

Liceo Linguistico Europeo “Paolino d’Aquileia” – Gorizia

Classe III^a

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, Bernouilli’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