The Sutton Academy

Knowledge Rich Curriculum Plan

SCIENCE- Physics Year 10

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity
Lesson: Scalar and Vector Quantities	• Students will know that scalar quantities have magnitude only • Students will know that vector quantities have magnitude and direction • Students will know how to represent vectors using diagrams • Students will know how to determine whether a quantity is a scalar or vector quantity • Students will know that forces may be either contact or non-contact	• ***Students need to already know that quantities can be represented using arrows***		Tier 2 Magnitude: size Tier 3 Scalar: Quantity with magnitude only Vector: Quantity with size and direction
Lesson: Gravity and Weight	• Students will know that weight is the force acting on an object due to gravity. • Students will know that the force of gravity close to Earth is due to the gravitational field around Earth • Students will know that the weight of an object depends on the gravitational field strength and the object's mass • Students will know that the equation used to calculate weight is: Weight = mass x gravitational field strength W = m g • Students will know that the unit of weight is Newtons • Students will know that the unit of gravitational field strength is N/ kg • Students will know that the weight of an object may be considered to act at a single point referred to as the object's centre of mass • Students will know that the weight of an object can be measured using a calibrated spring-balance	***Students need to already know that the unit of mass is kg***	Measuring weight using Newtonmeters	Tier 2 Calibrate: adjust to take into account all factors Tier 3 Centre of mass: a single point on an object where the weight acts at.

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	• Students will know how to perform calculations using the weight equation			
Lesson: Resultant Force	• Students will know that a number of forces acting on an object can be replaced by a single force that has the same effect as all of the original forces acting together, and this is known as the resultant force • Students will know that a resultant force can cause an object to accelerate, decelerate, change shape or change direction • Students will know that if an object has a resultant force of 0N acting on it whilst in motion it will continue to move at constant motion • Students will know that if if an object has a resultant force of 0N acting on it whilst stationary it will remain stationary • Students will know how to determine the resultant force of 2 forces acting in a straight line	***Students need to already know that the unit for force is Newtons.***		Tier 2 Tier 3 Resultant force: a single force that has the same effect as all the forces that are acting on an object.
Lesson: Resultant Force (HT)	• Students will know that not all forces act on an object in a straight line. • Students will know how to resolve a resultant force into two components • Students will know how to use vector diagrams to illustrate the resolution of forces. • Students will know how to use vector diagrams to determine the		Interpreting diagrams Drawing scale diagrams Measuring angles	Tier 2 Component: part of a larger whole Tier 3 Vector diagrams: diagrams that represent the magnitude and direction of a quantity

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	resultant of two forces, including magnitude and direction			
Lesson: Newton's first law	• Students will know that an object in motion will remain at constant motion unless an external force is applied to it • Students will know that if a resultant force acts on an object it will cause the velocity (speed and/ or direction) to change • HT only - Students will know that the tendency of objects to continue in their state of rest or of uniform motion is called inertia • Students will know how to apply Newton's first law to explain the motion of objects	• *Students need to already know that if the resultant force acting on a stationary object is 0N the object will remain stationary* *Students need to already know that if the resultant force on a moving object is 0N then the object will continue to move at constant velocity.*		Tier 2 Tier 3 Inertia: Property of matter that causes it to remain in state of rest/ constant motion, unless an external force is applied
Work Done	• Students will know that when a force causes an object to move through a distance work is done on the object • Students will know that work done is calculated using the equation: work done = force x distance (W = F s) • Students will know that work done has the unit Joule (J) • Students will know that one joule of work is done when a force of one newton causes a displacement of one metre • Students will know how to describe energy transfers when work is done • Students will know that 1 joule = 1 newton-metre	*Students need to already know that joule is the unit of energy* *Students need to already know that metre is the unit of distance* *Students need to already know that newton is the unit of force* *Students need to already know that the energy stores are kinetic; gravitational potential, chemical, elastic potential, magnetic, electrostatic and thermal*	Using formula from the equation sheet	Tier 3: Work done: transfer of energy

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	• Students will know that work done against frictional forces causes a rise in temperature of the object			
Lesson: Speed and Velocity	• Students will know that speed is a scalar quantity as it doesn't involve direction • Students will know that the speed of moving objects is rarely constant • Students will know that typical walking speed is 1.5 m/s • Students will know that typical running speed is 3 m/s • Students will know that typical cycling speed is 6 m/s • Students will know that typical value for speed of sound in air is 330 m/s • Students will know how to make measurements of distance and time and calculate speed of objects • Students will know how to use the speed equation to calculate speed, distance and time • Students will know that velocity of an object is its speed in a given direction • Students will know how to explain why velocity is a vector quantity • Students will know that an object travelling in circular motion at constant speed has changing velocity as its direction is changing	***Students need to already know that scalar quantities are quantities with magnitude only*** Students need to already know that vector quantities are quantities with magnitude and direction	Estimations Taking measurements of distance and time	Tier 2 Uniform: Remaining the same at all times Tier 3
Lesson: Distance-time graphs	• Students will know that distance-time graphs can be used to represent the motion of an object in a straight line. • Students will know that the speed of an object can be calculated from the gradient of the distance time graph • Students will know that an accelerating object will have a curved line, and the	• ***Students need to already know that speed is a measure of how fast an object is moving***	Interpreting graphs Determining gradients from graphs	Tier 2 Gradient: a measure of how steep a slope is Tier 3

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	speed at a particular point can be calculated by drawing a tangent and measuring the gradient • Students will know how to draw distance time graphs from measurements • Students will know how to interpret distance time graphs			
Lesson: Acceleration	• Students will know that acceleration is a measure of the rate of change of velocity • Students will know that the unit of acceleration is m/s^2 • Students will know that an object slowing down is decelerating, and that this is negative acceleration • Students will know that acceleration is calculated using acceleration = change in velocity / time taken • Students will know how to calculate acceleration using both the acceleration equation and the uniform acceleration equation found in the data sheet.	• ***Students need to already know velocity is a vector quantity***	Using formula from the equation sheet	Tier 2 Tier 3 Acceleration: the rate of change in velocity
Lesson: Velocity-time graphs	• Students will know that velocity time graphs can be used to represent the motion of an object • Students will know that the acceleration of an object can be calculated from the gradient of a velocity-time graph • Students will know that the distance travelled by an object can be calculated from the area under a velocity-time graph • Students will know how to draw velocity-time graphs • Students will know how to interpret velocity-time graphs •	***Students need to already know that acceleration is the rate of change in velocity*** Students need to already know that velocity is a vector quantity	Drawing Graphs Interpreting Graphs Calculating gradients	Tier 2 Tier 3

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Lesson: Stopping Distance	• Students will know that the stopping distance of a vehicle is the sum of the thinking distance and the braking distance • Students will know that the thinking distance is the distance the vehicle travels during the driver's reaction time • Students will know that the braking distance is the distance the vehicle travels under the braking force • Students will know that the greater the speed of the vehicle, the greater the stopping distance • Students will know that reaction times vary from person to person, with typical values ranging from 0.2 to 0.9 s • Students will know that a driver's reaction time can be affected by tiredness, drugs, alcohol and distractions • Students will know that when brakes are applied on a vehicle, work is done by the friction force between the brakes and wheels to reduce the kinetic energy of the vehicle, causing the temperature of the brakes to increase • Students will know that the greater the speed of a vehicle the greater the braking force needed to stop the vehicle. • Students will know that large decelerations can lead to brakes overheating and/ or loss of control. • Students will know how to evaluate the effect of various factors on braking distance • Students will know that the braking distance of a vehicle can be	***Students need to already know that kinetic energy is a store of energy in a moving object***		Tier 2 Tier 3 Stopping Distance: the total distance a car travels when coming to a stop Thinking distance: the distance a car travels when the driver responds to a stimulus and applies their foot to the brake Braking distance: the distance a car travels when the brake has been applied

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	affected by adverse road and weather conditions (such as wet or icy conditions) and poor condition of the vehicle (such as brakes or tyres) • Students will know how to measure human reaction times. • Students will know how to evaluate measurements from simple methods to measure the different reaction times • Students will know how to evaluate the effect of various factors on thinking distance. • TRIPLE ONLY: Students will know how to estimate the distance for a vehicle to make an emergency stop varies over a range of speeds typical for that vehicle • TRIPLE ONLY: Students will know how to interpret graphs relating speed to stopping distance for a range of vehicles			
Lesson: Forces and Elasticity	• Students will know that at least two forces are required to stretch, compress or twist an object • Students will know that elastic deformation means that an object is able to return to its original shape once the forces have been removed • Students will know that inelastic deformation means that an object is unable to return to its original shape after the forces have been removed • Students will know that the extension of an object is directly proportional to the force applied, up until the limit of proportionality.	• *Students will already know that the unit for force is N* • *Students will already know that the unit of extension is m* *Students will already know that the unit of spring constant is N/m*	Interpreting graphs Interpreting data	Tier 2 Compress: squash Tier 3 Elastic deformation: object returns to its original shape when forces are removed Inelastic deformation: object doesn't return to its original shape when forces are removed

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	• Students will know that the equation that links force, spring constant and extension is: force = spring constant x extension F = k e • Students will know that, when looking at compressed elastic objects, the extension is the compression of the object • Students will know how to calculate work done in stretching a spring using the equation: • elastic potential energy = 0.5 x spring constant x extension squared • Students will know how to use the force equation to calculate force, spring constant and extension • Students will know how to describe the difference between linear and non-linear relationships between force and extension • Students will know how to interpret data from an investigation of the relationship between force and extension			
Lesson: Hooke's Law Required Practical	• Students will know the method used to investigate the effect of increasing the force applied to an elastic object on the extension of the elastic object • Students will know that the independent variable is the force • Students will know that the dependent variable is extension • Students will know that the control variables include the object the force is being applied to	• *Students will already know how to convert cm to m* • *Students will already know that the force of weight is changed when mass is changed*	Interpreting graphs Identifying and controlling variables	

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Lesson: Moments (triple only) (2 lessons)	• Students will know that a force or a system of forces may cause an object to rotate • Students will know how to describe examples in which forces cause rotation • Students will know that the turning effect of a force is called the moment of the force • Students will know that the size of the moment of a force can be calculated using: Moment of a force = force x distance M = F d • Students will know that the unit of moments is Nm • Students will know that the distance is the perpendicular distance from the pivot to the line of action of the force, in metres • Students will know that if an object is balanced, the total clockwise moment about a pivot equals the total anticlockwise moment about the pivot • Student will know how to calculate the size of the force or the distance from a pivot acting on an object that is balanced • Students will know that a simple lever and gear system can be used to transmit the rotational effects of a force • Students will know how to explain how levers and gears transmit the rotational effects of forces	• ***Students will already know that the unit for force is N***		Tier 2 Tier 3 Moment: the turning effect of a force