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**Knowledge Rich Curriculum Plan**

Science – Physics

Year 12

| **Science**  **Year 12 Physics** | **Unit: Mechanics** |  |  |
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| **Lesson/Learning Sequence** | **Intended Knowledge:**  *Students will know that…* | **Tiered Vocabulary** | **Prior Knowledge:**  *In order to know this students, need to already know that…* |
| **Lesson:**  **Scalar and Vector** | * Students will know how to combine two vectors using scale drawing * Students will know how to combine two vectors at right angles to each other using calculations * Students will know how to resolve vectors into two components at right angles of each other * Students will know how to solve problems using resolved forces or closed triangles * Students will know that equilibrium means that forces acting on a point are equal and opposite * Students will know how to resolve forces using trigonometry |  | * ***Students need to already know that scalars have magnitude only, and that vectors have magnitude and direction only*** * ***Students need to already know that acceleration, velocity, displacement and force are examples of vector quantities*** |
| **Lesson:**  **Moments** | * Students will know that moments are the turning effect of forces * Students will know that moments depend on the size of the force and the distance from the pivot * Students will know that moment = force x distance from pivot   M = F d   * Students will know that a couple is a pair of equal and opposite coplanar forces acting on a pivot * Students will know that moment of a couple = force x perpendicular distance between the lines of action of the forces * Students will know that the principle of moments states that for objects to be balanced about a pivot the moments about the pivot must be equal * Students will know how to complete calculations involving moments and couples | Moment: turning effect of a force |  |
| **Lesson:**  **Mass, Weight and Centre of Mass** | * Students need to know that the centre of mass is the single point you can consider its weight to act through * Students need to know how to determine the centre of mass of a symmetrical object * Students need to know how to determine the centre of mass of an asymmetrical objects |  | * ***Students need to already know that mass is a measure of the amount of substance*** * ***Students need to already know that weight is the force of gravity acting on a mass*** * ***Students need to already know that weight = mass x gravitational field strength*** |
| **Lesson:**  **Motion-time graphs** | * Students need to know that instantaneous velocity is the velocity at a given point * Students need to know how to calculate instantaneous velocity using tangents * Students need to know how to estimate distance travelled by an object using the "counting squares" method |  | * ***Students need to already know how to describe the motion of an object using a displacement time graph and a velocity time graph*** * ***Students need to already know how to determine velocity from a displacement time graph*** * ***Students need to already know how to determine acceleration and distance travelled from a velocity time graph*** |
| **Lesson:**  **Motion with Uniform Acceleration** | * Students need to know how to use the equations for uniform acceleration to determine either displacement, initial velocity, final velocity, acceleration and time |  | * ***Students need to already know the following symbols:***   ***s - displacement***  ***u - initial velocity***  ***v - final velocity***  ***a - acceleration***  ***t - time*** |
| **Lesson:**  **Acceleration due to Gravity** | * Students will know that free fall is the motion of an object undergoing an acceleration of g * Students will know that the magnitude of g is 9.81 ms-1 |  | * ***Students need to already know that weight is the force of gravity working on a mass*** * ***Students need to already know that weight = force x gravitational field strength*** |
| **Lesson:**  **Required Practical 3 - Determining g** | * Students will know how to determine g by a freefall method |  |  |
| **Lesson:**  **Projectile Motion** | * Students will know that horizontal and vertical components of a force act independently of each other * Students will know how to solve projectile motion problems using the equations of uniform acceleration * Students will know that friction is often ignored when performing calculations * Students will know how to qualitatively describe the impact of friction on motion |  | * ***Students need to already know how to resolve forces into horizontal and vertical components*** |
| **Lesson:**  **Newton's Laws** | * Students will know how to apply Newton's laws to a variety of scenarios * Students will know that all objects fall at the same rate |  | * ***Students need to already know that Newton's 1st law states that a force is needed to change velocity*** * ***Students need to already know that Newton's 2nd Law states that acceleration is proportional to the force (F = m a)*** * ***Students need to already know that each force has an equal and opposite reaction force*** |
| **Lesson:**  **Drag, Lift and Terminal Speed** | * Students will know that drag is friction that occurs in fluids * Students will know that drag depends on viscosity of the fluid * Students will know that drag increases as speed increases * Students will know that drag depends on the shape of the object moving through it * Students will know that frictional forces convert kinetic energy into heat and sound * Students will know that lift is perpendicular to fluid flow * Students will know that lift happens when the shape of an object causes the fluid flowing over it to change direction * Students will know that the three main stages of reaching terminal speed are:   - The object accelerates from rest using a constant driving force  - As the speed increases, the frictional forces increase reducing the resultant forces  - The car reaches a speed at which the frictional forces are equal to the driving force   * Students will know how to explain how different objects reach terminal velocity |  | * ***Students need to already know that friction is a force that opposes motion*** * ***Students need to already know that fluid refers to liquids and gases*** |
| **Lesson:**  **Momentum** | * Students need to know that momentum before collision = momentum after collision * Students need to know how to answer problems on conservation on momentum * Students need to know that elastic collisions are collisions where momentum and kinetic energy are conserved * Students need to know that inelastic collisions are collisions where momentum is conserved and kinetic energy isn't conserved * Students need to know how to determine whether collisions are elastic or inelastic * Students need to know that the rate of change of momentum is directly proportional to the resultant force acting on an object * Students need to know that impulse = change in momentum |  | * ***Students need to already know that momentum = mass x velocity*** * ***Students need to already know that momentum is always conserved*** |
| **Lesson:**  **Work and Power** | * Students will know that force isn't always in the same direction as the movement * Students will know that W = Fcos(theta) * Students will know that Power = Force x velocity |  | * ***Students need to already know that work is done whenever energy is transferred*** * ***Students need to already know that work = force x distance*** * ***Students need to already know that power = change in energy ÷ change in time*** |
| **Lesson:**  **Conservation of Energy** | * Students will know how to describe conversions between kinetic and gravitational potential energy * Students will know how to complete calculations involving conversions between kinetic and gravitational potential energy |  | * ***Students need to already know that Ep = m g h*** * ***Students need to already know that Ek = 1/2 m v(squared)*** * ***Students need to already know that efficiency = energy output ÷ total energy input*** |