COLLEGIO NUOVO
FONDAZIONE SANDRA E ENEA MATTEI
PAVIA

COMPETITION FOR PLACES: PROGRAMME FOR THE ORAL TESTS

The competition for places at Collegio Nuovo entails a two-part oral test, covering two disciplines chosen by the candidate and pertinent to her chosen degree course, as specified in the call for applications.
For students enrolling on one of the courses at the University of Pavia that are taught in English, the oral test can also be conducted in English.

The topics listed below are broad indications which applicants should bear in mind when preparing for the test, whose main purpose is to ascertain their aptitude for and interest in the disciplines and, therefore, in the degree courses they intend to take. In addition, candidates may indicate one or more specific topics which they, personally, are interested in, and which they have studied in particular depth. These will be discussed at the start of the oral test.
They will also be required to outline, for the section committee, the content of their school curriculum.

HUMANITIES

ITALIAN
Italian literature of the 19th and 20th centuries with reference, in particular, to the most important authors, texts and literary movements of the period and analysis of the philological and linguistic aspects of the works examined.

HISTORY
Discussion of the key issues and events of nineteenth and twentieth century history.

PHILOSOPHY
Philosophical thought from Kant onwards; applicants must have direct knowledge of at least one key philosophical text from the last two centuries.

LATIN
Interpretation and analysis of some texts of Latin authors, chosen by the candidate, who will also be required to refer to the history of Latin literature.

SCIENCES

MATHEMATICS
The fundamentals of Euclidean geometry of the plane: in particular congruence, similarity, the theory of the equivalence of polygons, the circumference length and the area of a circle.

The main number sets, from natural numbers to real numbers; properties of mathematical operations and of order relations.
Equations, inequalities, linear and quadratic systems.
Elements of trigonometry with reference, in particular, to the definitions and properties of trigonometric functions.
Powers, radicals, exponentials, logarithms, and their properties.
Cartesian coordinates in the plane and graphical representation of the main first and second-order curves.
Limits, derivatives and integrals* with reference, in particular, to their properties and their applications, to the study of functions and to the calculation of areas and volumes (*only for candidates from Italian Scientific High Schools/*Liceo Scientifico*).

PHYSICS
Dynamics: the three principles of dynamics; inertial and non-inertial frames of reference; momentum, impulse, work and power, Kinetic energy and potential energy.
The law of conservation of mechanical energy. Static equilibrium of a rigid body.
The universal law of gravitation and Kepler's laws of planetary motion.
Base concepts of fluid mechanics: Archimedes' principle, Stevino's law, Bernoulli's theorem.
Thermodynamics: heat and energy, temperature, thermodynamic systems, ideal gas. First and second law of thermodynamics, entropy.
Propagation of waves: mechanical and optical waves. Reflection, interference and diffraction of light.
Coulomb's law and the concept of electric charge.
Magnetic induction and electric currents.
The biggest discoveries in Physics of the 19th century: Einstein's theory of relativity, black-body radiation, the photoelectric effect, Bohr's atomic model.

CHEMISTRY
The structure of the atom: electrons and orbitals. Electron configuration and the periodic table of elements. Covalent bonds and the geometry of molecules. Ionic bonds. The interactions between molecules and the three states of matter. Solutions. Chemical reactions. Reaction rate, activation energy, catalysis. Chemical equilibrium. Acids and bases. Oxidation and reduction.
Inorganic chemistry: nomenclature of inorganic compounds. Metals and non-metals.
Organic chemistry: nomenclature of organic compounds. Hydrocarbons and the main classes of organic compounds.

BIOLOGY
Living organisms: origin, classification, taxonomic criteria. Characteristics and phylogenetic relationships of the main *phyla*. Species concepts. Speciation and evolution. Properties of living organisms: autotrophic and heterotrophic nutrition. Respiration, fermentation and photosynthesis.
Reproduction.
Cell organisation in prokaryotic and eukaryotic cells. Comparison of animal, plant and microbial cells. Basic functions of the cell: transport of substances through the cell membrane; cellular metabolism; protein synthesis. The nucleus and cell division. Mitosis and meiosis. Mutations. Mendel's laws. DNA in replication and transcription. The genetic code.
The human body: anatomy and physiology of the autonomic systems (digestive, respiratory, circulatory, excretory) and of the systems controlling the social aspects of life (endocrine, nervous, locomotor).