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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***
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| **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***
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| **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***
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| **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***
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| **Lesson:** **Required Practical 3 - Determining g** | * Students will know how to determine g by a freefall method
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| **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***
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| **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***
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| **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***
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| **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***
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| **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***
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| **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***
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