Curriculum overview for Physics SL School year 2023/24

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Unit title	Content	Objectives/ Learning outcomes	Assessment tasks
YEAR 1 (125 classe	es)		
Measurement and	l uncertainties: 6 classes		
Measurement in physics 2 classes	Quantities and units Fundamental and derived units Scientific notation and metric multipliers Significant figures Orders of magnitude Estimation	 Using SI units in the correct format for all required measurements, final answers to calculations and presentation of raw and processed data Using scientific notation and metric multipliers Quoting and comparing ratios, values and approximations to the present order of magnitude 	Quizzes Problem solving (Formative assessment tools including self-assessment and peer assessment)
Uncertainties	Random and systematic errors	Estimating quantities to an appropriate number of significant figures Explaining how random and systematic errors can be	Practical investigations: Determination of the volume of an object
and errors 2 classes	Absolute, fractional and percentage uncertainties Error bars Uncertainty of gradient and intercepts	 Collecting data that include absolute and/or fractional uncertainties and stating these as an uncertainty range (expressed as: best estimate ± uncertainty range) Propagating uncertainties through calculations involving addition, subtraction, multiplication, division and raising to a power Determining the uncertainty in gradients and intercepts 	Report on practical investigation End-of-unit tests
Vectors and scalars 2 classes	Vector and scalar quantities Combination and resolution of vectors	 Solving vector problems graphically and algebraically 	
Space, time and m	notion: 36 classes		
Kinematics 12 classes	Distance and displacement Speed and velocity Acceleration Graphs describing motion Equations of motion for uniform acceleration Projectile motion Fluid resistance and terminal speed	 Determining instantaneous and average values for velocity, speed and acceleration Solving problems using equations of motion for uniform acceleration Sketching and interpreting motion graphs Determining the acceleration of free-fall experimentally Analysing projectile motion, including the resolution of vertical and horizontal components of acceleration, velocity and displacement 	Quizzes Problem solving (Formative assessment tools including self-assessment and peer assessment) Practical investigations:

		• Qualitatively describing the effect of fluid resistance on falling	What force is acting on a baseball? (Newton's second law
Forces and	Objects as point particles	Representing forces as vectors	of motion)
momentum 13 classes	Forces as interactions between bodies Free-body diagrams Newton's laws of motion	 Sketching and interpreting free-body diagrams Describing the consequences of Newton's first law for translational equilibrium Using Newton's second law quantitatively and qualitatively 	What does the friction depend on? (friction, coefficient of friction)
	tension, elastic force, drag force, buoyancy Field forces: gravitational, electric, magnetic	 Identifying force pairs in the context of Newton's third law Solving problems involving forces and determining resultant force 	How does a ball fall? (free fall, law of mechanical energy conservation)
	Linear momentum, impulse	 Describing different contact forces, solid friction (static and dynamic) by coefficients of friction Describing field forces 	How does a bicycle wheel turn? (circular motion, period, frequency, angular speed)
	Newton's second law expressed in terms of rate of change of momentum Impulse and force-time graphs	• Applying conservation of momentum in simple isolated systems including (but not limited to) collisions, explosions, or water jets	How much work is done by a weightlifter? (work, power)
	Conservation of linear momentum Elastic collisions, inelastic collisions and explosions Energy in collisions	 Using Newton's second law quantitatively and qualitatively in cases where mass is not constant Sketching and interpreting force-time graphs 	Reports on practical investigation
		• Determining impulse in various contexts including (but not limited to) car safety and sports	End-of-unit tests
	Circular motion Period, frequency, angular displacement and angular velocity	• Qualitatively and quantitatively comparing situations involving elastic collisions, inelastic collisions and explosions	
	Centripetal force Centripetal acceleration	 Identifying the forces providing the centripetal forces such as tension, friction, gravitational, electrical, or magnetic Solving problems involving centripetal force, centripetal acceleration, period, frequency, angular displacement, linear speed and angular velocity Qualitatively and quantitatively describing examples of circular motion including cases of vertical and horizontal 	
		CITCUIAR MOTION	4
work, energy	Kinetic energy	• Uscussing the conservation of total energy within energy	
11 classes	Elastic potential energy		

	Work done as energy transfer	• Sketching and interpreting force-distance graphs Determining	
	Power as rate of energy transfer	work done including cases where a resistive force acts	
	Principle of conservation of energy	 Solving problems involving power 	
	Efficiency	• Quantitatively describing efficiency in energy transfers	
Fields: 7 classes			
Gravitational	Kepler's three laws of orbital motion	Understanding Kepler's laws of orbital motion	Quizzes
fields	Newton's law of gravitation	• Describing the relationship between gravitational force and	Problem solving
7 classes	Gravitational field strength	centripetal force	(Formative assessment tools
	Gravitational field lines	 Applying Newton's law of gravitation to the motion of an 	including self-assessment and
		object in circular orbit around a point mass	peer assessment)
		 Solving problems involving gravitational force, gravitational 	
		field strength, orbital speed and orbital period	
		• Determining the resultant gravitational field strength due to	Poports on practical investigation
		two bodies	Reports on practical investigation
			End-of-unit tests
The particulate na	ture of matter: 24 classes		
Thermal energy	Molecular theory of solids liquids and gases	• Describing temperature change in terms of internal energy	Quizzes
transfers	Temperature and absolute temperature	•Using Kelvin and Celsius temperature scales and converting	Problem solving
8 classes	Internal energy	between them	(Formative assessment tools
0 0.00000	Specific heat capacity	• Applying the calorimetric techniques of specific heat capacity	including self-assessment and
	Phase change	or specific latent heat experimentally	peer assessment)
	Specific latent heat	• Describing phase change in terms of molecular behaviour	·····,
	Mechanism of thermal energy transfer	• Sketching and interpreting phase change graphs	Practical investigations:
	Quantitative description of rate of thermal energy	• Calculating energy changes involving specific heat capacity and	
	transfer by conduction	specific latent heat of fusion and vaporization	How is a metal heated? (specific
	Qualitative description of rate of thermal energy	• Sketching and interpreting graphs showing the variation of	heat capacity)
	transfer by convection	intensity with wavelength for bodies emitting thermal	
	Apparent brightness	radiation at different temperatures	How does a gas behave? (gas
	Luminosity	 Solving problems involving the Stefan–Boltzmann law and 	laws)
	Emission spectrum, Wien's displacement law	Wien's displacement law	Departs on practical investigation
Greenhouse	the conservation of energy	• Describing the effects of the Earth's atmosphere on the mean	Reports on practical investigation
effect	emissivity, albedo	surface temperature	End-of-unit tests
8 classes	radiative power	 Solving problems involving albedo, emissivity, solar constant 	
	main greenhouse gases	and the Earth's	
	absorption of infrared radiation		
	resonance model and molecular energy levels		

Caslavia	Drossuro	• Colving problems using the equation of state for an ideal gas	
Gasiaws	Fressure	• solving problems using the equation of state for an ideal gas	
8 classes	Equation of state for an ideal gas	and gas laws	
	Kinetic model of an ideal gas	• Sketching and interpreting changes of state of an ideal gas on	
	Mole, molar mass and the Avogadro constant	pressure–volume, pressure–temperature and volume–	
	Pressure related to the average translational speed of	temperature diagrams	
	molecules	 Investigating at least one gas law experimentally 	
	internal energy		
	Differences between real and ideal gases		
Wave behaviour:	23 classes		
Simple harmonic	Simple harmonic oscillations	• Qualitatively describing the energy changes taking place	Quizzes
motion	Time period, frequency, amplitude, displacement and	during one cycle of an oscillation	Problem solving
4 classes	phase difference	• Sketching and interpreting graphs of simple harmonic motion	(Formative assessment tools
	Conditions for simple harmonic motion	examples	including self-assessment and
	Time period for mass-spring system		peer assessment)
	Time period for simple pendulum		
Wave model	Travelling waves	• Explaining the motion of particles of a medium when a wave	Practical investigations:
4 classes	Wavelength, frequency, period and wave speed	passes through it for both transverse and longitudinal cases	
	Transverse and longitudinal waves	• Sketching and interpreting displacement-distance graphs and	How does a weight on a spring
	The nature of electromagnetic waves	displacement – time graphs for transverse and longitudinal	oscillate? (simple harmonic
	The nature of sound waves	waves	motion, period, frequency,
	The differences between mechanical waves and	• Solving problems involving wave speed, frequency and	energy changes)
	electromagnetic wayos	wavelength	
		• Investigating the sneed of sound experimentally	What do sounds look like? (pitch
		• Investigating the speed of sound experimentally	and timber)
		• Identify differences between mechanical and electromagnetic	
		waves	How loud is too loud? (intensity
Wave	Wavefronts and rays	• Sketching and interpreting diagrams involving wavefronts and	and loudness)
phenomena	Reflection and refraction	rays	
7 classes	Snell's law, critical angle and total internal reflection	 Sketching and interpreting the superposition of pulses and 	What is the speed of sound?
	Superposition	waves	
	superposition of waves and wave pulses	• Sketching and interpreting incident, reflected and transmitted	What is the index of refraction?
	double-source interference from coherent sources	waves at boundaries between media	
	the condition for constructive interference as given	 Solving problems involving reflection at a plane interface 	Reports on practical investigation
	by path difference	• Solving problems involving Snell's law, critical angle and total	Reports on practical investigation
	the condition for destructive interference as given by	internal reflection	End of unit tosts
	path difference	• Determining refractive index experimentally	
	Young's double-slit interference		

Standing waves the nature and formation of standing waves in terms and resonance 5 classes • Inderstanding of formation of standing waves in terms of opposite directions nodes and antinodes, relative amplitude and phase difference of points along a standing waves standing waves patterns in strings and pipes the nature of resonance including natural frequency and amplitude of oscillation based on driving frequency • Describing standing waves in strings, including two fixed boundaries. • Describing standing waves patterns in strings and pipes the nature of resonance including natural frequency the effect of damping on the maximum amplitude and resonant frequency of oscillation the effect of light, critical and heavy damping on the system. • Describing standing waves in strings and pipes to undaries. • Doppler effect standing waves patterns in strings and pipes the nature of the Doppler offect for sound waves and the effect of light, critical and heavy damping on the system. • Describing standing waves in terms of displacement nodes and antinodes • Doppler effect s classes the nature of the Doppler effect for sound waves and electromagnetic waves the representation of the Doppler effect for sound waves and electromagnetic waves the representation of the Doppler effect in terms of observer is moving the relative edition between source and observer • SketChing and interpreting the Doppler effect when there is relative motion between source and beserver • Doppler effect where the speed of light is much larger than the relative science and observer • SketChing and interpreting the source/observer • Doppler effect sesters • Practical activities included in the above mentioned top ics (kestarpand galaxies in space. • Dopple			Quantitatively describing double-slit interference intensity		
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The particular nature of matter: 9 classes	The particular nat	ure of matter: 9 classes			

Current and	Cells as source of emf	Describing chemical and solar cells	Quizzes
circuits	Chemical and solar cells	• Understanding Ohm's law for a closed circuit	Problem solving
9 classes	Circuit diagrams	Measuring internal resistance of a cell	(Formative assessment tools
	Direct current	• Drawing and interpreting circuit diagrams	including self-assessment and
	Electric potential difference	• Identifying ohmic and non-ohmic conductors through a	peer assessment)
	Conductors and insulators	consideration of the V/I characteristic graph	
	Electric resistance	 Solving problems involving potential difference, current, 	Practical investigations:
	Resistivity Ohm's law	 charge, power, resistance and resistivity Investigating combinations of resistors in parallel and series 	How does resistor (bulb, thermistor, LED) behave in
	Ohmic and non-ohmic behaviour of conductors	circuits	electric circuit? (resistivity, Ohm
	Heating effect of resistors	Describing ideal and non-ideal ammeters and voltmeters Describing any stical uses of a starticle divider size including	s law)
	Electric power	• Describing practical uses of potential divider circuits, including	
	Combination of resistors in series and in parallel	 Investigating one or more of the factors that affect resistance experimentally 	What are the properties of an electric cell? (electromotive force, internal resistance)
			Reports on practical investigation
			End-of-unit tests
Fields: 23 classes			
Electric and	Electric charge	• Identifying two forms of charge and the direction of the forces	Quizzes
magnetic fields	Forces between the two types of electric charge	between them	Problem solving
13 classes	Coulomb's law	• Describing electric field around a point charge, inside and	(Formative assessment tools
	the conservation of electric charge	outside a spherical charged conductor, around two point	including self-assessment and
	Millikan's experiment	charges and around two oppositely charged parallel plates,	peer assessment)
	Transfer of electric charge through friction,	including edge effects and draw electric field lines for these	, ,
	electrostatic induction and by contact	electric fields	End-of-unit tests
	Electric field, Electric field strength, Electric field lines	• Solving problems involving electric fields and Coulomb's law	
	Field line density and field strength	• Representing sources of charge, lines of electric force, and	
	Uniform electric field	field patterns using an appropriate symbolism	
	Work done in electric field	• Understanding the concept of electric potential and zero level	
	Electric potential	of electric potential	
	Magnetic field, Magnetic field lines	Mapping electric field using potential	

		• Describing the connection between equipotential surfaces and	
		field lines	
		• Drawing equipotential lines for electric field of a point charge,	
		a collection of up to four point charges, inside and outside a	
		solid charged conducting sphere, inside and outside a hollow	
		charged conducting sphere, between two oppositely charged	
		parallel plates.	
		 Sketching and interpretation of magnetic field lines 	
		• Determination of the direction of the magnetic field based in	
		the current direction in a current-carrying straight wire	
		• Representing magnetic field with magnetic field lines around	
		bar magnet, current carrying straight wire, circular coil, air-	
		core solenoid	
Motion in	the motion of a charged particle in a uniform electric	• Determining the direction of force on a charge moving in a	
electromagnetic	field or in a uniform magnetic field	magnetic field	
fields	the magnitude and direction of the force on a charge	• Determining the direction of force on a current-carrying	
10 classes	moving in a magnetic field	conductor in a magnetic field	
	the magnitude and direction of the force on a	• Solving problems involving magnetic forces, fields, current and	
	current-carrying conductor in a magnetic field	charges	
	the force per unit length between parallel wires	 Solving problems involving motion of charge particle in 	
		magnetic and electric fields	
		 Solving problems involving current-carrying conductor in a 	
		magnetic field	
		 Solving problems involving interaction between two paralel 	
		current-carrying conductors	
Nuclear and quant	um physics: 31 classes	1	
Structure of the	the Geiger–Marsden–Rutherford experiment and the	• Describing the Rutherford-Geiger-Marsden experiment that	Quizzes
atom	discovery of the nucleus	led to the discovery of the nucleus	Problem solving
9 classes	nuclear notation	• Describing the emission and absorption spectrum of common	(Formative assessment tools
	emission and absorption spectra, discrete atomic	gases	including self-assessment and
	energy levels	 Solving problems involving atomic spectra, including 	peer assessment)
	photons, frequency of the photon released during an	calculating the wavelength of photons emitted during atomic	
	atomic transition	transitions	Practical investigations:

Radioactive	isotopes	• Completing decay equations for alpha and beta decay	Modelling radioactive decay by
decay	nuclear binding energy and mass defect	• Determining the half-life of a nuclide from a decay curve	simulation or experimentally
9 classes	the variation of the binding energy per nucleon with	• Investigating half-life experimentally (or by simulation)	using dice
	nucleon number	• Describing the Rutherford-Geiger-Marsden experiment that	C C
	the mass-energy equivalence as given by E=mc ² in	led to the discovery of the nucleus	Reports on practical investigation
	nuclear reactions	• Applying conservation laws in particle reactions	
	the existence of the strong nuclear force, a short-	• Solving problems involving the energy released in radioactive	End-of-unit tests
	range, attractive force between nucleons	decay	
	the random and spontaneous nature of radioactive		
	decay		
	the changes in the state of the nucleus following		
	alpha, beta and gamma radioactive decay		
	the radioactive decay equations involving α , β -, β +, γ		
	the existence of neutrinos v and antineutrinos		
	the penetration and ionizing ability of alpha particles,		
	beta particles and gamma rays		
	the activity, count rate and half-life in radioactive		
	decay		
	the changes in activity and count rate during		
	radioactive decay using integer values of half-life		
	the effect of background radiation on count rate.		
Fission	The unified atomic mass unit	 Solving problems involving mass defect and binding energy 	
5 classes	Mass defect and nuclear binding energy	• Solving problems involving the energy released nuclear fission	
	energy released in spontaneous and neutron-induced	• Sketching and interpreting the general shape of the curve of	
	fission	average binding energy per nucleon against nucleon number	
	chain reactions in nuclear fission reactions		
	nuclear power plant		
	properties of the products of nuclear fission and their		
	management		
Fusion and stars	stability of stars	• Solving problems involving the energy released in nuclear	
8 classes	fusion as a source of energy in stars	fusion	
	conditions leading to fusion in stars in terms of	 Solving problems on conversion between astronomical units 	
	density and temperature	(AU), light years (ly) and parsecs (pc)	
	effect of stellar mass on the evolution of a star	• sketching and interpretation of HR diagrams, including the	
	the main regions of the Hertzsprung–Russell (HR)	location of main sequence stars, red giants, super giants,	
	diagram and main properties of stars in these regions	white dwarfs, the instability strip and lines of constant radius	

	stellar parallax as a method to determine the distance	• understanding diagrams with luminosity on the vertical axis	
	d to celestial bodies	and temperature on the horizontal axis	
	stellar radii	• determination of surface temperature and composition of a	
		star from the stellar spectrum	
		 determination of stellar radii using luminosity and surface 	
		temperature	
Experimental	Practical activities included in the above mentioned		
programme	topics (examples of practical investigations in the		
11 classes	assessment tasks column)		
Scientific investigation 13 classes			