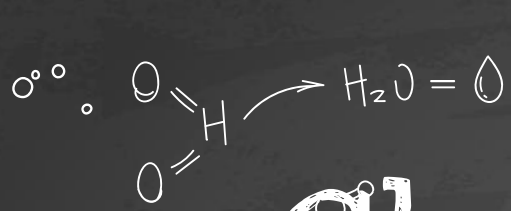
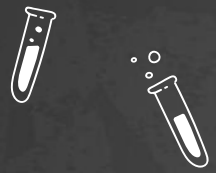
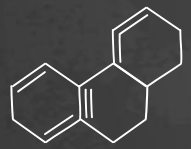
Chemistry - 1

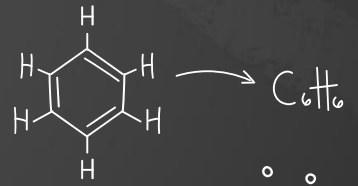
Hydrogen - water

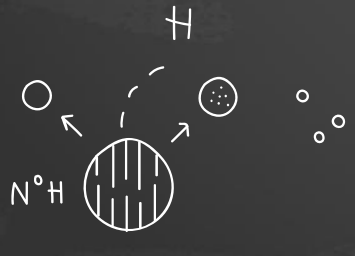
03/26/23

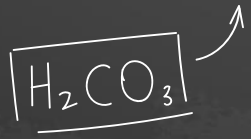


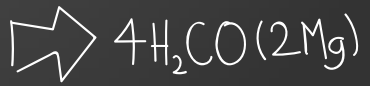




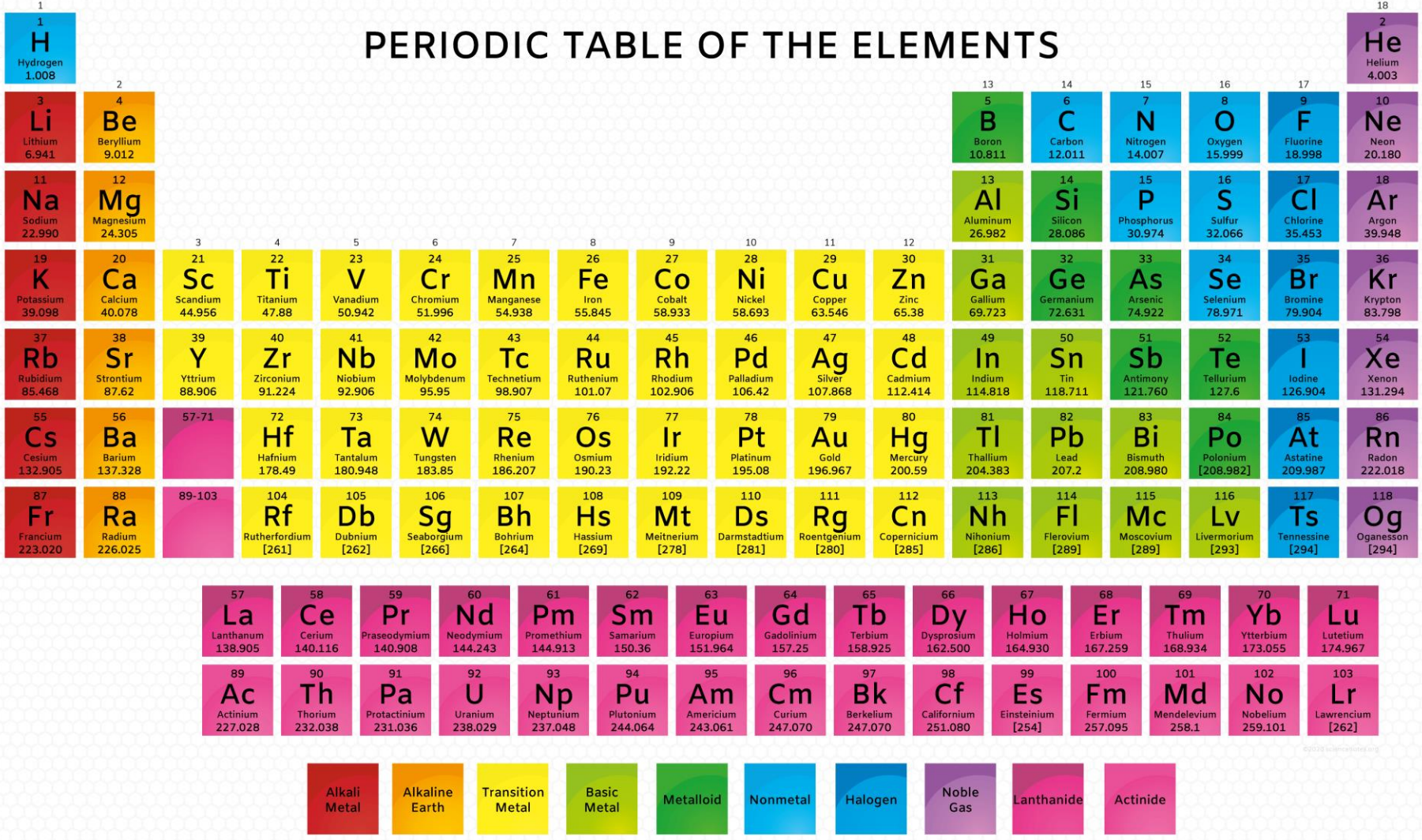




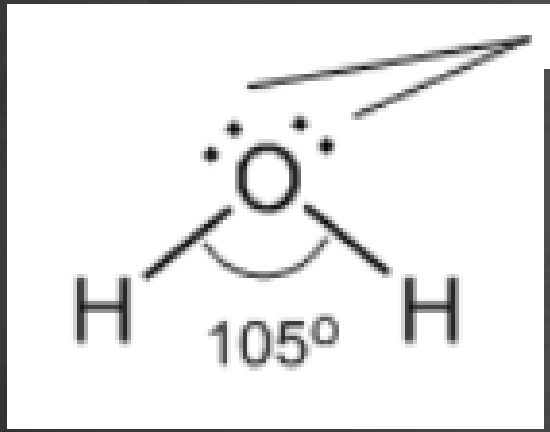




PERIODIC TABLE OF THE ELEMENTS

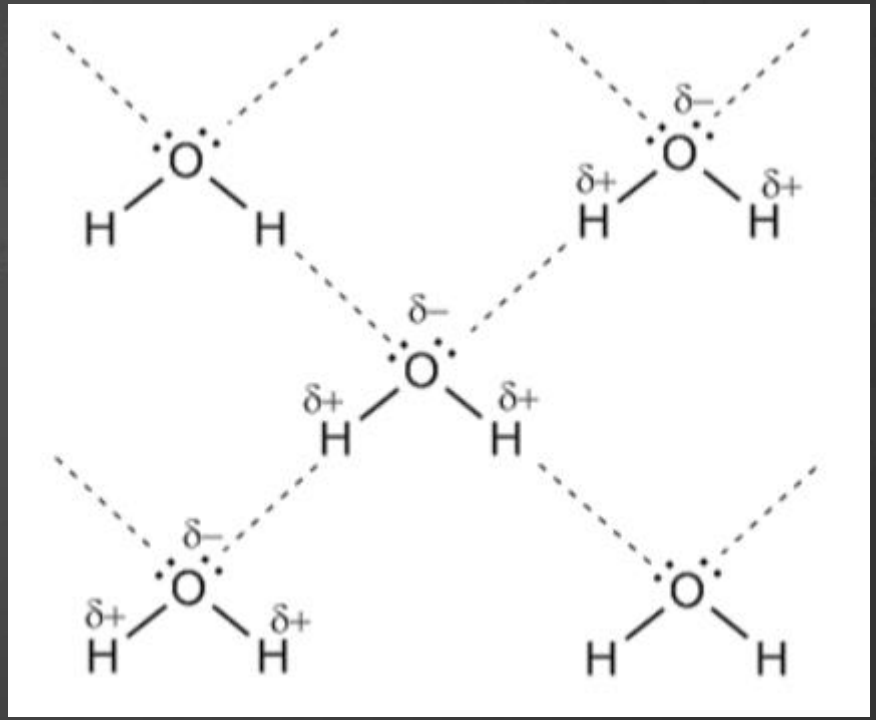


water, hydrogen bond

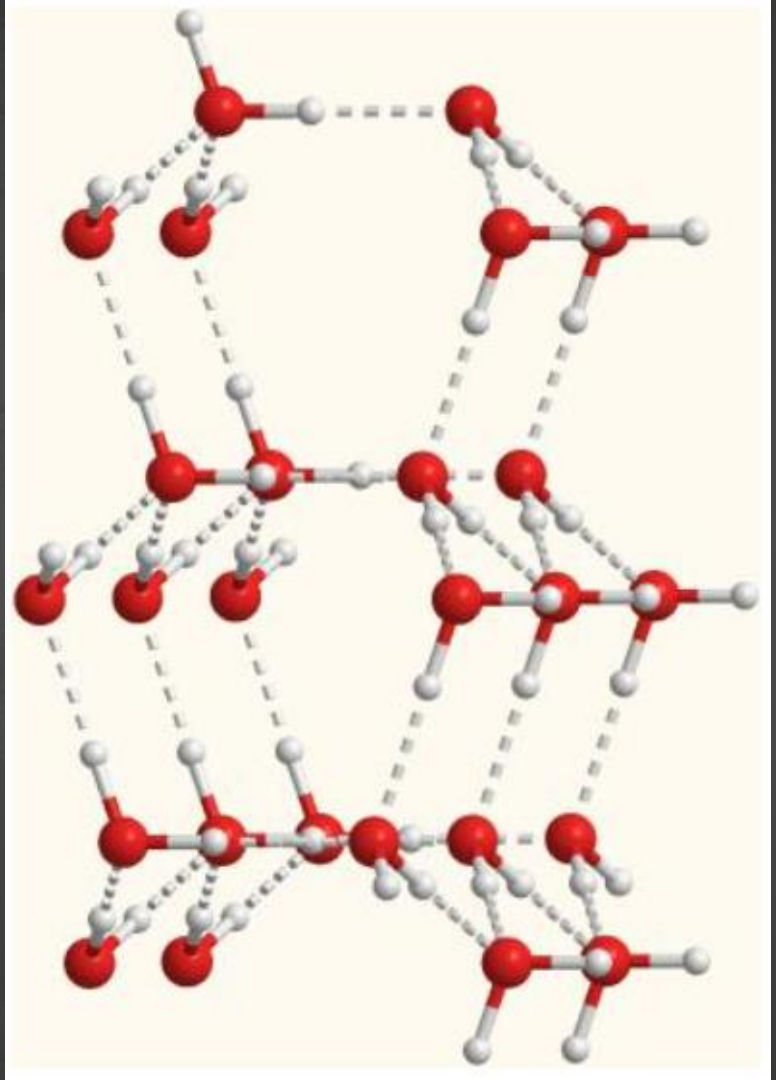


Unpaired electrons

Tetrahedron



7	8	9
N	O	F
Nitrogen	Oxygen	Fluorine
14.007	15.999	18.998
15	16	17
P	S	Cl
Phosphorus	Sulfur	Chlorine
30.974	32.066	35.453



Chemical properties of water

1. Reactions with metals and non-metals with release of hydrogen

$2Na + 2H_2O = H_2 + 2\ NaOH$

$2K + 2\ H_2O =$

$3Fe + 4\ H_2O = 4H_2 + Fe_3O_4$ (when heated)

$C + H_2O = H_2 + CO$

$CH_4 + 2\ H_2O = 4H_2 + CO_2$

2. Water decomposes into oxygen and hydrogen under electrical current

3. Water reactions with non-metal oxides (combination)

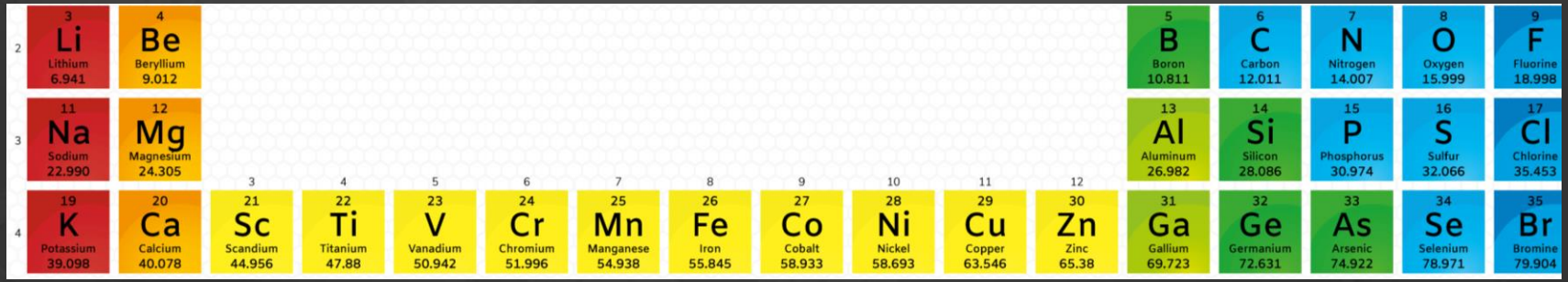
$SO_2 + H_2O =$ (sulfurous acid)

$SO_3 + H_2O =$

$CO_2 + H_2O =$ (carbonic acid)

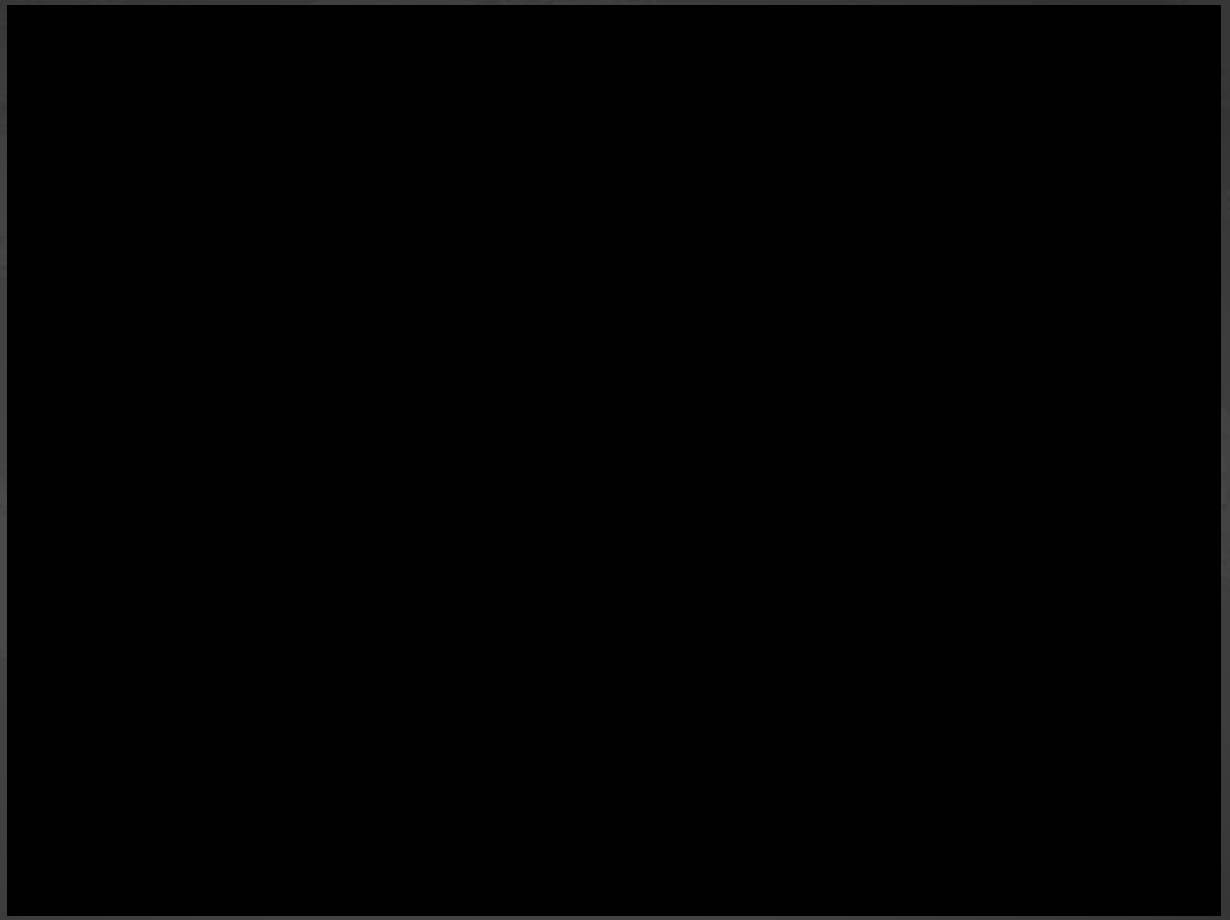
4. Some metal oxides also can react with water (combination)

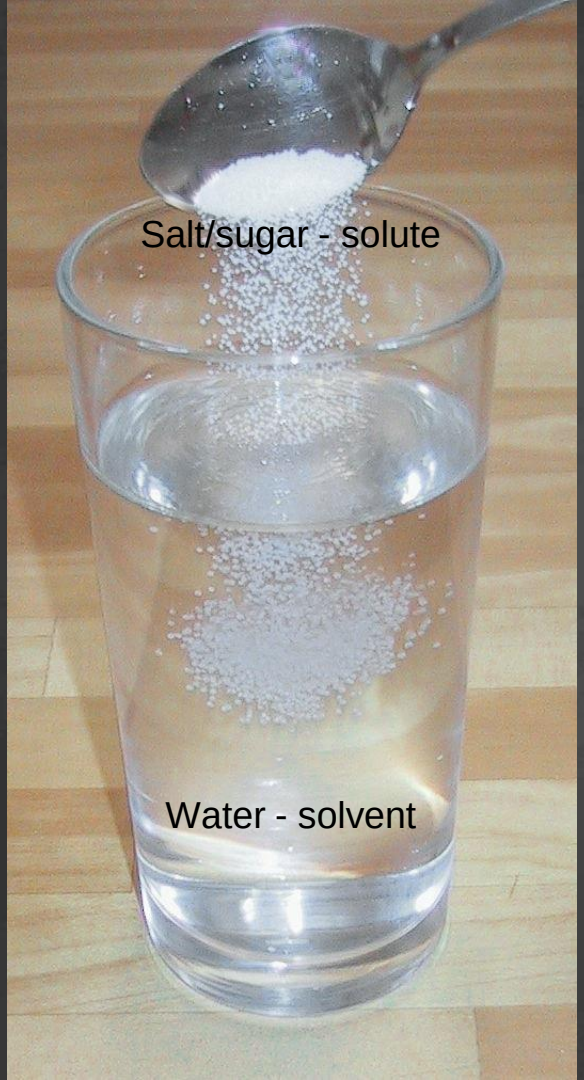
$CaO + H_2O =$



5. Water forms compounds where its molecule does not decompose (hydrates)

$$CuSO_4 + 5H_2O = CuSO_4 \cdot 5\,H_2O$$
$$H_2SO_4 + H_2O = H_2SO_4 \cdot H_2O$$
$$NaOH + H_2O = NaOH \cdot H_2O$$



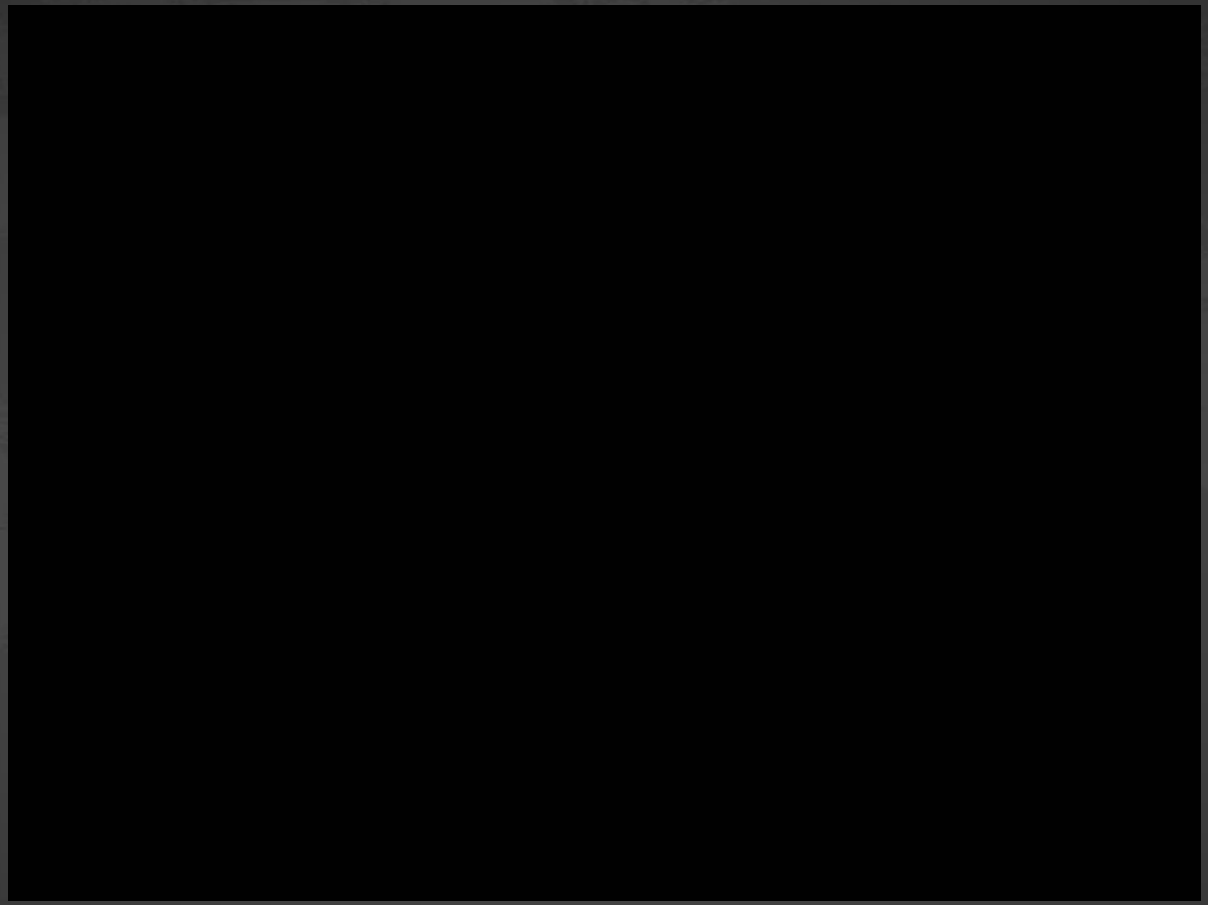


Dissolution, solutions

- 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.

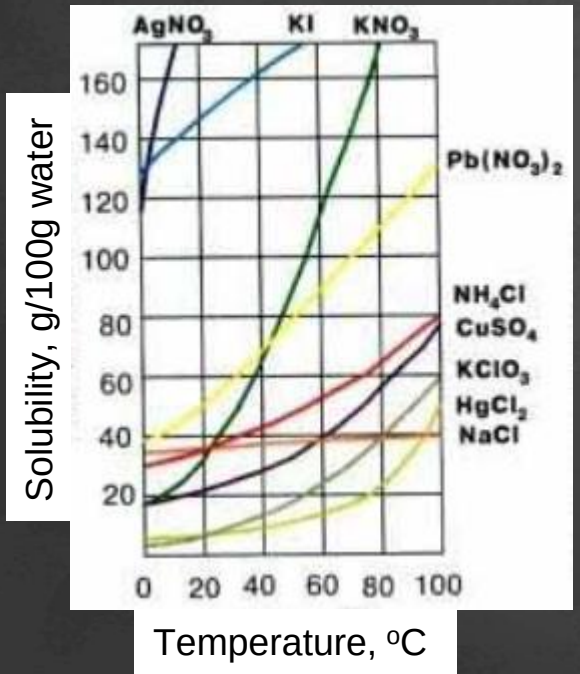
Solutions, dissolution

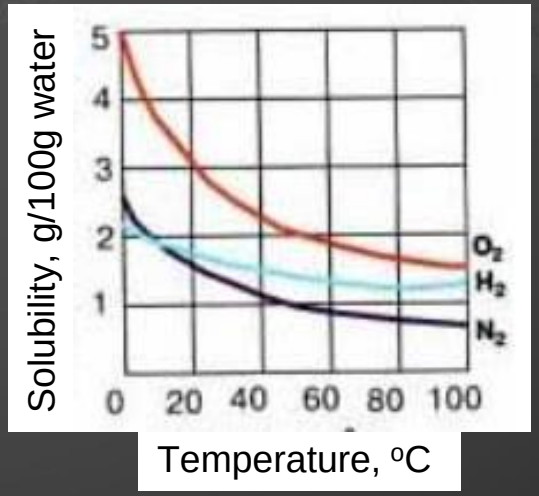
- Solutions can be solid (hydrogen dissolved in metals)
- There are no gas solutions because there are no interactions between gas molecules.



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

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

Concentration is a relative amount of a solute in a solution
Molar concentration is the ratio of amount of solute in moles to the volume in liters

$$3H_2 + N_2 = 2NH_3$$

Hydrogen - H_2 (molecular mass 2x1 = 2g)
Nitrogen - N_2 (molecular mass 2x14 = 28 g)
Ammonia - NH_3 (molecular mass 14 + 3x1 = 17 g)

1 mole of any gas at normal conditions takes up 22.4 L

This class uses the materials from the following books:
”

Manyuilov and Rodionov “Chemistry for children and adults”
Kuzmenko, Eremin, Popkov “Beginnings of chemistry”
http://school-collection.edu.ru (experiments)