

Ministry of Universities and Research

Annex A

Topics covered by the admission exam for long single cycle degree courses in Medicine and Surgery and in Dentistry and Prosthodontics , taught in English

A good level of general culture, focusing in particular on literature, history, philosophy, social and institutional studies, as well as the ability to analyse various types of texts and aptitude for logical-mathematical reasoning, are required for admission to the courses.

The required knowledge and skills are in line with the educational programmes of schools that adhere to the Ministerial programmes for high schools (*licei*) and to the guidelines for technical and professional institutes, especially in view of State Board Exams, and which regard the scientific fields of Biology, Chemistry, Physics and Mathematics.

General culture and logical reasoning

The exam will measure the ability to use the English language correctly and to complete a logical argument that is coherent with the premise, which will be stated symbolically or verbally, through multiple choice questions, also with short phrases, where the applicant must exclude the wrong, arbitrary or least probable conclusions.

The questions will regard scientific texts, extracts of classic or contemporary authors, current affairs texts taken from newspapers, magazines or specialized journals. The questions will also regard cases or problems of an abstract nature, the solution of which will require various forms of logical reasoning.

Questions on general culture relating to topics addressed during studies or current affairs, complete the exam.

Questions in the area of history may regard, among other things, elements characterising 20th century history and the present day.

In the area of social and institutional studies, in accordance with ministerial programmes and guidelines and in relation to activities completed within the context of “Cittadinanza e Costituzione” (Citizenship and Constitution), questions may regard, among other things, the Constitutional Charter,

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mass media and communication, the organization of the economy and political life, the different forms of government and State.

Biology

The chemistry of living things.

The biological importance of weak interactions.

Organic molecules in living organisms and their respective functions. The role of enzymes.

The cell as the basis of life.

Cell theory. Cell size. Prokaryotic and eukaryotic cells, animal and vegetal. Viruses.

The cellular membrane: structure and function – transport through the membrane.

Cellular structures and their specific functions.

The cell cycle and cellular reproduction: mitosis and meiosis - chromosome sets and chromosome maps.

Bioenergetics

The energy currency of cells: ATP.

Redox reactions in living things.

Energy metabolism: photosynthesis, glycolysis. aerobic respiration.

Reproduction and inheritance.

Life cycles. Sexual and asexual reproduction.

Mendelian genetics: Mendel's laws of inheritance and their application.

Classical genetics: chromosome theory of inheritance - inheritance models.

Molecular genetics: DNA structure and duplication, genetic code and its translation, protein synthesis. The DNA of prokaryotes. The chromosome structure of eukaryotes. Genes and regulation of gene expression.

Human genetics: transmission of mono and multi-factorial traits, hereditary diseases of autosomal and X-chromosome linked types.

Biotechnology: recombinant DNA technology and its applications.

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Inheritance and environment.

Mutations. Natural and artificial selection. Evolutionary theories. The genetic basis of evolution.

Anatomy and Physiology of animals and humans.

Animal tissues.

Anatomy of the major organs and systems in humans and their interactions.

Homeostasis.

Chemistry

The constitution of matter: states of matter; heterogeneous and homogeneous systems; compounds and elements.

Ideal gas laws.

The structure of the atom: elementary particles, atomic number and mass number, isotopes, electron configuration of atoms in the various elements.

The periodic table of elements: groups and periods, transition elements. Periodic properties of elements: atomic radius, ionization potential, electron affinity, metals and non-metals. Relations between electron configuration, position in the periodic table and element properties.

Chemical bonds: ionic bond, covalent bond, metallic bonding. Binding energy. Bond polarity. Electronegativity. Intermolecular forces.

Fundamentals of inorganic chemistry. Nomenclature and main properties of inorganic compounds: oxides, hydroxides, acids, salts.

Chemical reactions and stoichiometry: atomic and molecular weight, Avogadro constant, concept of the mole and its applications, elementary stoichiometric calculations, balancing simple reactions, various types of chemical reactions.

Solutions: solvent properties of water, solubility, the main ways of expressing the concentration of solutions.

Equilibria in aqueous solutions.

Elements of kinetic chemistry and catalysis.

Oxidation and reduction: oxidation number, the concepts of oxidizing and reducing agents. Balancing

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simple reactions.

Acids and bases: concept of acid and base, acidity, neutrality and basicity of aqueous solutions, pH, hydrolysis, buffer solutions.

Fundamentals of organic chemistry: bonds between carbon atoms; molecular, structural and displayed formulae. Concept of isomers; aliphatic, alicyclic and aromatic hydrocarbons. Functional groups: alcohols, ethers, amines, aldehydes, ketones, carboxylic acids, esters, amides. Elements of nomenclature.

Physics

Measures: direct and indirect measures, fundamental and derived quantities, physical dimensions of quantities, knowledge of the metric system and the CGS, Technical (or Practical) (ST) and the International (SI) systems of units, units of measure (names and relationships between fundamental and derived units), and multiples and submultiples (names and values).

Kinematics: kinematic quantities, various types of motion with particular regard to uniform and uniformly accelerating rectilinear motion, uniform circular motion, harmonic motion (for all motion: definition and relationships between related kinematic measures).

Dynamics: vectors and operations on vectors. Forces, moments of forces about a point. Moment of coupled forces. Vector composition of forces. Definitions of mass and weight. Acceleration due to gravity. Density and specific weight. Law of universal gravitation, 1st, 2nd and 3rd laws of motion. Work, kinetic energy, potential energy. Principle of conservation of energy. Impulse and momentum. Law of conservation of momentum.

Fluid mechanics. Pressure and its units of measurement (not only in the SI system). Archimedes' principle. Pascal's law. Stevin's law.

Thermology, thermodynamics: thermometry and calorimetry. Heat capacity and specific heat,. Mechanisms of heat propagation. Changes of state and latent heat. Ideal Gas Laws. First and second laws of thermodynamics.

Electrostatics and electrodynamics: Coulomb's law. Field and electric potential. Dielectric constant. Capacitors. Capacitors in series and in parallel. Direct current. Ohm's law. Kirchhoff's laws. Electrical resistance and resistivity, electrical resistors in series and in parallel. Work, Power, Joule effect. Generators. Electromagnetic induction and alternating currents. Effects of electrical currents (thermal, chemical and magnetic).

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Mathematics

Algebra and numerical sets: natural numbers, integers, rational and real numbers. Sorting and comparison; scales and scientific notation. Operations and their properties. Proportions and percentages. Powers with whole, rational exponents and their properties. Roots and their properties. Logarithms (base 10 and base e) and their properties. Elements of combinatorics. Algebraic and polynomial expressions. Special products of binomials, n^{th} power of a binomial, factorization of polynomials. Algebraic fractions. Algebraic equations and inequalities of the first and second order. Systems of equations.

Functions: basic concepts of functions and their graphical representations (domain, codomain, sign, maxima and minima, increasing and decreasing, etc.). Elementary functions: whole and fractional algebraic functions, exponential, logarithmic and trigonometric functions. Composite functions and inverse functions. Trigonometric equations and inequalities.

Geometry: polygons and their properties. Circle and circumference. Measurements of length, area and volume. Isometries, similarities and equivalences in the plane. Geometric loci. Measures of angles in degrees and radians. Sine, cosine, tangent of an angle and their significant values. Trigonometric formulas. Solving triangles. Cartesian reference system in a plane. Distance between two points and the midpoint of a segment. Equation of a line. Concepts of parallel and perpendicular. Distance of a point from a straight line. Equation of the circle, the parabola, hyperbola, ellipse and their representation in the Cartesian plane. Pythagorean Theorem. Euclidean Theorems (first and second).

Probability and Statistics: frequency distributions and their graphical representations. Concepts of random experiments and of events. Probability and frequency.