MARINA INTERNATIONAL SCHOOL

PHYSICS SCHEME OF WORK

FORM 6 - TERM 1

WEEK	**TOPIC**	**TOPIC DETAILS**
1.1	PHYSICAL QUANTITIES AND UNITS (Physical quantities)	☐ understand that all physical quantities consist of a numerical magnitude and a unit ☐ make reasonable estimates of physical quantities included within the syllabus
2.1	SI units	☐ recall the following SI base quantities and their units: mass (kg), length (m), time (s), current (A), temperature (K), amount of substance (mol) ☐ express derived units as products or quotients of the SI base units and use the named units listed in this syllabus as appropriate ☐ use SI base units to check the homogeneity of physical equations
2.2	SI units	use the following prefixes and their symbols to indicate decimal submultiples or multiples of both base and derived units: pico (p), nano (n), micro (μ), milli (m), centi (c), deci (d), kilo (k), mega (M), giga (G), tera (T) ☐ understand and use the conventions for labelling graph axes and table columns as set out in the ASE publication Signs, Symbols and Systematics (The ASE Companion to 16–19 Science, 2000)
2.3	Scalars and Vectors	☐ distinguish between scalar and vector quantities and give examples of each ☐ add and subtract coplanar vectors ☐ represent a vector as two perpendicular components

WEEK	TOPIC	TOPIC DETAILS
3.1	ELECTRICITY	Electric current ☐ understand that electric current is a flow of charge carriers ☐ understand that the charge on charge carriers is quantized ☐ define the coulomb ☐ recall and use Q = It ☐ derive and use, for a current-carrying conductor, the expression I = Anvq, where n is the number density of charge carriers
3.2	Potential difference and power	☐ define potential difference and the volt ☐ recall and use V = W / Q ☐ recall and use P = VI and P = I2R
3.3	Resistance and resistivity	☐ define resistance and the ohm ☐ recall and use V = IR ☐ sketch and discuss the I–V characteristics of a metallic conductor at constant temperature, a semiconductor diode and a filament lamp ☐ state Ohm's law ☐ recall and use R = Pl / A

WEEK	TOPIC	TOPIC DETAILS
4.1	MEASUREMENT TECHNIQUES	Measurements ☐ Use techniques for the measurement of length, volume, angle, mass, time, temperature and electrical quantities appropriate to the ranges of magnitude implied by the relevant parts of the syllabus. In particular, candidates should be able to: • measure lengths using rulers, calipers and micrometers • measure weight and hence mass using balances • measure an angle using a protractor • measure time intervals using clocks, stopwatches and the calibrated time-base of a cathode-ray oscilloscope (c.r.o.) • measure temperature using a thermometer • use ammeters and voltmeters with appropriate scales • use a galvanometer in null methods • use a cathode-ray oscilloscope (c.r.o.) ☐ use both analogue scales and digital displays ☐ use calibration curves
4.2	Errors and uncertainties	☐ understand and explain the effects of systematic errors (including zero errors) and random errors in measurements ☐ understand the distinction between precision and accuracy ☐ assess the uncertainty in a derived quantity by simple addition of absolute, fractional or percentage uncertainties (a rigorous statistical treatment is not required)
5.1	(DC CIRCUITS) Practical circuits	☐ Recall and use appropriate circuit symbols as set out in the ASE publication Signs, Symbols and Systematics (example circuit symbols are given in Section 5.5.) ☐ draw and interpret circuit diagrams containing sources, switches, resistors, ammeters, voltmeters, and/or any other type of component referred to in the syllabus ☐ define electromotive force (e.m.f.) in terms of the energy transferred by a source in driving unit charge round a complete circuit ☐ distinguish between e.m.f. and potential difference (p.d.) in terms of energy considerations ☐ understand the effects of the internal resistance of a source of e.m.f. on the terminal potential difference

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6.1	Kirchhoff's laws	☐ recall Kirchhoff's first law and appreciate the link to conservation of charge ☐ recall Kirchhoff's second law and appreciate the link to conservation of energy ☐ derive, using Kirchhoff's laws, a formula for the combined resistance of two or more resistors in series ☐ solve problems using the formula for the combined resistance of two or more resistors in series ☐ derive, using Kirchhoff's laws, a formula for the combined resistance of two or more resistors in parallel ☐ solve problems using the formula for the combined resistance of two or more resistors in parallel ☐ apply Kirchhoff's laws to solve simple circuit problems
6.2	Potential dividers	☐ Understand the principle of a potential divider circuit as a source of variable p.d. ☐ recall and solve problems using the principle of the potentiometer as a means of comparing potential differences

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7.1	KINEMATICS(Equations of motion)	☐ define and use distance, displacement, speed, velocity and acceleration ☐ use graphical methods to represent distance, displacement, speed, velocity and acceleration ☐ determine displacement from the area under a velocity-time graph ☐ determine velocity using the gradient of a displacement-time graph ☐ determine acceleration using the gradient of a velocity-time graph ☐ derive, from the definitions of velocity and acceleration, equations that represent uniformly accelerated motion in a straight line ☐ solve problems using equations that represent uniformly accelerated motion in a straight line, including the motion of bodies falling in a uniform gravitational field without air resistance ☐ describe an experiment to determine the acceleration of free fall using a falling body ☐ describe and explain motion due to a uniform velocity in one direction and a uniform acceleration in a perpendicular direction
8.1	ELECTRIC FIELDS (Concept of an electric field)	☐ understand the concept of an electric field as an example of a field of force and define electric field strength as force per unit positive charge acting on a stationary point charge ☐ represent an electric field by means of field lines
9.1	Uniform electric fields	☐ recall and use E = V / d to calculate the field strength of the uniform field between charged parallel plates in terms of potential difference and separation ☐ calculate the forces on charges in uniform electric fields ☐ describe the effect of a uniform electric field on the motion of charged particles

WEEK	TOPIC	TOPIC DETAILS
10.1	Momentum and Newton's laws of motion	Momentum and Newton's laws of motion ☐ understand that mass is the property of a body that resists change in motion ☐ recall the relationship F = ma and solve problems using it, appreciating that acceleration and resultant force are always in the same direction ☐ define and use linear momentum as the product of mass and velocity ☐ define and use force as rate of change of momentum ☐ state and apply each of Newton's laws of motion
10.2	Non-uniform motion	Non-uniform motion ☐ describe and use the concept of weight as the effect of a gravitational field on a mass and recall that the weight of a body is equal to the product of its mass and the acceleration of free fall ☐ describe qualitatively the motion of bodies falling in a uniform gravitational field with air resistance
11.1	Linear momentum and its conservation	Linear momentum and its conservation ☐ state the principle of conservation of momentum ☐ apply the principle of conservation of momentum to solve simple problems, including elastic and inelastic interactions between bodies in both one and two dimensions (knowledge of the concept of coefficient of restitution is not required) ☐ recognize that, for a perfectly elastic collision, the relative speed of approach is equal to the relative speed of separation ☐ understand that, while momentum of a system is always conserved in interactions between bodies, some change in kinetic energy may take place

WEEK	TOPIC	TOPIC DETAILS
11.2	Progressive waves	Progressive waves ☐ describe what is meant by wave motion as illustrated by vibration in ropes, springs and ripple tanks ☐ understand and use the terms displacement, amplitude, phase difference, period, frequency, wavelength and speed ☐ deduce, from the definitions of speed, frequency and wavelength, the wave equation v = f ʎ ☐ recall and use the equation v = f ʎ ☐ understand that energy is transferred by a progressive wave ☐ recall and use the relationship intensity ∝ (amplitude)2
12.1	WAVES CONTINUE	Transverse and longitudinal waves ☐ compare transverse and longitudinal waves ☐ analyze and interpret graphical representations of transverse and longitudinal waves Determination of frequency and wavelength of sound waves ☐ determine the frequency of sound using a calibrated cathode-ray oscilloscope (c.r.o.) ☐ determine the wavelength of sound using stationary waves Doppler effect ☐ understand that when a source of waves moves relative to a stationary observer, there is a change in observed frequency ☐ use the expression fo = fs V / V + Vs for the observed frequency when a source of sound waves moves relative to a stationary observer ☐ appreciate that Doppler shift is observed with all waves, including sound and light
12.2	Electromagnetic spectrum	Electromagnetic spectrum ☐ state that all electromagnetic waves travel with the same speed in free space and recall the orders of magnitude of the wavelengths of the principal radiations from radio waves to γ-rays

PHYSICS SCHEME OF WORK

FORM 6 - TERM 2

WEEK	TOPIC	TOPIC DETAILS
1.1	FORCES, DENSITY AND PRESSURE	Types of force ☐ describe the force on a mass in a uniform gravitational field and on a charge in a uniform electric field ☐ understand the origin of the upthrust acting on a body in a fluid ☐ show a qualitative understanding of frictional forces and viscous forces including air resistance (no treatment of the coefficients of friction and viscosity is required) ☐ understand that the weight of a body may be taken as acting at a single point known as its centre of gravity Turning effects of forces ☐ define and apply the moment of a force ☐ understand that a couple is a pair of forces that tends to produce rotation only ☐ define and apply the torque of a couple Equilibrium of forces ☐ state and apply the principle of moments ☐ understand that, when there is no resultant force and no resultant torque, a system is in equilibrium

WEEK	TOPIC	TOPIC DETAILS
2.1	FORCES, DENSITY AND PRESSURE continue	☐ use a vector triangle to represent coplanar forces in equilibrium Density and pressure ☐ define and use density ☐ define and use pressure ☐ derive, from the definitions of pressure and density, the equation $\Delta p = \rho g \Delta h$ ☐ use the equation $\Delta p = \rho g \Delta h$
3.1	SUPERPOSITON	Stationary waves ☐ explain and use the principle of superposition in simple applications ☐ show an understanding of experiments that demonstrate stationary waves using microwaves, stretched strings and air columns ☐ explain the formation of a stationary wave using a graphical method, and identify nodes and antinodes Diffraction ☐ explain the meaning of the term diffraction ☐ show an understanding of experiments that demonstrate diffraction including the diffraction of water waves in a ripple tank with both a wide gap and a narrow gap
3.2	SUPERPOSITON continue	Interference, two-source interference ☐ understand the terms interference and coherence ☐ show an understanding of experiments that demonstrate two-source interference using water ripples, light and microwaves ☐ understand the conditions required if two-source interference fringes are to be observed ☐ recall and solve problems using the equation ʎ = ax / D for double-slit interference using light Diffraction gratings ☐ recall and solve problems using the formula d sin θ = nʎ ☐ describe the use of a diffraction grating to determine the wavelength of light (the structure and use of the spectrometer are not included)

WEEK	TOPIC	TOPIC DETAILS
4.1	WORK, ENERGY AND POWER	Energy conversion and conservation ☐ give examples of energy in different forms, its conversion and conservation, and apply the principle of conservation of energy to simple examples Work and efficiency ☐ understand the concept of work in terms of the product of a force and displacement in the direction of the force ☐ calculate the work done in a number of situations including the work done by a gas that is expanding against a constant external pressure: $W = p \Delta V$ ☐ recall and understand that the efficiency of a system is the ratio of useful energy output from the system to the total energy input ☐ show an appreciation for the implications of energy losses in practical devices and use the concept of efficiency to solve problems
5.1	Potential energy and kinetic energy	Potential energy and kinetic energy ☐ derive, from the equations of motion, the formula for kinetic energy E = ½ m v2 ☐ recall and apply the formula E = ½ m v2 ☐ distinguish between gravitational potential energy and elastic potential energy ☐ understand and use the relationship between force and potential energy in a uniform field to solve problems ☐ derive, from the defining equation W = Fs, the formula $\Delta E_p = m g \Delta h$ for potential energy changes near the Earth's surface ☐ recall and use the formula $\Delta E_p = m g \Delta h$ for potential energy changes near the Earth's surface Power ☐ define power as work done per unit time and derive power as the product of force and velocity ☐ solve problems using the relationships P = W / t and P = Fv

WEEK	TOPIC	TOPIC DETAILS
6.1	PARTICLE PHYSICS	Atoms, Nuclei and Radiation ☐ infer from the results of the α-particle scattering experiment the existence and small size of the nucleus ☐ describe a simple model for the nuclear atom to include protons, neutrons, and orbital electrons ☐ distinguish between nucleon number and proton number ☐ understand that isotopes are forms of the same element with different numbers of neutrons in their nuclei ☐ understand and use the notation z AX for the representation of nuclides ☐ understand that nucleon number and charge are conserved in nuclear processes ☐ describe the composition, mass and charge of α-, β- and γ-radiations (both β– (electrons) and β+ (positrons) are included)☐ understand that an antiparticle has the same mass but opposite charge to the corresponding particle, and that a positron is the antiparticle of an electron ☐ state that (electron) antineutrinos are produced during β– decay and (electron) neutrinos are produced during β+ decay ☐ understand that α-particles have discrete energies, but that β-particles have a continuous range of energies because (anti)neutrinos are emitted in β-decay ☐ represent α- and β-decay by a radioactive decay ☐ use the unified atomic mass unit (u) as a unit of mass
7.1	DEFORMATION OF SOLIDS	Stress and strain ☐ understand that deformation is caused by tensile or compressive forces (forces and deformations will be assumed to be in one dimension only) ☐ understand and use the terms load, extension, compression, and limit of proportionality ☐ recall and use Hooke's law ☐ recall and use the formula for the spring constant k = F / x ☐ define and use the terms stress, strain and the Young modulus ☐ describe an experiment to determine the Young modulus of a metal in the form of a wire

WEEK	TOPIC	TOPIC DETAILS
8.1	Elastic and plastic behaviour	Elastic and plastic behaviour ☐ understand and use the terms elastic deformation, plastic deformation and elastic limit ☐ understand that the area under the force–extension graph represents the work done ☐ determine the elastic potential energy of a material deformed within its limit of proportionality from the area under the force–extension graph ☐ recall and use EP = 1/2 Fx = 1/2 kx2 for a material deformed within its limit of proportionality
9.1	Fundamental particles	Fundamental particles ☐ understand that a quark is a fundamental particle and that there are six flavours (types) of quark: up, down, strange, charm, top and bottom ☐ recall and use the charge of each flavour of quark and understand that its respective antiquark has the opposite charge (no knowledge of any other properties of quarks is required) ☐ recall that protons and neutrons are not fundamental particles and describe protons and neutrons in terms of their quark composition ☐ understand that a hadron may be either a baryon (consisting of three quarks) or a meson (consisting of one quark and one antiquark) ☐ describe the changes to quark composition that take place during β– and β+ decay ☐ recall that electrons and neutrinos are fundamental particles called leptons