Physics Department Programme of study: Overview

	Year 12 (Teacher A and Teacher B)		Year 13 (Teacher A and Teacher B)	
Phase 1	**A1 ELECTRICITY** Drawing and interpreting Circuit Diagrams Calculating Current, Charge and Potential Difference in circuits Calculating resistance in fixed and variable resistance components Explaining resistance, how and why it changes in circuits Interpreting I/V graph characteristics Resistivity (PAG) of materials and the practical measurements made to determine it Calculating power and electrical energy in various situations Emf and Internal resistance (PAG) in power supplies and batteries Including internal resistance in working circuit calculations Conservation of Charge and voltage in circuits: Kirchoff's laws Potential dividers and using variable resistance components to allow circuits to interact with the environment	**B1 MECHANICS** Scalars and vectors Forces: in equilibrium and disequilibrium, Newton's laws of motion Moments and their applications in situations involving see-saws, bolts, cranes, loading of ships Centre of mass and moments Uniform acceleration in one-dimension, equations of motion Distance/time and Velocity/time graphs Acceleration/time graphs Acceleration due to gravity (PAG) Projectile motion, two dimensional and ballistic motion Drag, lift and terminal velocity Momentum calculations and conservation of momentum Force, momentum and impulse Work and power Conservation of energy	**A8 NUCLEAR PHYSICS** Revisiting the Rutherford/Bohr model and its development The measurement of the nuclear radius by closest approach of an alpha particle The measurement of the nuclear radius by electron scattering Nuclear radius and nuclear density Types of nuclear radiation and their properties Background radiation and Intensity calculations The exponential law of decay Half-life and its applications Nuclear Decay and decay equations Mass defect, binding energy and $E=mc^2$ Nuclear Fission and fission reactor design Nuclear fusion and fusion reactor design	**B6 MAGNETIC FIELDS** Magnetic fields, shape and direction Magnetic flux and flux density Investigating force on a current carrying wire (PAG) Forces on charged particles in magnetic fields Electromagnetic induction and the theory of the generator Investigating flux linkage (PAG) Faraday's law and Lenz's law Alternating current The theory of transformer operation and design considerations **REVISION**
Phase 2	**A2 PARTICLES AND RADIATION** Atomic structure and the development of the Rutherford/Bohr atom Stable and unstable nuclei and the consequences for transmutation The fundamental forces Energy and mass ($E=mc^2$) Antiparticles and Photons Hadrons, Leptons and the classes of particles in the standard model Strange particles and the conservation of properties in equations Quarks and antiquarks, quark confinement rules Particle interactions and Feynman diagrams **A3 EM RADIATION AND QUANTUM PHENOMENA** The electron volt (eV) Describing energy in eV Electron energy levels in atoms Absorption and emission spectra in terms of photons and energy levels Wave-Particle duality and the electron microscope	**B2 MATERIALS** The structure and properties of matter Calculating density and the applications of 'average density' Determining Hooke's law and how the internal structure of the material changes when it deforms Stress, Strain and the Young modulus (PAG) Stress-Strain and Force extension graphs, explaining the shape and relating this to the use of a material for a purpose Brittle materials and their properties	**A9 ENGINEERING PHYSICS** Revisiting circular motion equations and calculations Inertia and motion Rotational motion, moment of inertia and rotational kinetic energy Torque, work and power in rotating systems Rotational equations of motion Flywheels and angular momentum Angular acceleration The First Law of thermodynamics Non-flow processes and closed systems p-V diagrams, Isothermal and adiabatic changes Four-stroke engines and indicator diagrams Engine power and efficiency, fuel mass flow, calorific values, thermal efficiency, mechanical efficiency The second law of thermodynamics Heat engines Reversed heat engines Heat pumps Coefficient of performance **REVISION**	
Phase 3	**A4 WAVES 2** Diffraction and interference (constructive and destructive) Two-source interference Diffraction gratings and their applications Young' double-slit experiment (PAG) Refraction, theory and practical applications Critical angle, theory and practical applications **A5 THERMAL PHYSICS** (Cont. Phase 4) Thermal energy and the kinetic theory of matter Thermal energy transfers in systems The three gas laws, Pressure, Boyle's and Charles' (PAG) The Ideal Gas equation ($pV=nRT$) Ideal gas assumptions Kinetic Theory and the pressure of an ideal gas Kinetic Theory of gas molecules Relating Kinetic energy to temperature	**B3 WAVES 1** Transverse and Longitudinal waves, describing waves Polarisation of transverse waves Progressive waves Wave speed and calculations using frequency, wavelength, distance and time Superposition and interference Stationary waves Investigating resonance (PAG) **B4 FURTHER MECHANICS** (Cont. Phase 4) Circular motion and the radian Centripetal force and derivation of acceleration in circular motion Simple harmonic motion and the links to circular motion Calculations with SHM The mass-spring system as a simple harmonic oscillator The simple pendulum and other types of SHO The limitations of models of SHM Free and forced vibrations and resonance		

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Phase 4	**A6 ELECTRIC FIELDS** Electric fields, shape, direction and effects on charged particles Electric potential and equipotential lines Work done by electric fields **A7 CAPACITANCE** (Cont. Phase 1 Yr 13) The theory of a capacitor The electric field in a capacitor Energy stored in a capacitor The effect of using a dielectric material in a capacitor Charging and discharging (PAG) The use of charging and discharging graphs and the time constant and time to halve	**B5 GRAVITATIONAL FIELDS** (Cont. Phase 1 Yr 13) Gravitational fields and $1/r^2$ changes Gravitational field strength, field lines. direction and effects on mass Gravitational potential and equipotential lines Work done by gravitational fields Orbits		
			STUDY LEAVE	