannot dissolve anymore is called ***saturated*** (under the given conditions)
  - Solubility is an ability of a substance to dissolve in a solution.
  - The measure of solubility is the amount of the substance in its saturated solution





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Solution Concentration

- Concentration is a relative amount of a solute in a solution

- The **mass fraction** is the ratio of the **mass** of a solute to the **mass** of the **solution**.

Molar concentration is the ratio of amount of solute in moles to the volume in liters

Example - 1

Magnesium Sulfate (25% solution) is used to decrease blood pressure.

This means that 100g solution contains 25 g $MgSO_4$. How to prepare such solution?

To prepare such solution we will need to take 25 g and 75 g of water:
25 + 75 = 100g
Percent concentration: (25g/100g) (x100%) = 25%

Example - 2

Only $MgSO_4 \cdot 7H_2O$ is available.

We will need to calculate what amount of $MgSO_4 \cdot 7H_2O$ contains 25 g of $MgSO_4$ and how much water is in that amount of $MgSO_4 \cdot 7H_2O$.

Preparation of the 25% solution with $MgSO_4 \cdot 7H_2O$ will require less water.

Example 3

Let's consider 1M solution of $AgNO_3$. This means that 1L of such solution contains 1 mole of $AgNO_3$.

We need to conduct the following reaction:

$$AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$$

What volume of 1M NaCl do we need to take to react with 1M solution of $AgNO_3$ for all the reactants to react fully?

According to the reaction 1 mole of each reacts. For solutions with equal molar concentrations, we need to take equal volumes.

This class uses the materials from the following books:
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Manyuilov and Rodionov “Chemistry for children and adults”
Kuzmenko, Eremin, Popkov “Beginnings of chemistry”
http://school-collection.edu.ru (experiments)