«UBI FUTURA CONSTRUAMUS»

PHYSICS OVERVIEW YEAR 4

Unit title and teaching hours	Key concept	Related concepts	Global context	Statement of inquiry	Objectives	ATL skills	Content
1. Forces and force fields **9 Hours**	Relationships	Interaction	Identities and relationships	By identifying relationships of similarity and difference we understand how force and matter interact.	A, C All strands	Critical-thinking skills Information literacy skills	The four 'fundamental' forces Fundamental forces in terms of strength and distance of action The reciprocal nature of distance–strength relationships Electrostatic attraction and repulsion Gravitational field: strength and law of '$1/r^2$ proportionality' The significance of the relative sizes of the gravitational and Coulomb constants
2. Forces and force systems **9 Hours**	Systems	Form	Scientific and technical innovation	Nature's forms have inspired us to use systems of force and to create innovative structures.	A, C, D All strands	Critical-thinking skills Creative-thinking skills Information literacy skills Transfer skills	Force: effects-units Force as a vector: size and direction Forces vector diagrams Static equilibrium, balanced and unbalanced forces Resultant force Force systems: force distribution /strong structural unit shapes
3. Kinematics **9 Hours**	Relationships	Movement	Orientation in space and time	To know where we are and where we are moving to, we need to describe the relationship between space and time	A,C, D All strands	Collaboration skills Information literacy skills Critical-thinking skills Transfer skills	Distance and speed Average speed = distance/time Speed vs. velocity Displacement vs. distance Acceleration: a rate of change / units Displacement–time graphs Velocity–time graphs Analyse linear and non-linear velocity–time Problems using equations of motion for displacement, velocity and acceleration

4. Energy, Work and Power **9 Hours**	Change	Energy , Transformations, Environment	Fairness and development	Human life has been completely changed and developed through the use of machines that are created to transform energy and do useful work	A, B, C, D All strands	Information literacy skills Communication skills Critical-thinking skills Creative-thinking skills	Energy form categories: heat, sound, mechanical, chemical, electrical, magnetic, nuclear Units for energy Potential and kinetic energy Work done and energy Work done by gravitational fields Transformation of energy Heat vs. Temperature State of matter and internal kinetic energy Latent Heat Specific hest capacity Conduction-Convection-Radiation The concept of power The definition of efficiency Efficiency of machines Sankey diagrams Work done by electric fields in an electric circuit
5. Waves : Sound-Light and Communication **9 Hours**	Relationships	Movement Energy	Personal and cultural expression	New global relationships have become possible as humanity has learned to communicate through energy as wave motion.	A, B, C, D All strands	Critical-thinking skills Creative-thinking skills Communication skills Transfer skills	Oscillatory motion around an equilibrium point Longitudinal and transverse wave motion Waves in terms of the key dimensions of wavelength, frequency and amplitude Speed of waves in terms of the properties of media The subjective experience of loudness and of pitch The subjective experience of brightness and of colour Principal regions of the electromagnetic spectrum

							Communication of information through modulation of wave amplitude and frequency Reflection and refraction in terms of wave fronts and a ray model Refractive index Total internal reflection Snell's law The phenomena of interference and resonance in terms of wave superpositioning The phenomenon of diffraction in terms of wavefronts and a ray model
6. Environmental physics **(Future possible interdisciplinaire unit : Physics and Individuals and Societies)** **9 Hours**	Change	Environment Evidence Models	Globalization and sustainability	Scientific evidence shows that human activity is leading to major changes in global environments.	A, B, C, D All strands	Critical-thinking skills: Creative-thinking skills: Transfer skills: Information literacy skills: Media literacy skills: Communication skills: Collaboration skills:	Surfaces in terms of their black-body emissivity and reflectivity Greenhouse effect and the chief greenhouse gases Absorption and re-emission of radiation Effects of the greenhouse effect on the earth–atmosphere system Main sectors of human activity that contribute to greenhouse gas emissions Types of energy sources: renewable and non-renewable Energy density of different fuel sources Fuel source power station Renewable energy sources: wind generators, hydroelectric, tidal, and solar systems Climate phenomena The effects of changing albedo on climate Effects of solar irradiation on climate Consequences of human activity Strengths and limitations of the use of models in making scientific predictions

PHYSICS OVERVIEW YEAR 5							
Unit title and teaching hours	**Key concept**	**Related concepts**	**Global context**	**Statement of inquiry**	**Objectives**	**ATL skills**	**Content**
1. Dynamics **12 hours**	Change	Movement	Fairness and development	Movement is change, and our world has been changed by freedom of movement.	A: All strands B: All strands C: All strands D: All strands	Communication skills: Critical-thinking skills: Collaboration skills: Creative-thinking skills: Information literacy skills:	Changes in displacement, velocity and acceleration for objects in free-fall Forces as the cause of a change in shape or motion, direction or speed The concept of inertia as a resistance to change in kinetic state. Apply the concept of inertia to discuss motion of objects in the absence of force- Newton's first law of motion in terms of inertia Forces as a cause of acceleration- The concept of momentum – Newton's second law of motion in terms of momentum The effects of resistive forces in gases and liquids-viscosity -resistive forces are proportional to velocity Action–reaction pairs of forces Law of conservation of momentum-(Collisions vs. explosions) Newton's third law of motion in terms of action-reaction Analyse motion in terms of force pairs acting on different bodies
2. Electricity **10 hours**	Systems	Development	Scientific and technical innovation	The developmentof electrical systems has defined the modern world and made new futures possible.	A: All strands B: All strands C: All strands D: All strands	Information literacy skills: Communication skills: Critical-thinking skills: Creative-thinking skills: Collaboration skills: Reflection skills: Affective skills:	<u>Prior Knowledge:</u> Negative electric charge is carried by electrons, positive electric charge is carried by protons Surplus or deficit of electrons leads to a static electric charge and moving electric charge produces an electric current Electric current -work done by the flow of electrons Electric current in terms of charge flow I = Q/t Simple series and parallel circuits

						Transfer skills:	Current variation in different parts of series and parallel circuits- conventional and real current flow Conductive properties of materials- electrical conductors and insulators Energy in an electric circuit -potential difference, or voltage Currents and voltages in circuits containing different conductors - Measure currents and voltages using ammeters and voltmeters V–I characteristics of a range of conductors Derive a relationship between V and I Ohm's law V=IR and circuit problems Resistance as caused through obstructions to the flow of free electrons Resistance as the constant of proportionality V=IR Resistance as an inverse measure of the conductive properties of a material-units Series resistances add, parallel resistances reduce total resistance Resistor network formulae in analysing networks Design and build circuits to solve given problems The concept of mechanical power as rate of work to electrical systems-units Maximum power ratings for common electrical devices -right size of fuse for an appliance Resistive heating in terms of collisions that transfer electrical energy from electrons to the material as thermal (kinetic) energy Resistor networks in terms of the distribution of current and potential difference Formulate resistor network formulae from Ohm's law B life in terms of the amp-hour (Ah) Electric power ratings using P=IV
3. Electromagnetism **10 hours**	Relationships	Interaction Energy	Fairness and development	Manipulating the relationship between interacting electric and magnetic forces makes it possible to distribute plentiful energy to everyone.	A: All strands B: All strands C: All strands D: All strands	Critical-thinking skills: Creative-thinking skills: Information literacy skills: Communication skills:	<u>Prior Knowledge:</u> Electrical, magnetic and gravitational forces as fundamental interactions. Basic properties of magnetic fields: polarity, strength variation-interactions in terms of strength and distance. Compare the properties of electrical and magnetic fields. Magnetic field produced by electric current -reference to sign conventions such as Maxwell's corkscrew rule The effect of various factors on the strength of an electromagnetic field produced by a solenoid

							Catapult field and motor effect of electromagnetic fields using suitable conventions such as Fleming's rules Factors affecting strength of motor effect in terms of the design of the device and the strength of electromagnetic fields Principal components of the electric motor How a current is induced in a conductor moving in an electromagnetic field. Factors affecting the size and direction of induced currents. Relationship between size, direction of induced currents and flux-explain the generation of alternating current (AC) The properties of alternating current (AC) in terms of changing current direction with time Compare the design of electric motors and dynamos Transformers and some of their common applications Generation of electricity in power plants-main components of electricity distribution systems Transformer designs for different applications The use of transformers to control transmission voltages for electricity distribution
4. Nuclear energy 10 hours	Change	Energy Consequences Environment	Scientific and technical innovation	Learning to control nuclear changes allows us to use matter in new ways and release huge quantities of energy, with consequences that can be both positive and negative.	A: All strands D: All strands	Critical-thinking skills: Information literacy skills: Media literacy skills: Affective skills: Communication skills: Collaboration skills:	The atomic model throughout history. The size of the atom. The significance of Geiger, Marsden and Rutherford's findings for the structure of the atom The properties of the electron and the two principal nucleons-Isotopes Strong nuclear force from the properties of protons and neutrons Radioactive decay series for alpha, beta and gamma emission Properties of ionizing radiations: alpha, beta, gamma Penetration and ionizing potential of alpha, beta and gamma ionizing radiations Definition of half-life. Calculations using half-life and radioactivity Medical and commercial uses of radioactive isotopes Energy stored in the form of bonds between nucleons The processes of nuclear fission and fusion Applications of nuclear fission to energy production, and the main components of a nuclear reactor. Global sustainability and environmental impact of nuclear power The potential and challenges of achieving sustainable nuclear fusion The quantum mechanical model for the atom nuclear changes produced by the ionizing radiations The use of nuclear technologies in weapons building

							The effects of nuclear explosions
5. Astrophysics 10 hours	Relationships	Form Models Evidence	Orientation in space and time	As we extend the reach of our observations, we better understand the relationships that form our models of the Universe, and so our place in the cosmos.	A: All strands D: All strands	Information literacy skills: Critical-thinking skills: Transfer skills:	Relative factors of scale for the size of Solar System, size of galaxy, size of known Universe Principal constituents of our Solar System: Sun, rocky planets, gas planets, satellites, asteroids, comets Astronomical bases for the calendar: the day, the month, the year Seasonal variations in temperature at high and low latitudes in terms of the Earth's axial tilt The phases of the Moon, solar and lunar eclipses Centripetal force -Planetary orbits in terms of centripetal force and gravitational attraction Kepler's laws for planetary motion Newton's law of universal gravitation <u>Revision:</u> Names and function of the principal parts of the human eye-the eye's inverted image -compare the eye to a camera-convex and concave lenses on light using a ray model- magnification and resolution of lenses Properties of images formed by biconvex and biconcave lenses at different object distances. Principle domains of the electromagnetic spectrum and their relative positioning in terms of wavelength and frequency-Light - Earth's atmosphere Composition of the Sun. Principal stages in the life of a star, and the magnitude of their duration Properties of: protostars, main-sequence stars, red giants, white dwarves, neutron stars, black holes Properties of some deep space objects: nebulae (both star-forming and supernova remnant), pulsars and other galaxies Time of travel for light over cosmological distances Definition of the light year Cosmological models: steady state, expansion Extended: Newton's law of universal gravitation Formation of images by biconvex and biconcave lenses using ray diagrams Wavelength regimes for gathering astronomical data: radio, IR, UV, visible and gamma The use of spectroscopic methods in astronomy Einstein's special relativity

							Spectroscopic and other evidence (excluding microwave background) for the expanding universe model Photon energies using spectroscopic line frequency from the Planck–Einstein relationship E = hf