P2 Module Outline

- Describe how to measure distance and time in a range of scenarios
- Describe how to measure distance and time and use these to calculate speed
- Make calculations using ratios and proportional reasoning to convert units and to compute rates
- Explain the vector-scalar distinction as it applies to displacement and distance, velocity and speed.
- Relate changes and differences in motion to appropriate distance-time and velocity time graphs; interpret lines and slopes
- **Interpret enclosed area in velocity time graphs (Higher only)**
- Calculate average speed for non-uniform motion
- Apply formulae relating distance, time and speed for uniform motion and for motion with uniform acceleration
- Recall examples of ways in which objects interact
- Describe how such examples involve interactions between pairs of objects which produce a force on each object
- Represent such forces as vectors
- Apply Newton's First Law to explain the motion of an object moving with uniform velocity and also an object where the speed and / or direction change
- **Use vector diagrams to illustrate resolution of forces, a net force(resultant force) and equilibrium situations (Higher only)**
- **Describe examples of the forces acting on an isolated object or system (Higher only)**
- **Describe using free body diagrams examples where two or more forces lead to a resultant force on an object (Higher only)**
- **Describe using free body diagrams examples of the special case where forces balance to produce a resultant force of zero (qualitative only) (Higher only)**
- Apply Newton's second law in calculations relating forces, masses and accelerations
- **Explain that inertia is a measure of how difficult it is to change the velocity of an object and that the mass is defined as the ratio of force over acceleration (Higher only)**
- **Define momentum and describe examples of momentum in collisions (Higher only)**
- *Apply formulae relating force, mass, velocity and acceleration to explain how the changes involved are inter related (Separate Science only)*
- Use the relationship between work done, force and distance moved along the line of action of the force and describe the energy transfer involved
- Calculate relevant values of stored energy and energy transfers; convert between newton-metres and joules
- Explain with reference to examples the definition of power as the rate at which energy is transferred
- Recall and apply Newton's third law
- **Explain why an object moving in a circle moving in a circle with a constant speed has a changing velocity (qualitative only) (Higher only)**
- Explain that to stretch, bend or compress an object, more than one force has to be applied
- Describe the difference between elastic and plastic deformation (distortions) caused by stretching forces
- Describe the relationship between force and extension for a spring and other simple systems
- Describe the difference between linear and non-linear relationships between force and extension
- Calculate a spring constant in linear cases
- Calculate the work done in stretching
- Describe that all matter has a gravitational field that causes attraction and the field strength is much greater for massive objects
- Define weight, describe how it is measured and describe the relationship between the weight of an object and the gravitational field strength (g) that has a value of 10N/kg at the Earth's surface
- Recall the acceleration in free fall
- *Apply formulae relating force, mass and relevant physical constants including gravitational field strength to the explore how the changes are interrelated (Separate Science only)*
- *Describe examples in which forces cause rotation (Separate Science only)*
- *Define and calculate the moment of the force in such examples (Separate Science only)*
- *Explain how levers and gears transmit the rotational effects of forces(Separate Science only)*
- *Recall that pressure in fluids(gases and liquids) causes a net force at right angles to any surface(Separate Science only)*
- *Use the relationship between the force, the pressure and the area in contact . (Separate Science only)*

P2 Formulae to Learn

Distance travelled (m) = speed (m/s) x time (s)

Acceleration (m/s^2) = change in velocity (m/s) / time (s)

Kinetic energy (J) = ½ mass (kg) x (speed (m/s))^2

Force (N) = mass (kg) x acceleration (m/s^2)

Momentum (kgm/s) = mass (kg) x velocity (m/s) (Higher only)

Work done (J) = Force (N) x distance (m) (along the line of action of the force)

Power (W) = work done (J) / time (s)

Force exerted by a spring (N) = extension (m) x spring constant (N/m)

Weight (N) = Gravity force (N) = mass (kg) x gravitational field strength, g (N/kg)

Potential Energy (J) = mass (kg) x height (m) x gravitational field strength, g (N/kg)

Moment of a force (Nm) = force (N) x distance (m) (normal to the direction of the force) (Separate Science only)

P2 Formulae to use (provided in the exam)

(Final velocity (m/s))^2 - (initial velocity (m/s))^2 = 2 x acceleration (m/s^2) x distance (m)

Energy transferred in stretching (J) = ½ x spring constant (N/m) x (extension (m))^2