

Translation from the Italian Language

*Ministry of Education, University and Research (MIUR)*

## **Annex A**

### **Study programs on which the questions are based in the Admission Test to the 6-year, single-cycle, Master Degree course in Medicine and Surgery, held in English**

In order to be admitted to the course, General Culture is a requirement, with particular regard to literature, history, philosophy social and institutional sciences. Analysis of various types of written texts and a good attitude for logical-mathematical reasoning are also required.

The capacities, abilities and required knowledge above refer to the Ministerial Programs for the schools that organize their courses and other learning activities in line with the above programs and that prepare students for State exams, which also refer to the disciplines of Biology, Chemistry, Physics and Mathematics.

#### **General culture and logical reasoning**

Assessment of the correct use of the English language and the ability of logical reasoning, coherent with the given information, which may be expressed in symbols or words in multiple choice questions. Testing the capacity to avoid the wrong, arbitrary or less probable conclusions.

The questions will be related to scientific texts, to classic and modern authors, to recent news in daily papers or in weekly or technical magazines. They will also be related to abstract cases or problems, which have to be solved using other types of logical reasoning.

Some questions on general culture, studied in secondary school, complete this section.

#### **Biology**

Chemistry of living organisms.

The biological importance of weak interactions.

Organic molecules in organisms and their function. The role of enzymes.

Cells as the base of life.

Cell theory. The dimension of cells. Prokaryotic and eukaryotic cells, animals and plants. Virus.

The cell membrane: structure and function – transfer through membranes.

The cell structures and their specific functions.

Cellular cycle and cell reproduction: Mitosis and meiosis- chromosomes and chromosome maps.

Bioenergy.

Energy in cells: ATP.

Oxygen reduction in living organisms.

Energy processes: photosynthesis, glycolysis, aerobic respiration and fermentation.

Reproduction and heredity.

Vital cycles. Sexual and asexual reproduction.

Genetics of Mendel: the laws of Mendel and their use.

Classical genetics; chromosome theory of heredity- heredity models.

Molecular genetics; structure and duplication of DNA, the genetic code, protein synthesis. Prokaryotic DNA. The structure of the eukaryotic chromosome. Genes and the regulation of gene expression.

Human genetics: transmission of mono, and poly characteristics, hereditary diseases connected to the X chromosome.

Biotechnology: the DNA recombining technology and its applications.

Heredity and Environment.

Mutations. Natural and artificial selection. Evolution theories. The genetic basis for evolution.

Anatomy and physiology of animals and of human beings.

Animal tissues.

Anatomy and physiology of the human systems and their interaction.

Homeostasis.

## **Chemistry**

The constitution of matter: states of aggregation of matter; heterogenic and homo-genic systems; compounds and elements.

Laws of perfect gases.

The atom structure; elementary particles; atom and mass number, isotopes, electronic structures of the atoms of the various elements.

The periodic system of elements; groups and periods: transition elements; periodic property of elements; atomic range; ionization potential ; electronic affinity; metal characteristics; relation between electronic structure, position in the periodic table and property of elements.

Chemical bindings; ionic bindings; covalent and metal bindings; Energy from bindings, polarity of bindings; electronegativity. Intermolecular bindings.

Basic Inorganic Chemistry; Names and main properties of inorganic compounds; oxides, hydro-oxides, acids and salts.

Chemical reactions and stoichiometry; atomic and molecular mass; Avogadro number, the concept of mole and its application; elementary calculations of stoichiometry; equilibrium of simple reactions, different types of chemical reactions.

Solutions; properties of water solutions; solubility, most important ways of expressing the concentration of solutions.

Equilibrium in water solutions

Elements of chemical kinetics and catalysis

Oxidation and reduction; oxidation number, the concepts of oxidation and reduction. Equilibrium of simple reactions

Acids and bases, the concept of acids and bases. Acidity, neutrality and baseness of water solutions. PH. Hydrolysis. Buffer solutions.

Basic Organic chemistry: carbon atom bindings, structure formulas, concepts of isomers. Aliphatic, alicyclic and aromatic Hydrocarbons. Functional groups; alcohols, amino, aldehydes, carbon-silicon acids amides. Elements of Nomenclature.

## **Physics**

Measures: direct and indirect measures, fundamental and derivate quantities, physical dimensions of quantities, metric system and CGS system, Technical or practical (ST) and International (SI) systems, units of measurement (names and relations between fundamental and derivate units), multiples and submultiples (names and values).

Kinematics; kinematic quantities, motion, with particular regard to uniform rectilinear motion and to uniformly accelerated rectilinear motion; uniformly circular motion ; harmonic motion. For all types of motion: definition and relation between the connected kinematic quantities.

Dynamics: vectors and operations on vectors. Forces, moments of forces in relation to a point. Moments of two forces. Vector composition of forces. Definition of mass and weight. Gravity acceleration. Density and specific weight. The law of gravity, 1<sup>st</sup> 2<sup>nd</sup> and 3<sup>rd</sup> laws of dynamics. Work, kinetic energy, potential energy. The principle of conservation of energy, impulses and quantity of motion. Principle of conservation of quantity of motion.

Fluid mechanics; pressure and units of measure, not only in SI system. The principles of Archimedes and Pascal and the Law of Stevino.

Thermology, thermodynamics: thermometric and calorimetry, specific heat, thermic capacity. Heat propagation mechanisms, Change of state. Law of perfect gases, first and second principles of thermodynamics.

Electrostatics electrodynamics: Law of Coulomb. Electric field and potential. Dielectric constants. Condensers. Parallel and serial condensers. Continuous current. Law of Ohm. Kirshoff's principles. Electrical resistance and resistivity, serial and parallel electrical resistances. Workload, power, and joule effect. Generators. Electromagnetic induction and alternating currents. Effects of electrical currents thermic, chemical and magnetic flows.

## **Mathematics**

Sets of numbers and algebra. Natural, whole, rational and real numbers. Orders and comparisons; orders of size and scientific annotations. Operations and their properties. Proportions and percentages. Potencies with whole and rational exponents and their properties. Radicals and their properties. Logarithms, base 10 and base e, basics of combinatory calculations. Algebraic expressions, polynomials. Binomials to n-potency, decomposition of polynomials. Algebraic fractions. Equations and dis-equation of first and second level. Systems of equations.

Functions: fundamental notions on functions and their graphic representation (dominion, co-dominion, signs, maximum and minimum, increase and decrease, and so on). Elementary functions: algebraic wholes, fractions, exponents, logarithms. Inverse and compose functions. Goniometric equations and dis-equations.

Geometry: Polygons and their properties. Circumferences and the circle. Measures of length, surfaces and volumes. Isometry, similarities and equivalences on surfaces. Geometric places. Measurements of angles in

degrees and radius. Sine and cosine. Goniometric formulas. Resolution of triangles. Cartesian reference system for planes. Distance between two points and a medium point in a segment. Conditions of parallelism and perpendicularity. Distance of a point from a line. Equations of Circumferences, parabolas, hyperboles, ellipses and their representation in the Cartesian table. Pythagoras theory. Euclidean first and second theory.

Probability and statistics: distribution of frequencies according to the type of characteristics and main graphic representations. Notions of causal experiments and of events. Probability and frequency.