John Taylor High School
Home of the National Forest Teaching School

Subject Curriculum Map: Physics | **Year Group:** 10

Term	Autumn 1		Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Topic	Waves (separate sciences only)	Motion (speed, velocity and acceleration)	Motion (Graphical)	Forces (Newton's Laws)	Forces (effects)	Particle model	Momentum and energy
Big Question	How are waves used for discovery and exploration?	How can the motion of an object be calculated using data?	How can the motion of an object represented graphically using data?	How do Newton's three laws of motion explain how forces influence objects?	What effects can forces have when applied to objects?	Why do different states of matter transfer heat differently?	How can the amount of energy an object has be predicted before and after an event?
Content	•frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound •sound needs a medium to travel •The ear •auditory range of humans and animals. •diffuse scattering and specular reflection at a surface •use of ray model to explain imaging in mirrors •light transferring energy from source to absorber leading to chemical and electrical effects •colours and the different frequencies of light, white light and prisms •pressure waves transferring energy; use for cleaning and physiotherapy by ultra-sound; •Conclusions drawn from seismic data •Infrared waves and black body radiation	•speed of sound, estimating speeds and accelerations in everyday contexts •acceleration caused by forces; Newton's First Law •weight and gravitational field strength •Typical values may be taken as: walking ~ 1.5 m/s running ~ 3 m/s cycling ~ 6 m/s. •typical value for the speed of sound in air is 330 m/s •acceleration = change in velocity time taken a = Δv t. •estimate the magnitude of everyday accelerations. •calculate average speed for non-uniform motion.	•interpreting quantitatively graphs of distance, time, and speed •If an object moves along a straight line, the distance travelled can be represented by a distance–time graph. •Determine speed by drawing a tangent and measuring the gradient of the •Calculate acceleration from a velocity time graph •The distance travelled can be calculated from the area under a velocity–time graph. • draw velocity–time graphs from •interpret enclosed areas in velocity–time graphs to determine distance travelled •Use the motion equation •draw and interpret velocity–time graphs for objects that reach terminal velocity	•Scalar quantities. •A vector quantity may be represented by an arrow. •All forces between objects are either: • contact forces – • non-contact forces. •Calculate the weight of an object using its mass •Considering gravity to act at a single point referred to as the object's 'centre of mass'. •A number of forces acting on an object may be replaced by a single force •use free body diagrams •A single force can be resolved into two components •use vector diagrams	•Students should be able to: • give examples of the forces involved in stretching, bending or compressing an object •explain why, to change the shape of an object (by stretching, bending or compressing •describe the difference between elastic deformation and inelastic deformation •describe the difference between a linear and non-linear relationship between force and extension •calculate a spring constant in linear cases •interpret data from an investigation of the relationship between force and extension	•pressure in fluids acts in all directions: variation in Earth's atmosphere with height, with depth for liquids, up-thrust force (qualitative). •relating models of arrangements and motions of the molecules in solid, liquid and gas phases to their densities •melting, evaporation, and sublimation as reversible changes •calculating energy changes involved on heating, using specific heat capacity; and those involved in changes of state, using specific latent heat •links between pressure and temperature of a gas at constant volume, related to the motion of its particles (qualitative).	•Momentum is defined by the equation: momentum = mass ×velocity •Conservation of momentum •examples of momentum in an event, such as a collision. •calculating work done as force x distance; •explain safety features such as: air bags, seat belts, gymnasium crash mats, cycle helmets and cushioned surfaces for playgrounds with reference to the concept of rate of change of momentum •calculate work done in stretching (or compressing) a spring (up to the limit of proportionality) using the equation: elastic potential energy = 0.5 ×spring constant × extension2 •***Students will also complete revision tasks based on all content from y9 and 10***
Assessment		• Pupils will be assessed through homework activities, lesson starter activities, end of Unit class tests and a range of required practicals aimed at assessing the pupils' practical abilities.					

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Subject Curriculum Map:	Physics	Year Group:	11

Term	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Topic	Electricity (Current, p.d and resistance)	Electricity (Component characteristics)	Electricity (Circuits in the home)	Electromagnetism	Nuclear	COURSE REVIEW
Big Question	How are circuits represented on diagrams and what information can they show?	How can the I-V characteristics of components be tested?	How is electricity used in the home?	What is the connection between current and magnetism and how is this connection used?	What is nuclear radiation and what are the risks and benefits of it?	
Content	•measuring resistance using p.d. and current measurements •exploring current, resistance and voltage relationships for different circuit elements; including their graphical representations •quantity of charge flowing as the product of current and time •drawing circuit diagrams;	•for some resistors, the value of R remains constant but that in others it can change as the current changes •The resistance of components such as lamps, diodes, thermistors and LDRs is not constant •The resistance of a thermistor decreases as the temperature increases. •The applications of thermistors in circuits •The resistance of an LDR decreases as light intensity increases. •The application of LDRs in circuits. •explain the design and use of a circuit to measure the resistance of a component by measuring the current through, and potential difference across, the component •draw an appropriate circuit diagram using correct circuit symbols.	•drawing circuit diagrams; exploring equivalent resistance for resistors in series •the domestic a.c. supply; live, neutral and earth mains wires, safety measures •power transfer related to p.d. and current, or current and resistance.	•exploring the magnetic fields of permanent and induced magnets, and the Earth's magnetic field, using a compass •magnetic effects of currents, how solenoids enhance the effect •how transformers are used in the national grid and the reasons for their use.	•the nuclear model and its development in the light of changing evidence •masses and sizes of nuclei, atoms and small molecules •differences in numbers of protons, and neutrons related to masses and identities of nuclei, isotope characteristics and equations to represent changes •ionisation; absorption or emission of radiation related to changes in electron orbits •radioactive nuclei: emission of alpha or beta particles, neutrons, or gamma rays, related to changes in the nuclear mass and/or charge •radioactive materials, half-life, irradiation, contamination and their associated hazardous effects, waste disposal •nuclear fission, nuclear fusion and our Sun's energy	•This term will include structured topic-based revision tasks , required practical review and past exam papers. •Embedding subject content to ensure that, when you return to school and the next step of your education, you are well prepared.
Assessment	• Pupils will be assessed through homework activities, lesson starter activities, end of Unit class tests and a range of required practicals aimed at assessing the pupils' practical abilities.					

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Subject Curriculum Map:	Physics	Year Group:	12

Term	Autumn Teacher 1			Autumn Teacher 2		Spring Teacher 1		Spring Teacher 2		Summer Teacher 1		Summer Teacher 2	
Topic	Measurements uncertainties and estimation	Materials	Mechanics - Statics	Quantum phenomena	Particles	Mechanics - Dynamics	Mechanics – Energy and momentum	Electricity – Resistance and resistivity	Electricity – e.m.f, internal resistance and potential dividers	Waves – Progressive and stationary waves	Waves – Refraction, diffraction and interference	Periodic motion	Circular motion
Big Question	How do we estimate physical quantities and the precision of that value?	How do materials behave when forces are applied to them?	How can forces on stationary objects be calculated?	Why does light behave differently in different situations	What are the fundamental particles of the universe and how do they interact ?	How can we predict an objects motion using only a few parameters?	How can the conservation of energy and momentum be used to predict an objects motion?	How do material affect the rate of electrical charges flow through them?	How can we vary the potential difference across components and how does this affect resistance?	What are waves and how can we describe them?	How do waves behave when travelling through materials, slits or diffraction gratings?	How can we describe and predict the motion of an oscillating object?	What causes objects to travel in a circle and how can we predict their motion?
Content	•The use of SI units and their prefixes •the estimation of physical quantities • the limitations of physical measurements •Absolute, fractional and percentage uncertainties represent uncertainty in the final answer for a quantity •Graph uncertainties •Review of uncertainties, Graph plotting, gradient calculations, data interpretation, source evaluation and risk assessments	•Mechanical properties of matter •stress, strain, Young modulus •force-extension graphs, energy stored	•Vectors and scalars •resolution of vectors into two components at right angles • addition rule for two vectors •calculations for two perpendicular vector •Balancing moments	•photon model to explain observable phenomena • The photoelectric effect •evidence supporting the photon model •wave-particle duality, particle diffraction • Energy levels and photon emission	•Simple model of the atom •SI units and relative units. •antiparticle masses, charge and rest energy •Knowledge of annihilation and pair production and the energies involved •Four fundamental interactions: •Simple diagrams to represent interactions •Classification of particles •Applications of conservation laws	•Newton's laws of motion •use of kinematic equations in one dimension with constant velocity or acceleration •graphical representation of accelerated motion •interpretation of velocity-time and displacement-time graphs • use of F = ma •one- and two-dimensional motion under constant force •projectile motion	•calculation of work done for constant forces, including force not along the line of motion • calculation of exchanges between gravitational potential energy and kinetic energy •principle of conservation of energy •principle of conservation of momentum •calculations for one-dimensional momentum problems	•electric current as rate of flow of charge, $I = \Delta q/\Delta t$ •Resistance definition •Resistivity definition •Ohm's law •conservation of charge and energy in circuits •relationships between currents, voltages and resistances in series and parallel circuits	•definition of emf and concept of internal resistance •potential difference in terms of energy transfer •power dissipated •potential divider circuits	•qualitative treatment of polarisation •graphical treatment of superposition and stationary waves •Applications of polarisers •Nature of longitudinal and transverse waves. •Nodes and antinodes on strings •Stationary waves on strings will be described in terms of harmonics	•path difference, phase and coherence, •Interference and diffraction using a laser as a source of monochromatic light. • safety issues associated with using lasers. •Appearance of the diffraction pattern from a single slit •variation of the width of the central diffraction maximum with wavelength and slit width. •Refraction at a plane surface •fibre optics	•simple harmonic motion •quantitative treatment using a $= -\omega^2 x$ and its solution $x = A \cos \omega t$. •Effects of damping on oscillations •Resonance and the effects of damping on the sharpness of resonance.	• radian measure of angle and angular velocity •application of $F = ma = mv2 /r = mr\omega 2$ to motion in a circle at constant speed
Assessment		• Pupils will be assessed through homework activities, lesson starter activities, end of Unit class tests and a range of required practicals aimed at assessing the pupils' practical abilities.											

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Subject Curriculum Map:	Physics	Year Group:	13

Term	Autumn Teacher 1		Autumn Teacher 2		Spring Teacher 1		Spring Teacher 2	Summer Teacher 1		Summer Teacher 2
Topic	Gravitational and electric fields	Capacitors	Thermal physics	Nuclear instability	Magnetic fields	Discovery of the electron	Nuclear energies	Wave particle duality	Special relativity	Revision
Big Question	How do gravitational fields interact with objects that have mass? How do electric fields interact with objects that have charge?	How do capacitors work?	What links the microscopic behaviour of particles to the macroscopic characteristics of gases?	What is radioactive decay and why does it happen?	How do magnetic fields affect moving charges?	How did scientists find out about electrons?	How does nuclear fission and fusion release energy and how do we control it?	What events led to the understanding of the photoelectric effect?	What happens as objects approach the speed of light?	
Content	•concept and definition of force fields •gravitational force and inverse square field for point (or spherical) masses •gravitational potential and changes in potential energy •electric force and field for point (or spherical) charges in a vacuum •electric potential and changes in potential energy •uniform electric fields •similarities and differences between electric and gravitational fields	•Capacitance definition • energy of a capacitor •quantitative treatment of charge and discharge curves •Quantitative treatment of capacitor discharge	•molecular kinetic theory •ideal gases; pV = NkT •absolute zero •relationship between temperature and average molecular kinetic energy • idea of internal energy •energy required for temperature change = mcΔθ	•nuclear decay •connections between nature, penetration and range of emissions from radioactive substances •evidence for existence of nucleus •activity of radioactive sources and idea of half-life •modelling with constant decay probability leading to exponential decay •nuclear changes in decay •Inverse-square law for γ radiation	•force on a straight wire and force on a moving charge in a uniform field •Faraday's and Lenz's laws •emf equals rate of change of magnetic flux linkage	•Production of cathode rays in a discharge tube •The principle of thermionic emission. •Specific charge of the electron •Principle of Millikan's determination of the electronic charge	•fission and fusion processes •E = mc2 applied to nuclear processes •calculations relating mass difference to energy change •Estimate of radius from closest approach of alpha particles and determination of radius from electron diffraction •Calculation of nuclear density •Graph of average binding energy per nucleon against nucleon number.	•wave-particle duality, particle diffraction •Newton's corpuscular theory of light •Significance of Young's double slits experiment •Maxwell's formula for the speed of electromagnetic waves in a vacuum •Fizeau's determination of the speed of light and its implications •ultraviolet catastrophe. • failure of classical wave theory to explain photoelectricity	•Principle of the Michelson-Morley interferometer •The concept of an inertial frame of reference. •Time dilation •Length contraction •Equivalence of mass and energy	• Students complete revision activities based on the entire A Level course
Assessment	• Pupils will be assessed through homework activities, lesson starter activities, end of Unit class tests and a range of required practicals aimed at assessing the pupils' practical abilities.									