

PREREQUISITES

PHYSICS PREREQUISITES

The students will benefit from having a preliminary high-school level preparation in selected mathematical topics:

- powers, roots, exponentials, logarithms, expression of numbers in powers of ten (i.e. scientific notation), and the concept of vector
- basic knowledge in planar geometry: the ability of calculating perimeter and area of polygons and of the circle and of applying the Pitagora theorem

The students should also be comfortable with the equivalence principles and their application to formula and equation inversions/manipulations.

Finally, the ability of providing a rudimental definition of the physical quantities velocity, acceleration, force, energy, temperature, and volume, although not strictly required, would be welcomed

CHEMISTRY PREREQUISITES

Students are presumed to have a good background in high school chemistry and should be able to answer to questions related to all subjects listed below. In the first two weeks, two preliminary tests will be organized in order to ascertain the individual preparation in chemistry. No mark will result from the two tests, that will be analyzed in a tutorial activity where the students will comment the results with the aim to reach a good individual level of basic knowledge in chemistry.

First test

1. Structure and periodic properties of the atoms

- Discuss the structure of the nucleus of atoms
- Be able to distinguish between atomic number Z and mass number A
- Discuss the structure of the nucleus of isotopes (nuclides)
- Describe the chemico-physical features of isotopic nuclides
- Be able to describe electronic configuration of atoms
- Correlate the electronic configuration of atoms to their position in the periodic Table

2. Ionic and covalent bonds

- Discuss the chemical properties of atoms on the basis of their position in the periodic Table
- Define the ionic and covalent bonds
- Be able to predict the formation of covalent/ionic bonds between atoms on the basis of their position in the periodic Table
- Discuss the meaning and the applications of electronegativity
- Describe the chemical features of compounds on the basis of the bond between atoms

3. Intermolecular forces and physical state of the matter

- Describe the connection between polarization of molecules and intermolecular forces
- Describe the main intermolecular forces of different energy (van der Waals, dipole-dipole, ion-dipole, hydrogen bonding)
- Discuss the connection among forces and the physical state of compounds
- Describe the main features of gas, liquid, and solid systems

Second test

1. Relative atomic and molecular mass (atomic and molecular weight) and moles

- Define the atomic mass unit (amu), the relative mass and the absolute mass of an atom
- Define the relative atomic and molecular mass
- Be able to calculate the relative molecular mass of a given compound
- Define a mole and the Avogadro number
- Be able to calculate the molecular and molar mass of a given compound

2. Reactions and stoichiometric calculations

- Be able to balance a reaction
- Be able to make simple stoichiometric calculations about masses of reagents and masses of products for a given reaction

3. Reductions, oxidations and redox reactions

- Define the oxidation number
- Discuss the meaning of the oxidation number
- Define a reduction and an oxidation
- Calculate the oxidation number of a few oxidants/reductants
- Be able to balance a redox reaction

HUMAN GENETICS PREREQUISITES

It is assumed that students have a good understanding of basic genetics. The self-study program includes the following topics: Mendelian genetics: Mendel's Laws of Heredity, probability of inheritance and Punnett Squares, alleles and genes, dominant and recessive alleles, homozygous and heterozygous definitions.

Students are encouraged to get acquainted with genetic terminology by visiting the websites: [http://www.genome.gov/Education/\(National Human Genome Research Institute\)](http://www.genome.gov/Education/(National%20Human%20Genome%20Research%20Institute)) and <http://biology.about.com/od/basicgenetics/a/aa071705a.htm>, or consulting the book 'Essential Genetics' by P. Russell., Cummings Ed.

Students are also encouraged to perform a self-examination test (multiple choice) before the course to check whether their basic knowledge in genetics is sufficient to successfully meet the course program.