Learning Journey – Year 11 – P5 Forces – Triple Science - Higher

What have I done previously in my learning journey?	
Previously….	You have previously learnt about forces. This has involved learning about: • Describing motion • Understanding different types of forces • Pressure in fluids • Balanced forces • Forces and motion
In this topic…	You will learn more about forces. This will include learning about: • Forces and their interactions • Work done and energy transfer • Forces and motion • Momentum (HT only)

We will develop our learning by studying the following each lesson:	RAG	Skills in Science checklist
B5.01 Force, Mass and Weight • Identify and describe scalar quantities and vector quantities • Identify and give examples of forces as contact or non-contact forces • Describe the interaction between two objects and the force produced on each as a vector • Describe weight and explain that its magnitude at a point depends on the gravitational field strength • Calculate weight by recalling and using the equation: [W = mg] • Represent the weight of an object as acting at a single point which is referred to as the object's 'centre of mass'		☐ Scientific Methods ☐ Practical ☐ Number Skills ☐ Application ☐ Communication
P5.02 Resultant Forces and Work Done • Calculate the resultant of two forces that act in a straight line • HT ONLY: Describe examples of the forces acting on an isolated object or system • HT ONLY: 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 • HT ONLY: Use free body diagrams and accurate vector diagrams to scale, to resolve multiple forces and show magnitude and direction of the resultant • HT ONLY: Use vector diagrams to illustrate resolution of forces, equilibrium situations and determine the resultant of two forces, to include both magnitude and direction • Describe energy transfers involved when work is done and calculate the work done by recalling and using the equation: [W = Fs] • Describe what a joule is and state what the joule is derived from • Convert between newton-metres and joules • Explain why work done against the frictional forces acting on an object causes a rise in the temperature of the object		☐ Scientific Methods ☐ Practical ☐ Number Skills ☐ Application ☐ Communication
P5.03a Forces and Elasticity • Describe 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), more than one force has to be applied – this is limited to stationary objects only • Describe the difference between elastic deformation and inelastic deformation caused by stretching forces • Describe the extension of an elastic object below the limit of proportionality and calculate it by recalling and applying the equation: [F = ke] • Explain why a change in the shape of an object only happens when more than one force is applied • Describe and interpret data from an investigation to explain possible causes of a linear and non-linear relationship between force and extension • Calculate work done in stretching (or compressing) a spring (up to the limit of proportionality) by applying, but not recalling, the equation: [Ee= ½ke2] • Required practical 6: investigate the relationship between force and extension for a spring.		☐ Scientific Methods ☐ Practical ☐ Number Skills ☐ Application ☐ Communication
P5.03b Moments, Levers and Gears • PHY ONLY: State that a body in equilibrium must experience equal sums of clockwise and anticlockwise moments, recall and apply the equation: [M = Fd] • PHY ONLY: Apply the idea that a body in equilibrium experiences an equal total of clockwise and anti-clockwise moments about any pivot • PHY ONLY: Explain why the distance, d, must be taken as the perpendicular distance from the line of action of the force to the pivot • PHY ONLY: Explain how levers and gears transmit the rotational effects of forces		☐
P5.03c Pressure in Fluids • PHY ONLY: Describe a fluid as either a liquid or a gas and explain that the pressure in a fluid causes a force to act at right angles (normal) to the surface of its container • PHY ONLY: Recall and apply the equation: [p = F/A] • PHY & HT ONLY: Explain why the pressure at a point in a fluid increases with the height of the column of fluid above and calculate differences in pressure in a liquid by applying [p = h ρ g]		☐

• PHY & HT ONLY: Describe up thrust an object and explain why the density of the fluid has an effect on the up thrust experienced by an object submerged in it • PHY & HT ONLY: Explain why an object floats or sinks, with reference to its weight, volume and the up thrust it experiences • PHY ONLY: Describe a simple model of the Earth's atmosphere and of atmospheric pressure, explaining why atmospheric pressure varies with height above a surface		
P5.04 Distance, displacement, speed and velocity • Define distance and displacement and explain why they are scalar or vector quantities • Express a displacement in terms of both the magnitude and direction • Explain that the speed at which a person can walk, run or cycle depends on a number of factors and recall some typical speeds for walking, running, cycling • Make measurements of distance and time and then calculate speeds of objects in calculating average speed for non-uniform motion • Explain why the speed of wind and of sound through air varies and calculate speed by recalling and applying the equation: [s = v t] • Explain the vector–scalar distinction as it applies to displacement, distance, velocity and speed • HT ONLY: Explain qualitatively, with examples, that motion in a circle involves constant speed but changing velocity		☐ Scientific Methods ☐ Practical ☐ Number Skills ☐ Application ☐ Communication
P5.05 Acceleration • Calculate the average acceleration of an object by recalling and applying the equation: [a = Δv/t] • Apply, but not recall, the equation: [v2 – u 2 = 2as]		☐ Scientific Methods ☐ Practical ☐ Number Skills ☐ Application ☐ Communication
P5.06 Distance-Time Graph • Represent an object moving along a straight line using a distance-time graph, describing its motion and calculating its speed from the graph's gradient • Draw distance–time graphs from measurements and extract and interpret lines and slopes of distance–time graphs • Describe an object which is slowing down as having a negative acceleration and estimate the magnitude of everyday accelerations		☐ Scientific Methods ☐ Practical ☐ Number Skills ☐ Application ☐ Communication
P5.07 Velocity-Time Graph • Represent motion using velocity–time graphs, finding the acceleration from its gradient and distance travelled from the area underneath • HT ONLY: Interpret enclosed areas in velocity–time graphs to determine distance travelled (or displacement) • HT ONLY: Measure, when appropriate, the area under a velocity– time graph by counting square		☐ Scientific Methods ☐ Practical ☐ Number Skills ☐ Application ☐ Communication
P5.08 Falling Objects • 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 • PHY ONLY: Draw and interpret velocity-time graphs for objects that reach terminal velocity • PHY ONLY: Interpret and explain the changing motion of an object in terms of the forces acting on it • PHY ONLY: Explain how an object falling from rest through a fluid due to gravity reaches its terminal velocity		☐ Scientific Methods ☐ Practical ☐ Number Skills ☐ Application ☐ Communication
P5.09 Newton's Laws ● 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 ● Define and apply Newton's second law relating to the acceleration of an object ● Recall and apply the equation: [F = ma] ● HT ONLY: Describe what inertia is and give a definition ● Apply Newton's Third Law to examples of equilibrium situations		☐ Scientific Methods ☐ Practical ☐ Number Skills ☐ Application ☐ Communication
P5.10 Investigating Motion • Estimate the speed, accelerations and forces of large vehicles involved in everyday road transport • Required practical 7: investigate the effect of varying the force on the acceleration of an object of constant mass, and the effect of varying the mass of an object on the acceleration		☐ Scientific Methods ☐ Practical ☐ Number Skills ☐ Application ☐ Communication
P5.11 Stopping Distances • Explain methods used to measure human reaction times and recall typical results • Interpret and evaluate measurements from simple methods to measure the different reaction times of students • Evaluate the effect of various factors on thinking distance based on given data • State typical reaction times and describe how reaction time (and therefore stopping distance) can be affected by different factors • Explain how the braking distance of a vehicle can be affected by different factors, including implications for road safety • Explain how a braking force applied to the wheel does work to reduce the vehicle's kinetic energy and		☐ Scientific Methods ☐ Practical ☐ Number Skills ☐ Application ☐ Communication

increases the temperature of the brake • Explain and apply the idea that a greater braking force causes a larger deceleration and explain how this might be dangerous for drivers • HT ONLY: Estimate the forces involved in the deceleration of road vehicle • PHY ONLY: Estimate the distance required for an emergency stop in a vehicle over a range of typical speeds • PHY ONLY: Interpret graphs relating speed to stopping distance for a range of vehicles		
P5.12 Momentum • HT ONLY: Calculate momentum by recalling and applying the equation: [p = mv] • HT ONLY: 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 • HT ONLY: Describe examples of momentum in a collision		☐ Scientific Methods ☐ Practical ☐ Number Skills ☐ Application ☐ Communication

Future Learning	In AS and A Level Physics you will build on your knowledge in this topic to study - Newton's laws of motion - Vectors and scalars - Mechanics - Energy - Momentum - Circular motion
In careers	Engineers analyse forces when designing a great variety of machines and instruments, from road bridges and fairground rides to atomic force microscopes. Anything mechanical can be analysed in this way. Recent developments in artificial limbs use the analysis of forces to make movement possible.