MARINA INTERNATIONAL SCHOOL

PHYSICS SCHEME OF WORK

FORM 4 - TERM 1

WEEK	TOPIC	TOPIC DETAILS
1.1	Measurement	☐ Use and describe the use of rules and measuring cylinders to find a length or a volume. ☐ Use and describe the use of clocks and devices, both analogue and digital, for measuring an interval of time. ☐ Obtain an average value for a small distance and for a short interval of time by measuring multiples (including the period of a pendulum). ☐ Understand that a micrometer screw gauge is used to measure very small distances.
2.1	Scalers and vectors	☐ Understand that vectors have a magnitude and direction ☐ Demonstrate an understanding of the difference between scalars and vectors and give common examples ☐ Determine graphically the resultant of two vectors
3.1	Mass and wight	☐ Show familiarity with the idea of the mass of a body ☐ State that weight is a gravitational force ☐ Distinguish between mass and weight ☐ Recall and use the equation W = mg ☐ Demonstrate understanding that weights (and hence masses) may be compared using a balance. ☐ Demonstrate an understanding that mass is a property that ‘resists’ change in motion. ☐ Describe, and use the concept of, weight as the effect of a gravitational field on a mass

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4.1	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 = ½mv 2 and change in gravitational potential energy = mgΔh ☐ 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
5.1	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 equations: efficiency = useful energy output energy input × 100% efficiency = useful power output ☐ power input × 100%
6.1	Work and Power	☐ 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 ☐ Relate (without calculation) power to work done and time taken, using appropriate examples ☐ Recall and use the equation P = ΔE / t in simple ☐ systems

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7.1	Density	☐ Recall and use the equation ρ = mV ☐ Describe an experiment to determine the density of a liquid and of a regularly shaped solid and make the necessary calculation ☐ Describe the determination of the density of an irregularly shaped solid by the method of displacement ☐ Predict whether an object will float based on density data
8.1	Pressure	☐ Recall and use the equation p = F / A ☐ Relate pressure to force and area, using appropriate examples ☐ Describe the simple mercury barometer and its use in measuring atmospheric pressure ☐ Relate (without calculation) the pressure beneath a liquid surface to depth and to density, using appropriate examples ☐ Use and describe the use of a manometer Recall and use the equation p = hρg
9.1	Motion	☐ Define speed and calculate average speed from total distance total time ☐ Plot and interpret a speed–time graph or a distance–time graph ☐ Recognise from the shape of a speed–time graph ☐ when a body is at rest moving with constant speed moving with changing speed ☐ Calculate the area under a speed–time graph to work out the distance travelled for motion with constant acceleration
10.1	motion	☐ Demonstrate understanding that acceleration and deceleration are related to changing speed including qualitative analysis of the gradient of a speed–time graph ☐ State that the acceleration of free fall for a body near to the Earth is constant ☐ Distinguish between speed and velocity ☐ Define and calculate acceleration using change of velocity time taken ☐ Calculate
11.1	motion	☐ Calculate speed from the gradient of a distance–time graph ☐ Calculate acceleration from the gradient of a speed–time graph ☐ Recognise linear motion for which the acceleration is constant ☐ Recognise motion for which the acceleration is not constant ☐ Understand deceleration as a negative acceleration ☐ Describe qualitatively the motion of bodies falling in a uniform gravitational field with and without air resistance (including reference to ☐ terminal velocity)

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12.1	Forces Effects of forces	☐ Recognise that a force may produce a change in size and shape of a body ☐ Plot and interpret extension–load graphs and describe the associated experimental procedure ☐ Describe the ways in which a force may change the motion of a body ☐ Find the resultant of two or more forces acting along the same line ☐ Recognise that if there is no resultant force on a body it either remains at rest or continues at constant speed in a straight line
12.2	Forces Effects of forces	☐ Understand friction as the force between two surfaces which impedes motion and results in heating ☐ Recognise air resistance as a form of friction ☐ State Hooke's Law and recall and use the expression F = k x, where k is the spring constant. ☐ Recognise the significance of the 'limit of proportionality' for an extension–load graph ☐ Recall and use the relationship between force, mass and acceleration (including the direction), F = ma ☐ Describe qualitatively motion in a circular path due to a perpendicular force (F = mv 2 / r is not required)
13.1	Turning effect Moment of force	☐ Describe the moment of a force as a measure of its turning effect and give everyday examples ☐ Understand that increasing force or distance from the pivot increases the moment of a force ☐ Calculate moment using the product force × perpendicular distance from the pivot ☐ Apply the principle of moments to the balancing of a beam about a pivot ☐ Apply the principle of moments to different situations ☐ Conditions for equilibrium ☐ Recognise that, when there is no resultant force and no resultant turning effect, a system is in equilibrium ☐ Perform and describe an experiment (involving vertical forces) to show that there is no net moment on a body in equilibrium

PHYSICS SCHEME OF WORK

FORM 4 - TERM 2

WEEK	TOPIC	TOPIC DETAILS
1.1	Momentum	☐ Understand the concepts of momentum and impulse ☐ Recall and use the equation momentum = mass × velocity, p = mv ☐ Recall and use the equation for impulse Ft = mv – mu ☐ Apply the principle of the conservation of momentum to solve simple problems in one dimension
2.1	Thermal Physics	☐ Simple kinetic molecular model of matter ☐ States of matter ☐ State the distinguishing properties of solids, liquids and gases ☐ 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
3.1	Molecular model	☐ 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

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4.1	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
5.1	Pressure changes	☐ Describe qualitatively, in terms of molecules, the effect on the pressure of a gas of: a change of temperature at constant volume a change of volume at constant temperature ☐ Recall and use the equation pV = constant for a fixed mass of gas at constant temperature
6.1	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
7.1	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

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8.1	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
9.1	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
10.1	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 infrared 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 infrared radiation ☐ Show understanding that the amount of radiation emitted also depends on the surface temperature and surface area of a body

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11.1	Consequences of energy transfer	☐ Identify and explain some of the everyday applications and consequences of conduction, convection and radiation

PHYSICS SCHEME OF WORK

FORM 4 - TERM 3

WEEK	TOPIC	TOPIC DETAILS
1.1	Properties of Waves -Properties of waves, including light and sound 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
2.1	Properties of waves, including light and sound General wave properties continue	☐ 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
3.1	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
4.1	light-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

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5.1	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
6.1	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
7.1	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 (infrared) 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
8.1	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 20 Hz to 20 000 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