

P8 Forces in Balance		
	Analysis	Revised?
Can describe the interaction between pairs of objects which produce a force on each object.		
Can describe the difference between scalars and vectors.		
Can recall the equation [weight = mass x gravitational field strength].		
Can recognise and use the symbol for proportionality.		
Students should be able to calculate the resultant of two forces that act in a straight line.		
<b>Can describe examples of the forces acting on an isolated object or system.</b>		
<b>Can use free body diagrams to describe qualitatively examples where several forces lead to a resultant force on an object, including balanced forces when the resultant force is zero.</b>		
<b>Can resolve a single force into two component forces acting at right angles to each other. The two component forces together have the same effect as the single force.</b>		
<b>Can use vector diagrams to illustrate resolution of forces, equilibrium situations and determine the resultant of two forces – This includes both magnitude and direction using scale drawings only.</b>		
Can describe examples in which forces cause rotation.		
Can recall and apply the equation: [Moment = Force x Distance].		
Can calculate the size of a force, or its distance from a pivot, acting on an object that is balanced.		
Can explain how levers and gears transmit the rotational effects of forces.		
P9 Motion		
	Analysis	Revised?
Can express displacement in terms of both magnitude and direction.		
Can recall typical values of speed for a person: walking, running and cycling.		
Can recall typical values of speed for different types of transportation systems.		
Can make measurements of distance and time and then calculate speeds of objects.		
Can recall and apply the equation: [distance = speed x time].		
Can calculate average speed for non-uniform motion.		
Can explain the vector–scalar distinction as it applies to displacement, distance, velocity and speed.		
<b>Can explain qualitatively, with examples, that motion in a circle involves constant speed but changing velocity.</b>		
<b>Can explain that if an object is accelerating, its speed at any particular time can be determined by drawing a tangent and measuring the gradient of the distance–time graph at that time.</b>		
Can draw distance–time graphs from measurements and extract and interpret lines and slopes of distance– time graphs, translating information between graphical and numerical form.		
Can determine speed from a distance–time graph.		
Can recall and apply the equation: [Acceleration = change in velocity / time].		
Can estimate the magnitude of everyday accelerations.		
<b>Can calculate the distance travelled by an object (or displacement of an object) from the area under a velocity–time graph.</b>		
Can draw velocity–time graphs from measurements and interpret lines and slopes to determine acceleration.		
<b>Can interpret enclosed areas in velocity–time graphs to determine distance travelled (or displacement).</b>		
<b>Can measure, when appropriate, the area under a velocity–time graph by counting squares.</b>		
Can apply the equation: $[(\text{final velocity})^2 - (\text{Initial velocity})^2 = 2 \times \text{acceleration} \times \text{distance}]$ .		
P10 Forces and Motion		
	Analysis	Revised?
Can recall the equation [work done = force x distance].		
Can describe the energy transfer involved when work is done.		
Can convert between Newton metres and Joules.		
Can give examples of the forces involved in stretching, bending or compressing an object.		
Can explain why, to change the shape of an object (by stretching, bending or compressing), more than one force has to be applied.		
Can describe the difference between elastic deformation and inelastic deformation caused by stretching forces.		
Can recall the equation [Force = spring constant x extension].		

Can describe the difference between a linear and non-linear relationship between force and extension.		
Can calculate a spring constant in linear cases.		
Can interpret data from an investigation of the relationship between force and extension.		
Can calculate the work done in stretching (or compressing) a spring up to the elastic limit using the equation: $[E = \frac{1}{2} \times \text{spring constant} \times (\text{extension})^2]$ .		
Can calculate relevant values of stored energy and energy transfers.		
<i>RP6: Can investigate the relationship between force and extension for a spring.</i>		
Can express a displacement in terms of both magnitude and direction.		
Can use ratios and proportional reasoning to convert units and to calculate rates.		
Can describe that acceleration due to the Earth's gravity is $9.8\text{m/s}^2$ .		
Can describe that once the resultant forces acting on a falling object reaches zero, the object is falling with a constant velocity called the terminal velocity.		
Can draw and interpret velocity-time graphs for objects that reach terminal velocity.		
Can interpret the changing motion in terms of forces acting.		
Can apply Newton's First Law to explain the motion of objects moving with a uniform velocity and objects where the speed and/or direction changes.		
Can describe that the tendency of objects to continue in their state of rest or of uniform motion is called inertia.		
Can recall and apply the equation: $[\text{Force} = \text{mass} \times \text{acceleration}]$ .		
<b>Can explain that inertial mass is a measure of how difficult it is to change the velocity of an object.</b>		
<b>Can explain that inertial mass is defined as the ratio of force over acceleration.</b>		
Can estimate the speed, accelerations and forces involved in large accelerations for everyday road transport.		
Can recognise and be able to use the symbol that indicates an approximate value or approximate answer,-		
<i>RP7: Can explain the effect of how varying the force on the acceleration of an object with constant mass.</i>		
Can apply Newton's Third Law to examples of equilibrium situations.		
Can estimate how the distance for a vehicle to make an emergency stop varies over a range of speeds.		
Can interpret graphs relating speed to stopping distance for a range of vehicles.		
Can explain methods used to measure human reaction times and recall typical results.		
Can interpret and evaluate measurements from simple methods to measure the different reaction times of students.		
Can evaluate the effect of various factors on thinking distance based on given data.		
Can explain the factors which affect the distance required for road transport vehicles to come to rest in emergencies, and the implications for safety.		
Can estimate how the distance required for road vehicles to stop in an emergency varies over a range of typical speeds.		
Can explain the dangers caused by large decelerations.		
<b>Can estimate the forces involved in the deceleration of road vehicles in typical situations on a public road.</b>		
Can recall and apply the equation: $[\text{Momentum} = \text{mass} \times \text{velocity}]$ .		
Can use the concept of momentum as a model to describe and explain examples of momentum in an event, such as a collision.		
Can use the concept of momentum as a model to complete calculations involving an event, such as the collision of two objects.		
Can apply the given equations: $[F = ma]$ $[a = v-u/t]$ .		
Can combine the equations given above to provide: $[F = m\Delta v/\Delta t]$ .		
Can explain safety features such as air bags, seat belts, gymnasium crash mats, cycle helmets and cushioned surfaces for playgrounds with reference to the concept of rate of change of momentum.		
Can apply equations relating to force, mass, velocity and acceleration to explain how changes involved are inter-related.		
<b>P11 Force &amp; Pressure</b>	<b>Analysis</b>	<b>Revised?</b>
Can recall and apply the equation: $[P = F/A]$ .		
Can apply the equation: $[\rho = h\rho g]$ .		
Can explain why in a liquid, pressure at a single point increases with the height of the column of liquid above it and the density of the liquid.		
Can calculate the differences in pressure at different depths of liquid.		
Can describe the factors which influence floating and sinking.		
Can describe a simple model of the Earth's atmosphere and of atmospheric pressure.		

Can explain why atmospheric pressure varies with height above a surface.		
<b>P12 Wave Properties</b>	<b>Analysis</b>	<b>Revised?</b>
Can describe the difference between longitudinal and transverse waves.		
Can describe evidence that, for both ripples on a water surface and sound waves in air, it is the wave and not the water or air itself that travels.		
Can describe wave motion in terms of their amplitude, wavelength, frequency and period.		
Can apply the equation: [Period = 1/frequency].		
Can recall and apply the equation: [wave speed = frequency x wavelength].		
Can identify amplitude and wavelength from given diagrams.		
Can describe a method to measure the speed of sound waves in air.		
Can describe a method to measure the speed of ripples on a water surface.		
Can show how changes in velocity, frequency and wavelength, in transmission of sound waves from one medium to another, are inter-related.		
<i>RP8: Can use a ripple tank to investigate and calculate wavelength, wave speed and frequency.</i>		
<i>RP9: Can investigate reflection of light by different types of surface and the refraction of light by different substances.</i>		
<b>Can describe, with examples, process which convert wave disturbances between sound waves and vibrations in solids.</b>		
<b>Can explain why the above only works over a limited frequency.</b>		
<b>Can recall the human hearing range is between 20Hz and 20kHz.</b>		
<b>Can explain the use of waves in the exploration of the Earth.</b>		
<b>Can explain that seismic waves can provide new evidence the led to the discoveries about parts of the Earth that are not directly observable.</b>		
<b>P13 Electromagnetic Waves</b>	<b>Analysis</b>	<b>Revised?</b>
Can describe the electromagnetic spectrum as a continuous spectrum of transverse wave radiation that travel through a vacuum at the same speed.		
Can give examples that illustrate the transfer of energy by electromagnetic waves.		
<b>Can explain why different substances may absorb, transmit, refract or reflect electromagnetic waves in ways that vary with wavelength.</b>		
<b>Can describe that some effects, for example refraction, are due to the difference in velocity of the waves in different substances.</b>		
<b>Can explain that radio waves are produced by oscillations in electrical circuits.</b>		
<b>Can explain that radio waves can induce oscillations in electrical circuits.</b>		
<i>RP: Can describe why the amount of IR radiation absorbed or radiated by a surface, depends on the nature of the surface.</i>		
<b>Can describe that radio waves can be produced by oscillations in electrical circuits.</b>		
<b>Can describe that when radio waves are absorbed they may create an alternating current with the same frequency as the radio wave itself, so radio waves can themselves induce oscillations in an electrical circuit.</b>		
Can draw conclusions from given data about the risks and consequences of exposure to radiation.		
Can recall the unit of radiation dose to be the Sievert (Sv) and millisievert (mSv).		
Can provide an example of a practical applications for each section of the electromagnetic spectrum: radio waves microwaves infrared visible light ultraviolet X-rays and gamma rays.		
<b>Can give brief explanations why each type of electromagnetic wave is suitable for the practical application.</b>		
<b>P14 Light</b>	<b>Analysis</b>	<b>Revised?</b>
Can construct ray diagrams to illustrate the reflection of a wave at a surface.		
Can describe the effects of reflection, transmission and absorption of waves at material interfaces.		
Can construct ray diagrams to illustrate the refraction of a wave at the boundary between two different media.		
<b>Can use wave front diagrams to explain refraction in terms of the change of speed that happens when a wave travels from one medium to a different medium.</b>		
<i>RP10: Can investigate ow the amount of IR radiation absorbed or radiated by a surface depends on the nature of that surface.</i>		
Can construct ray diagrams to illustrate the similarities and differences between convex and concave lenses		

can apply the equation: [magnification = image height/object height].		
Can explain how the colour of an object is related to absorption, transmission and reflection of different wavelengths of light.		
Can explain the effect of viewing objects through filters or the effect on light of passing through filters.		
Can explain why an opaque object has a particular colour.		
Can explain that all bodies emit radiation.		
Can explain that the intensity and wavelength distribution of any emission depends on the temperature of the body.		
<b>Can explain that a body at constant temperature is absorbing radiation at the same rate as it is emitting radiation. The temperature of a body increases when the body absorbs radiation faster than it emits radiation.</b>		
<b>Can explain that the temperature of the Earth depends on many factors such as rates of absorption and emission of radiation and the reflection of this into space.</b>		
<b>Can explain how the temperature of a body is related to the balance between incoming radiation and emitted radiation.</b>		
<b>Can use information or draw/interpret diagrams to show how radiation effects the temperature of the Earth's surface and atmosphere.</b>		
<b>P15 Electromagnetism</b>	<b>Analysis</b>	<b>Revised?</b>
Can describe the attraction and repulsion between unlike and like poles for permanent magnets.		
Can describe the difference between permanent and induced magnets.		
Can describe how to plot the magnetic field pattern of a magnet using a compass.		
Can draw the magnetic field pattern of a bar magnet showing how strength and direction change from one point to another.		
Can explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic.		
Can describe how the magnetic effect of a current can be demonstrated.		
Can draw the magnetic field pattern for a straight wire carrying a current and for a solenoid (showing the direction of the field).		
Can explain how a solenoid arrangement can increase the magnetic effect of the current.		
Can interpret diagrams of electromagnetic devices in order to explain how they work.		
<b>Can show that Fleming's left-hand rule represents the relative orientation of the force, the current in the conductor and the magnetic field.</b>		
<b>Can recall the factors that affect the size of the force on the conductor.</b>		
<b>Can apply the equation: [Force = Magnetic flux density x current x length of wire].</b>		
<b>Can explain how the force on a conductor in a magnetic field causes the rotation of the coil in an electric motor.</b>		
<b>Can explain how a moving-coil loudspeaker and headphones work.</b>		
<b>Can recall the factors that affect the size of an induced potential difference/induced current.</b>		
<b>Can recall factors that affect the direction of an induced potential difference/induced current.</b>		
<b>Can apply the principles of the generator effect in a given context.</b>		
<b>Can explain how the generator effect is used in an alternator to generate ac and in a dynamo to generate DC.</b>		
<b>Can draw/interpret graphs of potential difference generated in the coil against time.</b>		
<b>Can explain how a moving-coil microphone works.</b>		
<b>Can apply the equation: [Vp/Vs = Np/Ns].</b>		
<b>Can apply the equation:[Vs x Is = Vp x Ip].</b>		
<b>Can explain how the effect of ac in one coil induces a current in another coil.</b>		
<b>Can explain how the ratio of potential differences across the two coils depends on the ratio of the number of turns on each.</b>		
<b>Can calculate the current drawn from the input supply to provide a particular power output.</b>		
<b>Can apply the above equation to explain the advantages of transmitting power at high voltages.</b>		
<b>P16 Space</b>	<b>Analysis</b>	<b>Revised?</b>
Can explain how at the start of a stars life cycle, dust and gas are drawn together.		
Can explain that fusion reactions lead to an equilibrium between gravitational collapse and expansion due to fusion energy.		
Can describe the life cycle of a star for stars the same size as the Sun.		
Can describe the life cycle of a star for stars much more massive than the size of the Sun.		
Can explain how fusion processes lead to the formation of new elements.		
Can describe the similarities and differences between planets, their moons and artificial satellites.		

Can explain how for circular orbits, the force of gravity can lead to changing velocity but unchanged speed.		
Can explain how for a stable orbit, the radius must change if the speed changes.		
Can explain qualitatively the redshift of light from galaxies that are receding.		
Can explain that the change of each galaxy's speed with distance is evidence of an expanding universe.		
Can explain how redshift provide evidence for the Big Bang model.		
Can explain how scientists ae able to use observation to arrive at theories such as the Big Bang.		
Can explain that there is still much about the universe that is not understood, for example dark mass and dark energy.		