St Olave’s
Physics Department

Year 10 Examination
Revision Checklist

The following checklists include all the topics that will be included in the Year 10 end of year examination. Students should use the tickboxes to check their progress.

GCSE Electromagnetic Spectrum and Black Body Radiation – Topic List

	Start			End		
Students will be assessed on their ability to:	☹	😐	☺	☹	😐	☺
understand that light is part of a continuous electromagnetic spectrum which includes radio, microwave, infrared, visible, ultraviolet, x-ray and gamma ray radiations and that all these waves travel at the same speed in free space	☹	😐	☺	☹	😐	☺
identify the order of the electromagnetic spectrum in terms of decreasing wavelength and increasing frequency, including the colours of the visible spectrum	☹	😐	☺	☹	😐	☺
explain some of the uses of electromagnetic radiations and why they are useful for each, including:	☹	😐	☺	☹	😐	☺
• radio waves: TV/radio communications, Bluetooth	☹	😐	☺	☹	😐	☺
• microwaves: cooking and satellite transmissions	☹	😐	☺	☹	😐	☺
• infrared: heaters, infrared cameras, cooking food	☹	😐	☺	☹	😐	☺
• visible light: optical fibres and photography, visible light lasers	☹	😐	☺	☹	😐	☺
• ultraviolet: fluorescent lamps, banknote security, sunbeds	☹	😐	☺	☹	😐	☺
• x-rays: observing the internal structure of objects and materials, medical imaging, medical treatments.	☹	😐	☺	☹	😐	☺
• gamma rays: sterilising food and medical equipment, gamma knife, medical tracers	☹	😐	☺	☹	😐	☺
understand the detrimental effects of excessive exposure of the human body to electromagnetic waves, including:	☹	😐	☺	☹	😐	☺
• microwaves: internal heating of body tissue	☹	😐	☺	☹	😐	☺
• infrared: skin burns	☹	😐	☺	☹	😐	☺
• ultraviolet: damage to surface cells, skin cancer and blindness	☹	😐	☺	☹	😐	☺
• x-ray: ionising radiation so can cause mutations of genes and cancers.	☹	😐	☺	☹	😐	☺
• gamma: ionising radiation so can cause cancers and mutations of genes.	☹	😐	☺	☹	😐	☺
and describe simple protective measures against the risks.	☹	😐	☺	☹	😐	☺
explain how all objects emit and absorb infrared radiation and its link to temperature of the object.	☹	😐	☺	☹	😐	☺
understand the link between temperature change and net absorption/emittance of infra-red radiation.	☹	😐	☺	☹	😐	☺
describe and explain, using simple diagrams, the factors that affect the temperature of the earth's surface and atmosphere.	☹	😐	☺	☹	😐	☺
describe what is meant by a perfect black body.	☹	😐	☺	☹	😐	☺
sketch, understand and interpret black body radiation curves for different temperatures.	☹	😐	☺	☹	😐	☺

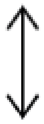
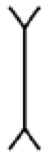
<u>GCSE Waves and Seismic waves – Topic List</u>

	Start			End		
	☹	😐	☺	☹	😐	☺
Waves may be either transverse or longitudinal.	☹	😐	☺	☹	😐	☺
The ripples on a water surface are an example of a transverse wave.	☹	😐	☺	☹	😐	☺
Longitudinal waves show areas of compression and rarefaction	☹	😐	☺	☹	😐	☺
Sound waves travelling through air are longitudinal.	☹	😐	☺	☹	😐	☺
Students should be able to describe the difference between longitudinal and transverse waves.	☹	😐	☺	☹	😐	☺
Students should be able to 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.	☹	😐	☺	☹	😐	☺
Students should be able to describe wave motion in terms of their amplitude, wavelength, frequency and period.	☹	😐	☺	☹	😐	☺
The amplitude of a wave is the maximum displacement of a point on a wave away from its undisturbed position.	☹	😐	☺	☹	😐	☺
The wavelength of a wave is the distance from a point on one wave to the equivalent point on the adjacent wave.	☹	😐	☺	☹	😐	☺
The frequency of a wave is the number of waves passing a point each second. Period = 1/frequency T= 1/f period, T, in seconds, s frequency, f, in hertz, Hz	☹	😐	☺	☹	😐	☺
The wave speed is the speed at which the energy is transferred (or the wave moves) through the medium.	☹	😐	☺	☹	😐	☺
All waves obey the equation, wavespeed = frequency x wavelength $v = f\lambda$ velocity, v, in metres per second, m/s frequency, f, in hertz, Hz wavelength, λ, in metres, m	☹	😐	☺	☹	😐	☺
Students should be able to: • identify amplitude and wavelength from given diagrams	☹	😐	☺	☹	😐	☺
Students should be able to • describe a method to measure the speed of sound waves in air • describe a method to measure the speed of ripples on a water surface.	☹	😐	☺	☹	😐	☺
Students should be able to show how changes in velocity, frequency and wavelength, in transmission of sound waves from one medium to another, are inter-related.	☹	😐	☺	☹	😐	☺
Required practical activity 8: make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid and take appropriate measurements.	☹	😐	☺	☹	😐	☺
Waves can be reflected at the boundary between two different materials.	☹	😐	☺	☹	😐	☺
Waves can be absorbed or transmitted at the boundary between two different materials.	☹	😐	☺	☹	😐	☺
Students should be able to construct ray diagrams to illustrate the reflection of a wave at a surface.	☹	😐	☺	☹	😐	☺

Students should be able to describe the effects of reflection, transmission and absorption of waves at material interfaces	☹	😐	☺	☹	😐	☺
Sound waves can travel through solids causing vibrations in the solid.	☹	😐	☺	☹	😐	☺
Within the ear, sound waves cause the ear drum and other parts to vibrate which causes the sensation of sound. The conversion of sound waves to vibrations of solids works over a limited frequency range. This restricts the limits of human hearing.	☹	😐	☺	☹	😐	☺
Students should be able to: • describe, with examples, processes which convert wave disturbances between sound waves and vibrations in solids.	☹	😐	☺	☹	😐	☺
Examples may include the effect of sound waves on the ear drum • explain why such processes only work over a limited frequency range and the relevance of this to human hearing.	☹	😐	☺	☹	😐	☺
Students should know that the range of normal human hearing is from 20 Hz to 20 kHz.	☹	😐	☺	☹	😐	☺
Students should be able to explain in qualitative terms, how the differences in velocity, absorption and reflection between different types of wave in solids and liquids can be used both for detection and exploration of structures which are hidden from direct observation.	☹	😐	☺	☹	😐	☺
Ultrasound waves have a frequency higher than the upper limit of hearing for humans. Ultrasound waves are partially reflected when they meet a boundary between two different media. The time taken for the reflections to reach a detector can be used to determine how far away such a boundary is. This allows ultrasound waves to be used for both medical and industrial imaging.	☹	😐	☺	☹	😐	☺
Seismic waves are produced by earthquakes. P-waves are longitudinal, seismic waves. P-waves travel at different speeds through solids and liquids. S-waves are transverse, seismic waves.	☹	😐	☺	☹	😐	☺
S-waves cannot travel through a liquid. P-waves and S-waves provide evidence for the structure and size of the Earth’s core. Echo sounding, using high frequency sound waves is used to detect objects in deep water and measure water depth.	☹	😐	☺	☹	😐	☺
Students should be aware that the study of seismic waves provided new evidence that led to discoveries about parts of the Earth which are not directly observable	☹	😐	☺	☹	😐	☺

GCSE Light and Sound - Topic List

	Start			End		
Students will be assessed on their ability to:	☹	😐	☺	☹	😐	☺
understand that light waves are transverse waves which can be reflected, refracted and diffracted	☹	😐	☺	☹	😐	☺
Waves can be reflected at the boundary between two different materials. Waves can be absorbed or transmitted at the boundary between two different materials.	☹	😐	☺	☹	😐	☺
Reflection from a smooth surface in a single direction is called specular reflection. Reflection from a rough surface causes scattering this is called diffuse reflection.	☹	😐	☺	☹	😐	☺
use the law of reflection (the angle of incidence equals the angle of reflection)	☹	😐	☺	☹	😐	☺
construct ray diagrams to illustrate the formation of a virtual image in a plane mirror	☹	😐	☺	☹	😐	☺
Some effects, for example refraction, are due to the difference in velocity of the waves in different substances.	☹	😐	☺	☹	😐	☺
Students should be able to construct ray diagrams to illustrate the refraction of a wave at the boundary between two different media	☹	😐	☺	☹	😐	☺
Students should be able to 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.	☹	😐	☺	☹	😐	☺
3.17 describe experiments to investigate the refraction of light, using rectangular blocks, semi-circular blocks and triangular prisms	☹	😐	☺	☹	😐	☺
Each colour within the visible light spectrum has its own narrow band of wavelength and frequency.	☹	😐	☺	☹	😐	☺
Colour filters work by absorbing certain wavelengths (and colour) and transmitting other wavelengths (and colour).	☹	😐	☺	☹	😐	☺
The colour of an opaque object is determined by which wavelengths of light are more strongly reflected. Wavelengths not reflected are absorbed. If all wavelengths are reflected equally the object appears white. If all wavelengths are absorbed the objects appears black.	☹	😐	☺	☹	😐	☺
Objects that transmit light are either transparent or translucent.	☹	😐	☺	☹	😐	☺
Students should be able to explain: • how the colour of an object is related to the differential absorption, transmission and reflection of different wavelengths of light by the object	☹	😐	☺	☹	😐	☺
Students should be able to explain: • the effect of viewing objects through filters or the effect on light of passing through filters	☹	😐	☺	☹	😐	☺
Students should be able to explain: why an opaque object has a particular colour	☹	😐	☺	☹	😐	☺
know and use the relationship between refractive index, angle of incidence and angle of refraction: $n = \frac{\sin i}{\sin r}$	☹	😐	☺	☹	😐	☺
describe an experiment to determine the refractive index of glass, using a glass block	☹	😐	☺	☹	😐	☺

A lens forms an image by refracting light. In a convex lens, parallel rays of light are brought to a focus at the principal focus. The distance from the lens to the principal focus is called the focal length. Ray diagrams are used to show the formation of images by convex and concave lenses.	☹	😐	☺	☹	😐	☺
The image produced by a convex lens can be either real or virtual, the image formed by a concave lens is always virtual.	☹	😐	☺	☹	😐	☺
Students should be able to construct ray diagrams for both convex and concave lenses.	☹	😐	☺	☹	😐	☺
The magnification produced by a lens can be calculated using the equation: $$\text{Magnification} = \frac{\text{Image Height}}{\text{Object Height}}$$ Magnification is a ratio and so has no units. Image height and object height should both be measured in either mm or cm.	☹	😐	☺	☹	😐	☺
In ray diagrams a convex lens will be represented by:  A concave lens will be represented by: 	☹	😐	☺	☹	😐	☺
Required practical 5: investigate the reflection of light by different types of surface and the refraction of light by different substances.	☹	😐	☺	☹	😐	☺
describe the role of total internal reflection in transmitting information along optical fibres and in prisms	☹	😐	☺	☹	😐	☺
explain the meaning of critical angle c	☹	😐	☺	☹	😐	☺
know and use the relationship between critical angle and refractive index: $$\sin c = \frac{1}{n}$$	☹	😐	☺	☹	😐	☺
understand the difference between analogue and digital signals	☹	😐	☺	☹	😐	☺
describe the advantages of using digital signals rather than analogue signals	☹	😐	☺	☹	😐	☺
describe how digital signals can carry more information	☹	😐	☺	☹	😐	☺
understand that sound waves are longitudinal waves and how they can be reflected, refracted and diffracted	☹	😐	☺	☹	😐	☺
Sound waves can travel through solids causing vibrations in the solid.	☹	😐	☺	☹	😐	☺
Within the ear, sound waves cause the ear drum and other parts to vibrate which causes the sensation of sound. The conversion of sound waves to vibrations of solids works over a limited frequency range. This restricts the limits of human hearing.	☹	😐	☺	☹	😐	☺
Students should be able to: • describe, with examples, processes which convert wave disturbances between sound waves and vibrations in solids. Examples may include the effect of sound waves on the ear drum • explain why such processes only work over a limited frequency range and the relevance of this to human hearing. Students should know that the range of normal human hearing is from 20 Hz to 20 kHz.	☹	😐	☺	☹	😐	☺
understand that the frequency range for human hearing is 20 Hz – 20,000 Hz	☹	😐	☺	☹	😐	☺
describe an experiment to measure the speed of sound in air	☹	😐	☺	☹	😐	☺
understand how an oscilloscope and microphone can be used to display a sound wave	☹	😐	☺	☹	😐	☺
describe an experiment using an oscilloscope to determine the frequency of a sound wave	☹	😐	☺	☹	😐	☺
relate the pitch of a sound to the frequency of vibration of the source	☹	😐	☺	☹	😐	☺

relate the loudness of a sound to the amplitude of vibration.	☹	😐	☺	☹	😐	☺
Ultrasound waves have a frequency higher than the upper limit of hearing for humans.	☹	😐	☺	☹	😐	☺
Ultrasound waves are partially reflected when they meet a boundary between two different media. The time taken for the reflections to reach a detector can be used to determine how far away such a boundary is. This allows ultrasound waves to be used for both medical and industrial imaging.	☹	😐	☺	☹	😐	☺
Echo sounding, using high frequency sound waves is used to detect objects in deep water and measure water depth.	☹	😐	☺	☹	😐	☺

GCSE Kinematics -Topic List

	Start			End		
	☹	😐	☺	☹	😐	☺
To revise basics (e.g. speed), and introduce important new ideas e.g. vector quantities, velocity, acceleration and graphical analysis of distance/time and velocity/time graphs	☹	😐	☺	☹	😐	☺
Speed does not involve direction. Speed is a scalar quantity.	☹	😐	☺	☹	😐	☺
The speed of a moving object is rarely constant. When people walk, run or travel in a car their speed is constantly changing.	☹	😐	☺	☹	😐	☺
The speed that a person can walk, run or cycle depends on many factors including: age, terrain, fitness and distance travelled.	☹	😐	☺	☹	😐	☺
Students should be able to recall typical values of speed for a person walking, running and cycling as well as the typical values of speed for different types of transportation systems.	☹	😐	☺	☹	😐	☺
It is not only moving objects that have varying speed. The speed of sound and the speed of the wind also vary.	☹	😐	☺	☹	😐	☺
A typical value for the speed of sound in air is 330 m/s.	☹	😐	☺	☹	😐	☺
Students should be able to make measurements of distance and time and then calculate speed.	☹	😐	☺	☹	😐	☺
For an object moving at constant speed the distance travelled in a specific time can be calculated using the equation: distance travelled = speed × time $s = v\,t$ distance, s, in metres, m speed, v, in metres per second, m/s time, t, in seconds, s	☹	😐	☺	☹	😐	☺
Scalar quantities have magnitude only.	☹	😐	☺	☹	😐	☺
Vector quantities have magnitude and an associated direction.	☹	😐	☺	☹	😐	☺
Distance is how far an object moves. Distance does not involve direction. Distance is a scalar quantity.	☹	😐	☺	☹	😐	☺
Displacement includes both the distance an object moves, measured in a straight line from the start point to the finish point and the direction of that straight line. Displacement is a vector quantity.	☹	😐	☺	☹	😐	☺
Students should be able to express a displacement in terms of both the magnitude and direction.	☹	😐	☺	☹	😐	☺
The velocity of an object is its speed in a given direction. Velocity is a vector quantity.	☹	😐	☺	☹	😐	☺
Students should be able to give examples of objects that have a constant speed but at the same time a changing velocity.	☹	😐	☺	☹	😐	☺
When an object moves in a circle the direction of the object is continually changing. This means that an object moving in a circle at constant speed has a continually changing velocity.	☹	😐	☺	☹	😐	☺
If an object moves along a straight line, how far it is from a certain point can be represented by a distance–time graph.	☹	😐	☺	☹	😐	☺
The speed of an object can be calculated from the gradient of its distance–time graph.	☹	😐	☺	☹	😐	☺
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.	☹	😐	☺	☹	😐	☺

The average acceleration of an object can be calculated using the equation: acceleration = (change in velocity)/(time taken) $a = (\Delta v)/t$ acceleration, a, in metres per second squared, m/s^2 change in velocity, Δv, in metres per second, m/s time, t, in seconds, s	☹	😐	☺	☹	😐	☺
An object that slows down (decelerates) has a negative acceleration.	☹	😐	☺	☹	😐	☺
Students should be able to estimate the magnitude of everyday accelerations.	☹	😐	☺	☹	😐	☺
The acceleration of an object can be calculated from the gradient of a velocity–time graph.	☹	😐	☺	☹	😐	☺
The distance travelled by an object can be calculated from the area under a velocity–time graph.	☹	😐	☺	☹	😐	☺
• draw velocity–time graphs from measurements and extract and interpret lines, slopes and enclosed areas of velocity–time graphs, translating information between graphical and numerical form	☹	😐	☺	☹	😐	☺
• determine acceleration and distance travelled from a velocity–time graph						
The following equation applies to uniform acceleration: Final velocity^2 – Initial velocity^2 = 2 × acceleration × distance $v^2 - u^2 = 2as$ final velocity, v, in metres per second, m/s initial velocity, u, in metres per second, m/s acceleration, a, in metres per second squared, m/s^2 distance, s, in metres, m	☹	😐	☺	☹	😐	☺
Near the Earth's surface any object falling freely under gravity has an acceleration of about 9.8 m/s^2.	☹	😐	☺	☹	😐	☺
An object falling through a fluid initially accelerates due to the force of gravity. Eventually the resultant force will be zero and the object will move at its terminal velocity.	☹	😐	☺	☹	😐	☺
Students should be able to: • draw and interpret velocity–time graphs for objects that reach terminal velocity • interpret the changing motion in terms of the forces acting.	☹	😐	☺	☹	😐	☺

GCSE Dynamics -Topic List

	Start			End		
	☹	😐	☺	☹	😐	☺
Scalar quantities have magnitude only.	☹	😐	☺	☹	😐	☺
Vector quantities have magnitude and an associated direction.	☹	😐	☺	☹	😐	☺
A vector quantity may be represented by an arrow. The length of the arrow represents the magnitude, and the direction of the arrow the direction of the vector quantity	☹	😐	☺	☹	😐	☺
A force is a push or pull that acts on an object due to the interaction with another object. All forces between objects are either:	☹	😐	☺	☹	😐	☺
• contact forces – the objects are physically touching	☹	😐	☺	☹	😐	☺
• non-contact forces – the objects are physically separated.	☹	😐	☺	☹	😐	☺
Examples of contact forces include friction, air resistance, tension and normal contact force.	☹	😐	☺	☹	😐	☺
Examples of non-contact forces are gravitational force, electrostatic force and magnetic force.	☹	😐	☺	☹	😐	☺
Force is a vector quantity.	☹	😐	☺	☹	😐	☺
Students should be able to describe the interaction between pairs of objects which produce a force on each object. The forces to be represented as vectors.	☹	😐	☺	☹	😐	☺
A number of forces acting on an object may be replaced by a single force that has the same effect as all the original forces acting together. This single force is call the resultant force.	☹	😐	☺	☹	😐	☺
Students should be able to calculate the resultant of two forces that act in a straight line.	☹	😐	☺	☹	😐	☺
Describe examples of the forces acting on an isolated object or system	☹	😐	☺	☹	😐	☺
Newton’s First Law: If the resultant force acting on an object is zero and:	☹	😐	☺	☹	😐	☺
• the object is stationary, the object remains stationary	☹	😐	☺	☹	😐	☺
• the object is moving, the object continues to move at the same speed and in the same direction. So the object continues to move at the same velocity.	☹	😐	☺	☹	😐	☺
So, when a vehicle travels at a steady speed the resistive forces balance the driving force.	☹	😐	☺	☹	😐	☺
So, the velocity (speed and/or direction) of an object will only change if a resultant force is acting on the object.	☹	😐	☺	☹	😐	☺
Students should be able to 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.	☹	😐	☺	☹	😐	☺
The tendency of objects to continue in their state of rest of uniform motion is called inertia	☹	😐	☺	☹	😐	☺
Newton’s Third Law: Whenever two objects interact, the forces they exert on each other are equal and opposite.	☹	😐	☺	☹	😐	☺
Students should be able to apply Newton’s Third Law to examples of equilibrium situations.	☹	😐	☺	☹	😐	☺
Newton’s Second Law: The acceleration of an object is proportional to the resultant force acting on the object, and inversely proportional to the mass of the object.	☹	😐	☺	☹	😐	☺

As an equation: resultant force = mass × acceleration F = m a resultant force, F, in newtons, N mass, m, in kilograms, kg acceleration, a, in metres per second^2, m/s^2	☹	😐	☺	☹	😐	☺
Students should be able to explain that:	☹	😐	☺	☹	😐	☺
• inertial mass is a measure of how difficult it is to change the velocity of an object	☹	😐	☺	☹	😐	☺
• inertial mass is defined as the ratio of force over acceleration.	☹	😐	☺	☹	😐	☺
Students should be able to estimate the speed, accelerations and forces involved in large accelerations for everyday road transport.	☹	😐	☺	☹	😐	☺
Students should recognise and be able to use the symbol that indicates an approximate value or approximate answer,~	☹	😐	☺	☹	😐	☺
AQA Required practical activity 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 produced by a constant force.	☹	😐	☺	☹	😐	☺
Weight is the force acting on an object due to gravity. The force of gravity close to the Earth is due to the gravitational field around the Earth.	☹	😐	☺	☹	😐	☺
The weight of an object depends on the gravitational field strength at the point where the object is.	☹	😐	☺	☹	😐	☺
The weight of an object can be calculated using the equation: weight = mass × gravitational field strength W = m g weight, W, in newtons, N mass, m, in kilograms, kg gravitational field strength, g, in newtons per kilogram, N/kg (In any calculation the value of the gravitational field strength (g) will be given.)	☹	😐	☺	☹	😐	☺
The weight of an object may be considered to act at a single point referred to as the objects 'centre of mass'.	☹	😐	☺	☹	😐	☺
The weight of an object and the mass of an object are directly proportional.	☹	😐	☺	☹	😐	☺
Weight is measured using a calibrated spring-balance (a newtonmeter).	☹	😐	☺	☹	😐	☺
An object falling through a fluid initially accelerates due to the force of gravity. Eventually the resultant force will be zero and the object will move at its terminal velocity.	☹	😐	☺	☹	😐	☺
Students should be able to:	☹	😐	☺	☹	😐	☺
draw and interpret velocity–time graphs for objects that reach terminal velocity	☹	😐	☺	☹	😐	☺
interpret the changing motion in terms of the forces acting.	☹	😐	☺	☹	😐	☺
The stopping distance of a vehicle is the sum of the distance the vehicle travels during the driver's reaction time (thinking distance) and the distance it travels under the braking force (braking distance). For a given braking force the greater the speed of the vehicle, the greater the stopping distance.	☹	😐	☺	☹	😐	☺
Students should be able to estimate how the distance for a vehicle to make an emergency stop varies over a range of speeds typical for that vehicle.	☹	😐	☺	☹	😐	☺

Students will be required to interpret graphs relating speed to stopping distance for a range of vehicles.	☹	😐	☺	☹	😐	☺
Reaction times vary from person to person. Typical values range from 0.2 s to 0.9 s.	☹	😐	☺	☹	😐	☺
A driver's reaction time can be affected by tiredness, drugs and alcohol. Distractions may also affect a driver's ability to react.	☹	😐	☺	☹	😐	☺
Students should be able to:	☹	😐	☺	☹	😐	☺
• 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.	☹	😐	☺	☹	😐	☺
The braking distance of a vehicle can be affected by adverse road and weather conditions and poor condition of the vehicle.	☹	😐	☺	☹	😐	☺
Adverse road conditions include wet or icy conditions. Poor condition of the vehicle is limited to the vehicle's brakes or tyres.	☹	😐	☺	☹	😐	☺
Students should be able to:	☹	😐	☺	☹	😐	☺
• explain the factors which affect the distance required for road transport vehicles to come to rest in emergencies, and the implications for safety	☹	😐	☺	☹	😐	☺
• estimate how the distance required for road vehicles to stop in an emergency varies over a range of typical speeds.	☹	😐	☺	☹	😐	☺
When a force is applied to the brakes of a vehicle, work done by the friction force between the brakes and the wheel reduces the kinetic energy of the vehicle and the temperature of the brakes increases.	☹	😐	☺	☹	😐	☺
The greater the speed of a vehicle the greater the braking force needed to stop the vehicle in a certain distance.	☹	😐	☺	☹	😐	☺
The greater the braking force the greater the deceleration of the vehicle. Large decelerations may lead to brakes overheating and/or loss of control.	☹	😐	☺	☹	😐	☺
Students should be able to:	☹	😐	☺	☹	😐	☺
• explain the dangers caused by large decelerations	☹	😐	☺	☹	😐	☺
• estimate the forces involved in the deceleration of road vehicles in typical situations on a public road.	☹	😐	☺	☹	😐	☺

GCSE Forces in Action – Topic List

	Start			End		
	☹	😐	☺	☹	😐	☺
Momentum is defined by the equation: momentum = mass × velocity p = m v momentum, p, in kilograms metre per second, kg m/s mass, m, in kilograms, kg velocity, v, in metres per second, m/s	☹	😐	☺	☹	😐	☺
In a closed system, the total momentum before an event is equal to the total momentum after the event. This is called conservation of momentum.	☹	😐	☺	☹	😐	☺
Students should be able to use the concept of momentum as a model to: · describe and explain examples of momentum in an event, such as a collision · complete calculations involving an event, such as the collision of two objects.	☹	😐	☺	☹	😐	☺
When a force acts on an object that is moving, or able to move, a change in momentum occurs.	☹	😐	☺	☹	😐	☺
The equations F= m x a and $a = \frac{v-u}{t}$ combine to give the equation $F = \frac{m\Delta v}{t}$ where m Δ v = change in momentum ie force equals the rate of change of momentum.	☹	😐	☺	☹	😐	☺
Students should be able to 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.	☹	😐	☺	☹	😐	☺
Students should be able to apply equations relating force, mass, velocity and acceleration to explain how the changes involved are inter-related.	☹	😐	☺	☹	😐	☺
Newton's Third Law: Whenever two objects interact, the forces they exert on each other are equal and opposite.	☹	😐	☺	☹	😐	☺
Students should be able to apply Newton's Third Law to examples of equilibrium situations.	☹	😐	☺	☹	😐	☺
A number of forces acting on an object may be replaced by a single force that has the same effect as all the original forces acting together. This single force is called the resultant force.	☹	😐	☺	☹	😐	☺
Students should be able to calculate the resultant of two forces that act in a straight line.	☹	😐	☺	☹	😐	☺
Students should be able to: · describe examples of the forces acting on an isolated object or system	☹	😐	☺	☹	😐	☺
Students should be able to: · 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.	☹	😐	☺	☹	😐	☺

A single force can be resolved into two components acting at right angles to each other. The two component forces together have the same effect as the single force.	☹	😐	☺	☹	😐	☺
Students should be able to use vector diagrams to illustrate resolution of forces, equilibrium situations and determine the resultant of two forces, to include both magnitude and direction (scale drawings only).	☹	😐	☺	☹	😐	☺

GCSE Static Electricity - Topic List

	Start			End		
	☹	😐	☺	☹	😐	☺
When certain insulating materials are rubbed against each other they become electrically charged. Negatively charged electrons are rubbed off one material and on to the other. The material that gains electrons becomes negatively charged. The material that loses electrons is left with an equal positive charge.	☹	😐	☺	☹	😐	☺
When two electrically charged objects are brought close together they exert a force on each other. Two objects that carry the same type of charge repel. Two objects that carry different types of charge attract. Attraction and repulsion between two charged objects are examples of non-contact force.	☹	😐	☺	☹	😐	☺
Students should be able to: • describe the production of static electricity, and sparking (covered later), by rubbing surfaces	☹	😐	☺	☹	😐	☺
• describe evidence that charged objects exert forces of attraction or repulsion on one another when not in contact	☹	😐	☺	☹	😐	☺
• explain how the transfer of electrons between objects can explain the phenomena of static electricity.	☹	😐	☺	☹	😐	☺
The greater the charge on an isolated object the greater the potential difference between the object and earth. If the potential difference becomes high enough a spark may jump across the gap between the object and any earthed conductor which is brought near it.	☹	😐	☺	☹	😐	☺
A charged object creates an electric field around itself. The electric field is strongest close to the charged object. The further away from the charged object, the weaker the field. A second charged object placed in the field experiences a force. The force gets stronger as the distance between the objects decreases.	☹	😐	☺	☹	😐	☺
Students should be able to: • draw the electric field pattern for an isolated charged sphere	☹	😐	☺	☹	😐	☺
• explain the concept of an electric field	☹	😐	☺	☹	😐	☺
• explain how the concept of an electric field helps to explain the non-contact force between charged objects as well as other electrostatic phenomena such as sparking.	☹	😐	☺	☹	😐	☺

GCSE Current Electricity -Topic List

	Start			End		
	☹	😐	☺	☹	😐	☺
Circuit diagrams use standard symbols.	☹	😐	☺	☹	😐	☺
Students should be able to draw and interpret circuit diagrams.	☹	😐	☺	☹	😐	☺
For electrical charge to flow through a closed circuit the circuit must include a source of potential difference	☹	😐	☺	☹	😐	☺
Electric current is a flow of electrical charge. The size of the electric current is the rate of flow of electrical charge. Charge flow, current and time are linked by the equation: charge = current x time Q = I x t charge, Q, in coulombs, C current, I, in amps, A time, t, in seconds, s	☹	😐	☺	☹	😐	☺
The current at any point in a single closed loop of a circuit has the same value as the current at any other point in the same closed loop. (ONLY TRUE FOR A SERIES CIRCUIT LOOP, NOT FOR LOOPS IN A PARALLEL CIRCUIT)	☹	😐	☺	☹	😐	☺
Energy transferred can be calculated using the equation: energy transferred = charge flow × potential difference E=Q x V energy transferred, E, in Joules, J charge, Q in coulombs, C potential difference, V in volts, V	☹	😐	☺	☹	😐	☺
The current through a component depends on both the resistance of the component and the potential difference across the component. The greater the resistance of the component the smaller the current for a given potential difference (p.d.) across the component.	☹	😐	☺	☹	😐	☺
Questions will be set using the term potential difference. Students will gain credit for the correct use of either potential difference or voltage.	☹	😐	☺	☹	😐	☺
Current, potential difference or resistance can be calculated using the equation: potential difference = current x resistance V = I x R potential difference, V in volts, V current, I, in amps, A resistance, R, in ohms, Ω	☹	😐	☺	☹	😐	☺
The current through an ohmic conductor (at a constant temperature) is directly proportional to the potential difference across the resistor. This means that the resistance remains constant as the current changes.	☹	😐	☺	☹	😐	☺

The resistance of components such as lamps, diodes, thermistors and LDRs is not constant; it changes with the current through the component. The resistance of a filament lamp increases as the temperature of the filament increases.	☹	😐	☺	☹	😐	☺
The current through a diode flows in one direction only. The diode has a very high resistance in the reverse direction.	☹	😐	☺	☹	😐	☺
The resistance of a thermistor decreases as the temperature increases.	☹	😐	☺	☹	😐	☺
The applications of thermistors in circuits eg a thermostat is required.	☹	😐	☺	☹	😐	☺
The resistance of an LDR decreases as light intensity increases.	☹	😐	☺	☹	😐	☺
The application of LDRs in circuits eg switching lights on when it gets dark is required.	☹	😐	☺	☹	😐	☺
Students should be able to: • explain the design and use of a circuit to measure the resistance of a component by measuring the current through, and potential difference across, the component • draw an appropriate circuit diagram using correct circuit symbols.	☹	😐	☺	☹	😐	☺
Students should be able to use graphs to explore whether circuit elements are linear or non-linear and relate the curves produced to their function and properties	☹	😐	☺	☹	😐	☺
Required practical 4: investigate, using circuit diagrams to construct circuits, the V–I characteristics of a filament lamp, a diode and a resistor at constant temperature.	☹	😐	☺	☹	😐	☺
There are two ways of joining electrical components, in series and in parallel. Some circuits include both series and parallel parts.	☹	😐	☺	☹	😐	☺
For components connected in series: • there is the same current through each component	☹	😐	☺	☹	😐	☺
• the total potential difference of the power supply is shared between the components						
• the total resistance of two components is the sum of the resistance of each component.	☹	😐	☺	☹	😐	☺
For components connected in parallel: • the potential difference across each component is the same	☹	😐	☺	☹	😐	☺
• the total current through the whole circuit is the sum of the currents through the separate components						
• the total resistance of two resistors is less than the resistance of the smallest individual resistor.						
Students should be able to: • use circuit diagrams to construct and check series and parallel circuits that include a variety of common circuit components	☹	😐	☺	☹	😐	☺
• describe the difference between series and parallel circuits	☹	😐	☺	☹	😐	☺
• explain qualitatively why adding resistors in series increases the total resistance whilst adding resistors in parallel decreases the total resistance	☹	😐	☺	☹	😐	☺
• explain the design and use of dc series circuits for measurement and testing purposes	☹	😐	☺	☹	😐	☺
• calculate the currents, potential differences and resistances in dc series circuits	☹	😐	☺	☹	😐	☺
solve problems for circuits which include resistors in series using the concept of equivalent resistance.	☹	😐	☺	☹	😐	☺

AQA Required practical activity 3: investigate, using circuit diagrams to set up a circuit, the factor(s) that affect the resistance of an electrical component, this should include the length of a wire at constant temperature, combinations of resistors in series and parallel	☹	😐	☺	☹	😐	☺

GCSE Mains Electricity – Topic List

	Start			End		
Cells and batteries supply current that always passes in the same direction. This is called direct current (d.c.). An alternating current (a.c.) is one that changes direction. Mains electricity is an a.c. supply. In the United Kingdom it has a frequency of 50 Hz and is about 230 V. Students should be able to explain the difference between direct and alternating voltage.	☹	😐	☺	☹	😐	☺
Most electrical appliances are connected to the mains using three-core cable. The insulation covering each wire is colour coded for easy identification: live wire – brown, neutral wire – blue, earth wire – green and yellow stripes.	☹	😐	☺	☹	😐	☺
The live wire carries the alternating potential difference from the supply. The neutral wire completes the circuit. The earth wire is a safety wire to stop the appliance becoming live. The potential difference between the live wire and earth (0 V) is about 230 V. The neutral wire is at, or close to, earth potential (0 V). The earth wire is at 0 V, it only carries a current if there is a fault.	☹	😐	☺	☹	😐	☺
Our bodies are at earth potential (0 V). Touching the live wire produces a large potential difference across our body. This causes a current to flow through our body, resulting in an electric shock.	☹	😐	☺	☹	😐	☺
Students should be able to explain: • that a live wire may be dangerous even when a switch in the mains circuit is open	☹	😐	☺	☹	😐	☺
• the dangers of providing any connection between the live wire and earth	☹	😐	☺	☹	😐	☺
If an electrical fault causes too great a current, the circuit is disconnected by a fuse or a circuit breaker in the live wire. The current will cause the fuse to overheat and melt or the circuit breaker to switch off ('trip'). A circuit breaker operates much faster than a fuse and can be reset.	☹	😐	☺	☹	😐	☺
Appliances with metal cases are usually earthed. If a fault occurs a large current flows from the live wire to earth. This melts the fuse and disconnects the live wire. Some appliances are double insulated, and therefore have no earth connection	☹	😐	☺	☹	😐	☺
Students should be able to explain how the power transfer in any circuit device is related to the potential difference across it and the current through it, and to the energy changes over time: power = potential difference x current $P=VI$ Or power = $(\text{current})^2$ x resistance $P=I^2R$ power, P in watts, W potential difference, V in volts, V current, I, in amps, A resistance, R, in ohms, Ω	☹	😐	☺	☹	😐	☺
Everyday electrical appliances are designed to bring about energy transfers	☹	😐	☺	☹	😐	☺
The amount of energy an appliance transfers depends on how long the appliance is switched on for and the power of the appliance.	☹	😐	☺	☹	😐	☺

Students should be able to describe how different domestic appliances transfer energy from batteries or a.c. mains to the kinetic energy of electric motors or the energy of heating devices.	☹	😐	☺	☹	😐	☺
Work is done when charge flows in a circuit.	☹	😐	☺	☹	😐	☺
The amount of energy transferred by electrical work can be calculated using the equation: energy transferred = power × time $E = P\,t$ energy transferred, E, in joules, J power, P, in watts, W time, t, in seconds, s Students must be able to recall and use this equation. (This can also be used in conjunction with the equation E=QV which was covered in the current electricity module)	☹	😐	☺	☹	😐	☺
Students should be able to explain how the power of a circuit device is related to: • the p.d. across it and the current through it	☹	😐	☺	☹	😐	☺
• the energy transferred over a given time.	☹	😐	☺	☹	😐	☺
Students should be able to describe, with examples, the relationship between the power ratings for domestic electrical appliances and the changes in stored energy when they are in use.	☹	😐	☺	☹	😐	☺
The National Grid is a system of cables and transformers linking power stations to consumers.	☹	😐	☺	☹	😐	☺
Step-up transformers are used to increase the potential difference from the power station to the transmission cables then step-down transformers are used to decrease, to a much lower value, the potential difference for domestic use.	☹	😐	☺	☹	😐	☺
This is done because, for a given power, increasing the potential difference reduces the current, and hence reduces the energy losses due to heating in the transmission cables.	☹	😐	☺	☹	😐	☺
Students should be able to explain why the National Grid system is an efficient way to transfer energy.	☹	😐	☺	☹	😐	☺

GCSE National and Global Energy Resources - Topic List

	Start			End		
	☹	😐	☺	☹	😐	☺
The main energy resources available for use on Earth include: fossil fuels (coal, oil and gas), nuclear fuel, biofuel, wind, hydro-electricity, geothermal, the tides, the Sun and water waves.	☹	😐	☺	☹	😐	☺
A renewable energy resource is one that is being (or can be) replenished as it is used.	☹	😐	☺	☹	😐	☺
The uses of energy resources include: transport, electricity generation and heating.	☹	😐	☺	☹	😐	☺
Students should be able to:	☹	😐	☺	☹	😐	☺
• describe the main energy sources available	☹	😐	☺	☹	😐	☺
• distinguish between energy resources that are renewable and energy resources that are non-renewable	☹	😐	☺	☹	😐	☺
• compare ways that different energy resources are used, the uses to include transport, electricity generation and heating	☹	😐	☺	☹	😐	☺
• understand why some energy resources are more reliable than others	☹	😐	☺	☹	😐	☺
• describe the environmental impact arising from the use of different energy resources	☹	😐	☺	☹	😐	☺
• explain patterns and trends in the use of energy resources	☹	😐	☺	☹	😐	☺
Descriptions of how energy resources are used to generate electricity are *not* required.	☹	😐	☺	☹	😐	☺
Students should be able to:	☹	😐	☺	☹	😐	☺
• consider the environmental issues that may arise from the use of different energy resources	☹	😐	☺	☹	😐	☺
• show that science has the ability to identify environmental issues arising from the use of energy resources but not always the power to deal with the issues because of political, social, ethical or economic considerations.	☹	😐	☺	☹	😐	☺

GCSE Work Energy and Power – Topic List

	Start			End		
	☹	😐	☺	☹	😐	☺
A system is an object or group of objects.	☹	😐	☺	☹	😐	☺
There are changes in the way energy is stored when a system changes. Students should be able to describe all the changes involved in the way energy is stored when a system changes, for common situations. For example: • an object projected upwards • a moving object hitting an obstacle • an object accelerated by a constant force • a vehicle slowing down • bringing water to a boil in an electric kettle.	☹	😐	☺	☹	😐	☺
Throughout this section on Energy students should be able to calculate the changes in energy involved when a system is changed by: • heating • work done by forces • work done when a current flows • use calculations to show on a common scale how the overall energy in a system is redistributed when the system is changed.	☹	😐	☺	☹	😐	☺
When a force causes an object to move through a distance work is done on the object. So a force does work on an object when the force causes a displacement of the object.	☹	😐	☺	☹	😐	☺
When a force causes an object to move through a distance work is done on the object. So a force does work on an object when the force causes a displacement of the object.	☹	😐	☺	☹	😐	☺
The work done by a force on an object can be calculated using the equation: work done = force × distance moved along the line of action of the force $W = F s$ work done, W, in joules, J force, F, in newtons, N distance, s, in metres, m One joule of work is done when a force of one newton causes a displacement of one metre. 1 joule = 1 newton-metre	☹	😐	☺	☹	😐	☺
Students should be able to describe the energy transfer involved when work is done.	☹	😐	☺	☹	😐	☺
Students should be able to convert between newton-metres and joules.	☹	😐	☺	☹	😐	☺
Work done against the frictional forces acting on an object causes a rise in the temperature of the object.	☹	😐	☺	☹	😐	☺

Students should be able to calculate the amount of energy associated with a moving object, a stretched spring and an object raised above ground level.	☹	😐	☺	☹	😐	☺
The kinetic energy of a moving object can be calculated using the equation: kinetic energy= 0.5× mass × speed^2 $E_k = ½ m v^2$ kinetic energy, E_k, in joules, J mass, m, in kilograms, kg speed, v, in metres per second, m/s	☹	😐	☺	☹	😐	☺
Explain that when a car brakes, work is done by friction between the brakes and the wheel, which leads to a transfer of KE to thermal energy in the brakes. Apply the equations for work (W = F s) and KE ($Ek = ½ m v^2$) to situations where road vehicles are braking in order to determine the forces acting.						
The amount of gravitational potential energy gained by an object raised above ground level can be calculated using the equation: g.p.e. = mass × gravitational field strength × height $E_p = m g h$ gravitational potential energy, E_p, in joules, J mass, m, in kilograms, kg gravitational field strength, g, in newtons per kilogram, N/kg (In any calculation the value of the gravitational field strength (g) will be given.) height, h, in metres, m	☹	😐	☺	☹	😐	☺
Students should be able to: • give 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.	☹	😐	☺	☹	😐	☺
The extension of an elastic object, such as a spring, is directly proportional to the force applied, provided that the limit of proportionality is not exceeded.	☹	😐	☺	☹	😐	☺
force = spring constant × extension $F = k e$ force, F, in newtons, N spring constant, k, in newtons per metre, N/m extension, e, in metres, m This relationship also applies to the compression of an elastic object, where 'e' would be the compression of the object.	☹	😐	☺	☹	😐	☺

A force that stretches (or compresses) a spring does work and elastic potential energy is stored in the spring. Provided the spring is not inelastically deformed, the work done on the spring and the elastic potential energy stored are equal.	☹	😐	☺	☹	😐	☺
The amount of elastic potential energy stored in a stretched spring can be calculated using the equation: elastic potential energy= 0.5 × spring constant × extension^2 $E_e = ½ k e^2$ (assuming the limit of proportionality has not been exceeded) elastic potential energy, E_e, in joules, J spring constant, k, in newtons per metre, N/m extension, e, in metres, m	☹	😐	☺	☹	😐	☺
Students should be able to: • describe the difference between a linear and non-linear relationship between force and extension • calculate a spring constant in linear cases • interpret data from an investigation of the relationship between force and extension • calculate work done in stretching (or compressing) a spring (up to the limit of proportionality) using the equation for elastic potential energy	☹	😐	☺	☹	😐	☺
Power is defined as the rate at which energy is transferred or the rate at which work is done. power = energy transferred/time $P = E/ t$ power= work done / time $P = W /t$ power, P, in watts, W energy transferred, E, in joules, J time, t, in seconds, s work done, W, in joules, J An energy transfer of 1 joule per second is equal to a power of 1 watt.	☹	😐	☺	☹	😐	☺
Students should be able to give examples that illustrate the definition of power eg comparing two electric motors that both lift the same weight through the same height but one does it faster than the other.	☹	😐	☺	☹	😐	☺