

*Liceo Linguistico Europeo “Paolino d’Aquileia” – Gorizia*

*Classe III<sup>a</sup>*

*Anno Scolastico 2008 – 2009*

## FISICA IN LINGUA INGLESE

(Prof. Erica Bisesi)

### PROGRAMMA:

#### **1° modulo:**

##### **OBSERVATIONS AND MEASUREMENTS:**

*the scientific method:* the Scientific Revolution in the XVII century, theory and experiments; *scientific measurement:* scientific notation and units, significant figures, approximation, dimensional analysis; *describing world:* the use of mathematics and graphs, problem-solving techniques

#### **2° modulo:**

##### **MECHANICS:**

*vectors:* definitions and main operations, graphical representation; *kinematics:* position, displacement, velocity and acceleration, trajectory; reference frames and relative motion, from classical to modern relativity; different kinds of motion – introduction; *dynamics:* mass, equilibrium and forces; the three laws of dynamics; *the forces of nature:* fundamental and non-fundamental forces, gravitation, electromagnetism, contact forces, tension, friction, air resistance; apparent forces; *energy and conservation laws:* forms of energy, work done by a constant force, kinetic and potential energy, gravitational potential energy; work done by variable forces, elastic potential energy, Hooke’s law; power; energy conservation law; linear momentum, the impulse-momentum theorem, centre of mass; law of conservation of linear momentum, collisions in one and two dimensions, designing a safer automobile; torque and rotational kinetic energy, angular momentum; law of conservation of angular momentum; *different kinds of motion:* linear uniform, circular uniform, naturally accelerated and decelerated, motion along unbanked and banked curves, non-uniform curvilinear motion, free fall, motion of projectiles, motion of satellites and planets, Kepler’s laws of planetary motion, orbital speed of Earth and Mercury, escape speed, motion of a spring, the hopping kangaroo, rolling objects, the bicycle

#### **3° modulo:**

##### **ASTRONOMY FROM ANCIENTS’ THOUGHT TO MODERN PHYSICS:**

*historical perspective:* astronomic discoveries in ancient cultures, history of astronomy in the Western culture; *philosophical perspective:* the Copernican Revolution, science and faith in the modern world; *scientific perspective:* introduction to special and general relativity

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### **PROGRAMMA:**

#### **1° modulo:**

##### **THE SCIENTIFIC METHOD:**

the Scientific Revolution in the XVII century; theory and experiments; the infinitesimal calculus of Newton and Leibniz

#### **2° modulo:**

##### **ELASTICITY AND OSCILLATIONS, WAVES AND SOUND:**

Hooke's law; *simple harmonic motion*: description, period and frequency, graphical analysis; the pendulum; damped oscillations, forced oscillations and resonance; *waves*: waves and energy transport; transverse and longitudinal waves; speed of transverse waves on a string; periodic waves; mathematical description of a wave, graphing waves; principle of superposition; reflection, refraction, interference and diffraction of waves; standing waves; earthquakes; *sound waves*: description, amplitude and intensity; the speed of sound; *the musical instruments*: standing sound waves and timbre, string and wind instruments; beats; the human ear; the Doppler effect; infrasounds and ultrasounds, medical applications

#### **3° modulo:**

##### **THERMAL PHYSICS:**

*temperature and the ideal gas*: main concepts and scales, absolute temperature; thermal expansion of solid and liquids; molecular picture of a gas; the ideal gas law; *heat*: internal energy; heat capacity and specific heat; phase transitions and diagrams; *heat transmission*: conduction, convection and radiation, the global warming and the greenhouse effect; *thermodynamics*: the three laws of thermodynamics; general formulation of the law of conservation of energy; thermodynamic processes, reversible and irreversible processes; heat engines, refrigerators and heat pumps, efficiency, the Carnot cycle; entropy

#### **4° modulo:**

##### **FLUIDS:**

states of matter; *pressure*: definition and measurement, atmospheric pressure; Pascal's principle; the effect of gravity on fluid pressure; Archimede's principle; fluid flow, the continuity equation, Bernoulli's equation, arterial flutter and aneurisms, airplane wings; viscosity

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### **PROGRAMMA:**

#### **1° modulo:**

##### **THE SCIENTIFIC METHOD:**

the Scientific Revolution in the XVII century; theory and experiments; the infinitesimal calculus of Newton and Leibniz

#### **2° modulo:**

##### **THE FORCES OF NATURE:**

fundamental interactions and particles: gravity, electromagnetism, nuclear forces, quarks and leptons, the Standard Model of particle physics, unification, the LHC experiment in Genève

#### **3° modulo:**

##### **ELECTROSTATICS:**

electric charge: types of charge, elementary charge, polarization; electrical conductors and insulators: charging by rubbing, grounding, induction; Coulomb's law; the electric field: the electric field due to a point charge, electric field lines, field lines for a point charge and for a dipole; motion of a point charge in a uniform electric field; Gauss's law for electric fields; electric potential energy: potential energy due to a single charge and to several point charges; electric potential: electric potential energy and potential difference; capacitors; dielectrics: polarization in a dielectric medium

#### **4° Modulo:**

##### **ELECTRODYNAMICS:**

electric current; electromotive force and circuits; microscopic view of current in a metal: the free-electron model and drift velocity; resistance and resistivity: the Ohm's law; resistivity dependence on temperature; Kirchhoff's rules; circuits: resistors in series and parallel, RC circuits

#### **5° Modulo:**

##### **MAGNETISM:**

magnetic fields: permanent magnets, magnetic field lines, the Earth's magnetic field, magnetic force on a point charge, cross product and direction of a magnetic force; motion of charged particles in a uniform magnetic field: bubble chamber, mass spectrometers and cyclotrons; magnetic materials: ferromagnetic, paramagnetic and diamagnetic substances

**6° Modulo:**

**ELECTROMAGNETIC INDUCTION AND WAVES**

*magnetic field due to an electric current; the Ampere's law; the Faraday's law; the Lenz's law; electric fields induced by changing magnetic fields; alternate currents:* electricity in the home; *electromagnetic waves:* waves and energy transport, waves properties, mathematical description of a wave, Maxwell's equations, speed of electromagnetic waves in vacuum and in matter; the electromagnetic spectrum (visible light, infrared, ultraviolet, radio waves, microwaves, X-rays and gamma-rays); astrophysics at different electromagnetic wavelengths

**LIBRI DI TESTO E ULTERIORI SUPPORTI DIDATTICI:**

1. A. Giambattista – B. McCarthy Richardson – R. C. Richardson, **College Physics**, McGraw Hill – Higher Education (volume unico);
2. A. Caforio – A. Ferilli, **Nuovo Compendio di Fisica Sperimentale**, Le Monnier (volume unico);
3. [www.cern.ch/education](http://www.cern.ch/education)