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FISICA / Physics

PROGRAMMAZIONE ANNUALE DEL GRUPPO DISCIPLINARE

A.S. 2020/2021

INDIRIZZO SCOLASTICO: LICEO SCIENTIFICO – CLASSI II
ORE SETTIMANALI: 2+1(Physics)

MODULI di FISICA	Units from Physics' Syllabus
1. ENERGIA E LAVORO *(trimestre, 16 ore)* - Lavoro compiuto da una forza, energia cinetica, teorema dell'energia cinetica, energia potenziale gravitazionale, energia potenziale elastica, conservazione dell'energia meccanica, potenza *Libro di testo:* Vol. 1, cap. 9, par. 1, 2, 3, 4	**Energy** • Identify changes in kinetic, gravitational potential, chemical, elastic (strain), nuclear and internal energy that have occurred as a result of an event or process • Recognise that energy is transferred during events and processes, including examples of transfer by forces (mechanical working), by electrical currents (electrical working), by heating and by waves • Apply the principle of conservation of energy to simple examples • Recall and use the expressions kinetic energy (K.E. = ½ mv^2) and change in gravitational potential energy (G.P.E.= $mg\Delta h$) • Apply the principle of conservation of energy to examples involving multiple stages • Explain that in any event or process the energy tends to become more spread out among the objects and surroundings (dissipated) **Energy resources** • Describe how electricity or other useful forms of energy may be obtained from: – chemical energy stored in fuel – water, including the energy stored in waves, in tides, and in water behind hydroelectric dams – geothermal resources – nuclear fission – heat and light from the Sun (solar cells and panels) – wind • Give advantages and disadvantages of each method in terms of renewability, cost, reliability, scale and environmental impact • Show a qualitative understanding of efficiency • Understand that the Sun is the source of energy for all our energy resources except geothermal, nuclear and tidal

	• Show an understanding that energy is released by nuclear fusion in the Sun • Recall and use the equation: **Work** • Demonstrate understanding that work done = energy transferred • Relate (without calculation) work done to the magnitude of a force and the distance moved in the direction of the force • Recall and use W = Fd = ΔE **Power** • Relate (without calculation) power to work done and time taken, using appropriate examples • Recall and use the equation P = ΔE/t in simple systems ***Textbook*** **5. Forces and matter** 5.4 Pressure 5.5 Calculating pressure ***Workbook*** Ex. 5.3 Pressure
2. TEMPERATURA E CALORE *(trimestre, 12 ore)* - La temperatura, le scale termometriche e il principio zero della termodinamica - La dilatazione termica lineare e volumica - Calore specifico e legge fondamentale della calorimetria - Passaggi di stato e calore latente - Propagazione del calore (cenni) *Libro di testo:* Vol. 2, cap. 10	**Thermal physics** *Simple kinetic molecular model of matter* *States of matter* • State the distinguishing properties of solids, liquids and gases *Molecular model* • Describe qualitatively the molecular structure of solids, liquids and gases in terms of the arrangement, separation and motion of the molecules • Interpret the temperature of a gas in terms of the motion of its molecules • Describe qualitatively the pressure of a gas in terms of the motion of its molecules • Show an understanding of the random motion of particles in a suspension as evidence for the kinetic molecular model of matter • Describe this motion (sometimes known as Brownian motion) in terms of random molecular bombardment • Relate the properties of solids, liquids and gases to the forces and distances between molecules and to the motion of the molecules • Explain pressure in terms of the change of momentum of the particles striking the walls creating a force • Show an appreciation that massive particles may be moved by light, fast-moving molecules *Evaporation* • Describe evaporation in terms of the escape of more-energetic molecules from the surface of a liquid • Relate evaporation to the consequent cooling of the liquid • Demonstrate an understanding of how temperature, surface area and draught over a surface influence evaporation • Explain the cooling of a body in contact with an evaporating liquid *Pressure changes* • Describe qualitatively, in terms of molecules, the effect on the pressure of a gas of: – a change of temperature at constant volume
3. TERMODINAMICA *(pentamestre, 22 ore)* - Il modello del gas perfetto, la legge di Boyle e le due leggi di Gay-Lussac, equazione di stato dei gas perfetti	

(prospettiva microscopica e macroscopica) - Energia cinetica media delle molecole ed energia interna del gas perfetto - Lavoro di una trasformazione isobara, lavoro di una trasformazione qualsiasi, primo principio della termodinamica, applicazioni del primo principio a particolari trasformazioni, trasformazioni adiabatiche e trasformazioni cicliche - Macchine termiche e loro rendimento, secondo principio della termodinamica; trasformazioni cicliche notevoli (cenni) *Libro di testo:* Vol. 2, cap. 11	– a change of volume at constant temperature • Recall and use the equation pV = constant for a fixed mass of gas at constant temperature **Thermal properties and temperature** *Thermal expansion of solids, liquids and gases* • Describe qualitatively the thermal expansion of solids, liquids, and gases at constant pressure • Identify and explain some of the everyday applications and consequences of thermal expansion • Explain, in terms of the motion and arrangement of molecules, the relative order of the magnitude of the expansion of solids, liquids and gases *Measurement of temperature* • Appreciate how a physical property that varies with temperature may be used for the measurement of temperature, and state examples of such properties • Recognise the need for and identify fixed points • Describe and explain the structure and action of liquid-in-glass thermometers • Demonstrate understanding of sensitivity, range and linearity • Describe the structure of a thermocouple and show understanding of its use as a thermometer for measuring high temperatures and those that vary rapidly • Describe and explain how the structure of a liquid-in-glass thermometer relates to its sensitivity, range and linearity *Thermal capacity (heat capacity)* • Relate a rise in the temperature of a body to an increase in its internal energy • Show an understanding of what is meant by the thermal capacity of a body • Give a simple molecular account of an increase in internal energy • Recall and use the equation thermal capacity = mc • Define specific heat capacity • Describe an experiment to measure the specific heat capacity of a substance • Recall and use the equation change in energy = mcΔT *Melting and boiling* • Describe melting and boiling in terms of energy input without a change in temperature • State the meaning of melting point and boiling point • Describe condensation and solidification in terms of molecules • Distinguish between boiling and evaporation • Use the terms latent heat of vaporisation and latent heat of fusion and give a molecular interpretation of latent heat • Define specific latent heat • Describe an experiment to measure specific latent heats for steam and for ice • Recall and use the equation energy = ml **Thermal processes** *Conduction* • Describe experiments to demonstrate the properties of good and bad thermal conductors • Give a simple molecular account of conduction in solids including lattice vibration and transfer by electrons

	Convection • Recognise convection as an important method of thermal transfer in fluids • Relate convection in fluids to density changes and describe experiments to illustrate convection *Radiation* • Identify infra-red radiation as part of the electromagnetic spectrum • Recognise that thermal energy transfer by radiation does not require a medium • Describe the effect of surface colour (black or white) and texture (dull or shiny) on the emission, absorption and reflection of radiation • Describe experiments to show the properties of good and bad emitters and good and bad absorbers of infra-red radiation • Show understanding that the amount of radiation emitted also depends on the surface temperature and surface area of a body *Consequences of energy transfer* • Identify and explain some of the everyday applications and consequences of conduction, convection and radiation ***Textbook*** **6. Energy transformation and energy transfers** 6.1 Form of energy 6.2 Energy conversions 6.3 Conservation of energy 6.4 Energy calculations **7. Energy resources** 7.1 The energy we use 7.2 Energy from Sun **8. Work and power** 8.1 Doing work 8.2 Calculating work done 8.3 Power 8.4 Calculating power ***Workbook*** Ex. 6.1 Recognising forms of energy Ex. 6.2 Energy efficiency Ex. 6.3 Energy calculations Ex. 7.1 Renewables and non-renewables Ex. 7.2 Wind energy Ex. 7.3 Energy from the Sun Ex. 8.1 Forces doing work, transferring energy Ex. 8.2 Calculating work done Ex. 8.3 Measuring work done Ex. 8.4 Work done
4. MOTI RETTILINEI *(pentamestre, 16 ore)* - Traiettoria e spostamento, moti rettilinei uniformi, moti vari, moti accelerati, moto di un grave, lettura	**General wave properties** • Demonstrate understanding that waves transfer energy without transferring matter • Describe what is meant by wave motion as illustrated by vibration in ropes and springs and by experiments using water waves • Use the term wavefront • Give the meaning of speed, frequency, wavelength and amplitude • Distinguish between transverse and longitudinal waves and give suitable examples

e interpretazione di grafici, primo e secondo principio della dinamica *Libro di testo:* Vol. 1, cap. 8, cap. 10 par. 1, 2	• Describe how waves can undergo: – reflection at a plane surface – refraction due to a change of speed – diffraction through a narrow gap • Describe the use of water waves to demonstrate reflection, refraction and diffraction • Recall and use the equation v = f λ • Describe how wavelength and gap size affects diffraction through a gap • Describe how wavelength affects diffraction at an edge **Sound** • Describe the production of sound by vibrating sources • Describe the longitudinal nature of sound waves • State that the approximate range of audible frequencies for a healthy human ear is 20Hz to 20000 Hz • Show an understanding of the term ultrasound • Show an understanding that a medium is needed to transmit sound waves • Describe an experiment to determine the speed of sound in air • Relate the loudness and pitch of sound waves to amplitude and frequency • Describe how the reflection of sound may produce an echo • Describe compression and rarefaction • State typical values of the speed of sound in gases, liquids and solids **Light** *Reflection of light* • Describe the formation of an optical image by a plane mirror, and give its characteristics • Recall and use the law angle of incidence = angle of reflection • Recall that the image in a plane mirror is virtual • Perform simple constructions, measurements and calculations for reflection by plane mirrors *Refraction of light* • Describe an experimental demonstration of the refraction of light • Use the terminology for the angle of incidence i and angle of refraction r and describe the passage of light through parallel-sided transparent material • Give the meaning of critical angle • Describe internal and total internal reflection • Recall and use the definition of refractive index n in terms of speed • Recall and use the equation *sin(i)/sin(r)=n* • Recall and use *n=1/sin(c)* • Describe and explain the action of optical fibres particularly, in medicine and communications technology Thin converging lens • Describe the action of a thin converging lens on a beam of light • Use the terms principal focus and focal length • Draw ray diagrams for the formation of a real image by a single lens • Describe the nature of an image using the terms enlarged/same size/diminished and upright/inverted • Draw and use ray diagrams for the formation of a virtual image by a single lens • Use and describe the use of a single lens as a magnifying glass

	• Show understanding of the terms real image and virtual image *Dispersion of light* • Give a qualitative account of the dispersion of light as shown by the action on light of a glass prism including the seven colours of the spectrum in their correct order • Recall that light of a single frequency is described as monochromatic *Electromagnetic spectrum* • Describe the main features of the electromagnetic spectrum in order of wavelength • State that all electromagnetic waves travel with the same high speed in a vacuum • Describe typical properties and uses of radiations in all the different regions of the electromagnetic spectrum including: – radio and television communications (radio waves) – satellite television and telephones (microwaves) – electrical appliances, remote controllers for televisions and intruder alarms (infra-red) – medicine and security (X-rays) • Demonstrate an awareness of safety issues regarding the use of microwaves and X-rays • State that the speed of electromagnetic waves in a vacuum is 3.0 × 108 m/s and is approximately the same in air ***Textbook*** **12. Sound** 12.1 Making sound 12.2 At the speed of sound 12.3 Seeing sounds 12.4 How sound travels **13. Light** 13.1 Reflecting light 13.2 Refraction of light 13.3 Total internal reflection 13.4 Lenses **14. Properties of waves** 14.1 Describing waves 14.2 Speed, frequency and wavelength 14.3 Explaining wave phenomena **15. Spectra** 15.1 Dispersion of light 15.2 The electromagnetic spectrum ***Workbook*** Ex. 12.1 Sound on the move Ex. 12.2 Sound as a wave Ex. 13.1 On reflection Ex. 13.2 Reflection if light Ex. 13.3 The changing speed of light Ex. 13.4 A perfect mirror Ex. 13.5 Image in a lens Ex. 14.1 Describing waves Ex. 14.2 The speed of waves Ex. 14.3 Wave phenomena Ex. 15.1 Electromagnetic waves Ex. 15.2 Using electromagnetic radiation