

Classe 2E

Liceo Morgagni di Roma

Programma di Fisica

anno scolastico 2022-2023

Docente: Enrico Campagna

Libro adottato: "Complete Physics for Cambridge IGCSE, 3rd ed." di S. Pople, ed. Oxford University Press

Eserciziario: "Complete Physics for Cambridge IGCSE - Workbook" di S. Lloyd, ed. Oxford University Press

0. **Review of last year topics:** Uncertainties, direct/indirect measurements. Vectors, composition, decomposition, sine and cosine on the goniometric circumference, moments, mass, gravitational force, velocity, acceleration (the uniformly accelerated motion). The impulse theorem. Vincula and normal force. The inclined plane with no friction and with static/sliding friction.
1. **Properties of waves:** Mean of propagation. Definition of wavelength and period. The hertz. Amplitude related to intensity and frequency to pitch. Relation between λ , T and speed. Meaning of longitudinal and transverse waves (with a class experience). Describing waves. Resonant waves, normal modes on a spring.
2. **Sound:** Generating sounds. Fundamental mode and harmonics of a string. The phenomenon of echo. Time of travel. Incidence angle, reflection angle. Law of reflection and refraction (Snell's law).
3. **Light:** Reflecting light. Refracting light. Total internal reflection. Lenses: How to find conjugate points (source and image) with biconvex lenses. Parabolic mirrors. Real and virtual images. Dispersion of light and the dependence of the refraction index with frequency. The electromagnetic spectrum.
4. **Magnetism:** Soft and hard magnetic materials, the demagnetization (hammering, heating up, with cycles with an electromagnet). Magnetic fields. The earth magnetic field and the compass.
5. **Static electricity:** Charging and discharging. Electrical induction. Polarization. Volta's electrophorus. The electric-field lines. Insulating and conducting materials. Explaining static electricity. Electric field and electric charge.
6. **Electrical quantities:** Current in electric circuits: Electrical resistance. First and second Ohm's laws. Electricity and energy. Electrical power.

7. **Electric circuits:** Circuit components (cell, battery, switch, ammeter, voltmeter, variable resistor, potential divider, LDR, thermistor, diode). Resistors in series and in parallel: the equivalent resistance. Electronic circuits and digital signals. Electrical safety: fuses, grounding, trip switch.
8. **Electromagnetic forces:** The magnetic field generated by a wire and by a solenoid (the grab right-hand rule). The electromagnets and their use (electric bells, relays). How electric motor are constructed. Force on a current-carrying conductor (Fleming's left-hand rule).
9. **Electromagnetic induction:** The induced current (Fleming's right-hand rule). The induced e.m.f. Generating alternate current. Power lines and transformers. How transformers work.
10. **The nuclear atom:** Atomic structure. The Rutherford experiment. Protons, neutrons and electrons. Atomic number, mass number. Isotopes. The lepton family, the barions and the quarks.
11. **Radioactivity:** Contamination and irradiation. Natural background and artificial sources. Alpha, beta and gamma decays. Penetrating and ionizing power. The half-life. Using radioactivity (smoke detectors, thickness measurement, medical diagnosis, fault detection, food irradiation and sterilization. Fission and fusion.
12. **The earth in space:** Sun, earth, moon (day/night, seasons, moon phases), The solar system (definition of ellipse, the three Kepler's laws, inner/outer planets, asteroids, comets). The evolution of a star (nebula, protostar, nuclear reactions, novae, supernovae, white dwarfs, neutron stars, black holes). Galaxies. The expanding universe (Doppler effect, cosmological redshift, Hubble's law).
13. **Motion on the plane:** The circular motion. Tangential and centripetal acceleration. Angular velocity. The uniform circular motion: relation among velocity, angular velocity and acceleration.

Laboratory experiences:

- Path of light and reflection
- Refraction
- Curved mirror and lenses
- Electrostatics
- Circuits (parallel and series resistors)
- More on circuits (the deviator) and electrodynamics.

Roma, 06/06/2023

Il docente del corso
prof. Enrico Campagna

I rappresentanti degli studenti