YEAR 11 2023-2024 AUT 1-2

'An ambitious curriculum that meets the needs of all'

Medium Term Planning - Topic: Forces

Curriculum Intent	**In addition to working further on objectives from Years 7-9, pupils will be taught, following National Curriculum guidelines, the following this topic:**
Skills/Assessment Objective Links	• Forces and fields: electrostatic, magnetic, gravity. • Forces as vectors. • Calculating work done as force x distance; elastic and inelastic stretching. • Pressure in fluids acts in all directions: variation in Earth's atmosphere with height, with depth for liquids, up-thrust force (qualitative). • Speed of sound, estimating speeds and accelerations in everyday contexts. • Interpreting quantitatively graphs of distance, time, and speed. • Acceleration caused by forces; Newton's First Law. • Weight and gravitational field strength. • Decelerations and braking distances involved on roads, safety.
Spiritual, moral, social, and cultural development	**SMSC:** Engineers analyze forces when designing a great variety of machines and instruments, from road bridges and fairground rides to atomic force microscopes. Anything mechanical can be analyzed in this way. Recent developments in artificial limbs use the analysis of forces to make movement possible. **PSHE/British Values:** Safety considerations often focus on the reduction of forces or by spreading forces over increased time. Examples include car seat belts and sports padding. **Skills Builder:** Interpreting data and graphs, working in teams to conduct investigations. Building discussion and investigative skills.
Numeracy	**Arithmetic and numerical computation:** Recognise and use expressions in decimal form. Recognise and use expressions in standard form. Use ratios, fractions and percentages. Make estimates of the results of simple calculations **Handling data:** Use an appropriate number of significant figures. Find arithmetic means. Construct and interpret frequency tables and diagrams, bar charts and histograms. Understand the terms mean, mode and median. Use a scatter diagram to identify a correlation between two variables. Make order of magnitude calculations. **Algebra:** Understand and use the symbols: =, <, <<, >>, >, ∝ , ~ . Change the subject of an equation. Substitute numerical values into algebraic equations using appropriate units for physical quantities. Solve simple algebraic equations. **Graphs:** Translate information between graphical and numeric form. Understand that y = mx + c represents a linear relationship. Plot two variables from experimental or other data. Determine the slope and intercept of a linear graph. Draw and use the slope of a tangent to a curve as a measure of rate of change. Understand the physical significance of area between a curve and the x-axis and measure it by counting squares as appropriate. **Geometry and trigonometry:** Use angular measures in degrees. Visualise and represent 2D and 3D forms including two dimensional representations of 3D Objects. Calculate areas of triangles and rectangles, surface areas and volumes of cubes

Literacy	**Vocabulary Tier 2:** Acceleration, braking, distance, contact, non-contact, conservation, deformation, force, pressure, resolution. **Vocabulary Tier 3:** Mass, weight, momentum, equilibrium, Newton, inertia, moment, scalar, vector, upthrust, thrust, lift, velocity. **Reading:** Students are given opportunity to develop their skills in specified tasks that develop disciplinary literacy. Throughout the GCSE Physics and Combined Science course they develop their understanding of the requirements of exam questions and the key terminology in questions. In addition, they read practical methodology and translate this to actions in laboratory tasks. **Writing:** Students construct answers independently and through class teaching. Their answers range from single word answers to the planning and writing of 6-mark "extended writing" tasks that require linking of multiple concepts from a topic. These often develop students ability to construct written evaluations of contrasting situations, where the use of comparative connectives are required. **Oracy:** Students are regularly given the opportunity to practice their scientific vocabulary in class discussion, through choral response and in giving instruction to others during practical activities.
Becoming future ready	**Careers/Employability:** Engineering – all disciplines, automotive design, aerospace engineering, marine engineering. Manufacturing, machine operation, fabrication. Transport system design and operation. Infrastructure design. Pilot. Computer games design. Materials science. Product development.
Adaptation **QFT/SEND Provision**	Throughout this topic, quality first teaching will provide differentiation: **By product:** Assessments have opportunities for students to achieve all grades, with structured questions and opportunities for development of extended writing for all abilities. **By resource:** PowerPoints, worksheets and booklets are differentiated as appropriate and produced in conjunction with class teachers for students who would benefit from additional scaffolding of resources in order to achieve their potential. **By Intervention**: by providing different levels of supervision and support, including the specific deployment of teaching assistants within lessons. Structured intervention is planed and delivered based on summative assessment results. **By Progressive Questioning:** exploring pupils' understanding through interactive dialogue. **By Grouping:** according to prior attainment, gender, social preference. **By Task:** Pupils should be involved in the identification of targets which are meaningful to them and in the selection of an appropriate task from the given range. **By Offering Optional Activities:** In class or as homework, to extend learning. This QFT/SEND provision will be explicit within the lesson-by-lesson schemes of work.

Implementation Curriculum Delivery	To be able to: • P.5.1.1.a. - I can define the terms vectors and scalar, giving examples of each. • P.5.1.1.b. - I can use arrows to represent the magnitude and direction of vector quantities. • P.5.1.2.a. - I can define a force as a push or pull that acts on an object due to the interaction with another object and give examples of contact and non-contact forces. • P.5.1.2.b. - I can describe the interaction between pairs of objects which produce a force on each object and illustrate with vector diagrams. • P.5.1.3.a. - I can define weight as the force acting on an object due to gravity. I can describe how an objects weight can be measured using a newton meter. • P.5.1.3.b. - I can calculate the weight of an object by recalling and applying the equation: W = mg • P.5.2.1.a. - I can describe energy transfers involved when work is done, and calculate the work done by recalling and using the equation: [W = Fs] • P.5.2.1.b. - I can state that one joule of work is done when a force of one newton causes a displacement of one metre, stating that the Nm is an equivalent unit to the joule • P.5.2.1.c. - I can explain why work done against the frictional forces acting on an object causes a rise in the temperature of the object • P.5.1.4.a. - I can calculate the resultant of two forces that act in a straight line • P.5.1.4.b (HT) - I can use free body diagrams to qualitatively describe examples where several forces act on an object, and explain how that leads to a single resultant force or no force • P.5.1.4.c (HT) - I can use free body diagrams, and accurate vector diagrams to scale, to resolve multiple forces and show magnitude and direction of the resultant, or represent one force as two component forces at right angles • P.5.3.a. - I can explain why more than one force is needed to change the shape of a stationary object, giving examples of the forces involved. • P.5.3.b. - I can describe the difference between elastic deformation and inelastic deformation caused by stretching forces. • P.5.3.c. - I can state that the extension of an elastic object, such as a spring, is directly proportional to the force applied, provided that the limit of proportionality is not exceeded (Hooke's law). This also applies the compression of an elastic object. • P.5.3.d. - I can recall and apply the equation: F=ke

Learning Outcomes (Knowledge)	• P.5.3.e. I can explain that the work done on an elastic object (such as a spring) is equal to the elastic potential energy stored by it. I can apply the equation: E_e=1/2 ke^2 • Required practical. I know how to investigate the relationship between force and extension for a spring (Hooke's law). I can interpret data from this investigation and can calculate the spring constant of the spring. • P.5.6.1.1. - I can identify displacement as a vector quantity, and express displacement in terms of both its magnitude and direction • P.5.6.1.2.a.- I can describe speed as a scalar quantity and estimate the average speed of a person walking, running and cycling as well as the speed of sound in air. • P.5.6.1.2.b. - I can make measurements of distance and time and calculate speed for a moving object by recalling and applying the equation: s=vt. • P.5.6.1.3. - I can describe velocity as speed in a given direction and identify it as a vector quantity. I can explain, with examples, that motion in a circle involves constant speed but changing velocity. • P.5.6.1.4.a. - I can draw and interpret distance-time graphs including calculating the gradient of a straight line to find the speed of a moving object. • P.5.6.1.4.b. (HT only) - I can find the speed at a particular time of an accelerating object by calculating the gradient of a tangent of a curve on a distance-time graph. • P.5.6.1.5 - I can calculate the average acceleration of an object by recalling and applying the equation: a= Δv/t • P.5.6.1.5.b. - I can draw and interpret velocity time graphs, including calculating the gradient to find the acceleration of an object. • P.5.6.1.5.c. (HT only) - I can calculate the total distance travelled by an object by calculating the area under a velocity-time graph. • P.5.6.1.5.d. - I can apply the equation: v2 - u2 = 2as • P.5.6.1.5.e. - I can state that near the Earth's surface, any object falling freely under gravity has an acceleration of about 9.8 m/s2. • P.5.6.1.5.f. - I know that falling objects initially accelerate due to gravity but reach terminal velocity when the resultant force reaches zero. • P.5.6.1.5.g. (Physics only) - I can draw and interpret velocity-time graphs for objects that reach terminal velocity • P.5.6.1.l (Physics only) - I can interpret and explain the changing motion of an object in terms of the forces acting on it • P.5.6.2.a - I can explain the motion of an object moving with a uniform velocity, and identify that forces must be in effect if its velocity is changing, by stating and applying Newton's First Law • P.5.6.2.b. - I can explain that the acceleration of an object is proportional to the resultant force acting on the object, and calculate the force or acceleration for an object by recalling and applying the equation: F = ma • P.5.6.2.c (HT) - I can describe inertia as the tendency of objects to continue being at rest or in uniform motion, and inertial mass as a measure of how difficult it is to change the velocity of an object, defining it as the ratio of force over acceleration • P.5.6.2.d. - I can estimate the speed, accelerations and forces of large vehicles involved in everyday road transport • P.5.6.2.e. - I can apply Newton's Third Law to examples of equilibrium situations • P.5.7.1.a. - I can calculate momentum by recalling and applying the equation: p = mv • P.5.7.2.a. - I can explain and apply the idea that, in a closed system, the total momentum before an event is equal to the total momentum after the event. • P.5.7.2.b. - I can describe examples of momentum in a collision. • P.5.7.2.c (Physics only) - I can complete conservation of momentum calculations involving two objects. • P.5.7.3.a (Physics only) - I can explain that when a force acts on an object that is moving, or able to move, a change in momentum occurs. • P.1.7.3.b (Physics only) - I can calculate a force applied to an object, or the change in momentum it causes, by applying but not recalling the equation: F = mΔv/Δt • P.5.7.3.c (Physics only) - I can explain that an increased force delivers an increased rate of change of momentum. • P.5.7.3.d (Physics only) - I can apply the idea of rate of change of momentum to explain safety features such as air bags, seat belts, helmets and cushioned surfaces.
Current learning to be developed in the future within:	• Mechanics and further mechanics in KS5. • Topic 8 – Space.

Assessment	Refer to assessment maps for formative and summative assessment opportunities.
Impact	Attainment and Progress – Refer to assessment results / data review documentation.