HW 2 ***Structure of an atom, subatomic particles***

- Atoms are made of **nucleus** and an **electron cloud** around it
- The **electron** cloud has a negative charge, **protons in the nucleus** have positive charge.
- In each atom the number of protons is equal to the number of electrons so as a whole an atom is neutral
- (An atom can lose or acquire electrons, getting charged)
- In addition to protons a nucleus contains **neutrons**. The neutrons do not have any charge.
- Electrons, protons, and neutrons are subatomic particles

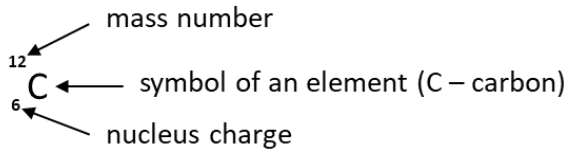
An element is a substance with the atoms that have the same charge of the nucleus. An element always increases its weight during chemical reactions.

A = Z + N

A – mass number of an atom

Z – charge of the nucleus

N – number of neutrons in the nucleus



Isotopes are substances made of atoms with the same charge of the nucleus (the same number of protons), but with different number of neutrons in the nucleus. Isotopes differ only by their mass number. All elements contain one or several isotopes.

The average atomic mass of an element is **the sum of the masses of its isotopes**, each multiplied by its natural abundance (the decimal associated with percent of atoms of that element that are of a given isotope). (See the table in the end of the HW with natural isotopes and their abundance for some elements.)

$$\text{atomic mass of an element} = \left(\text{fractional abundance of isotope 1} \times \text{mass of isotope 1}\right) + \left(\text{fractional abundance of isotope 2} \times \text{mass of isotope 2}\right) + \ldots$$

E.g. the average atomic mass of natural carbon made of ~98.9% of carbon with atomic mass of 12 and 1.1% of carbon with atomic mass of 13 is (0.989 x 12) + (0.011 x 13) = 12.011

Answer the following questions:

1. How many protons and neutrons are in the nucleus of oxygen $^{16}_{8}O$?
2. How many protons, neutrons and electrons are in the nucleus of boron $^{11}_{5}B$?
3. There are 20 protons and 20 neutrons in the calcium atom. What is the charge of calcium with 18 electrons? Write down the symbol of this ion.
4. What is the relative atomic mass of the element Sb if it has two isotopes: $^{121}_{51}Sb$ (atomic mass 120.9) – natural abundance 57.4% and $^{123}_{51}Sb$ (atomic mass 122.9) – natural abundance 42.7%.
5. *The atomic mass of natural copper is 63.5. It is composed of two isotopes: ^{63}Cu and ^{65}Cu. What is the abundance of each of these isotopes? What are their nuclei compositions (how many protons and neutrons)?
6. Fill out the empty spaces in the table:

Symbol	$^{12}_{6}C$	$^{17}_{8}O^{2-}$			
Number of protons	6		12		8
Number of neutrons	6		13	12	10
Number of electrons	6	10		10	10
Charge	0	-2	0	+1	