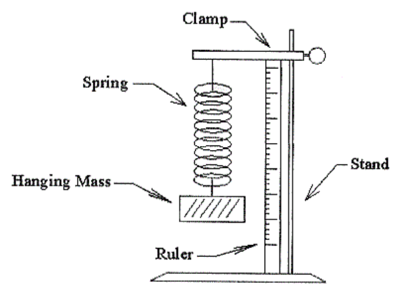
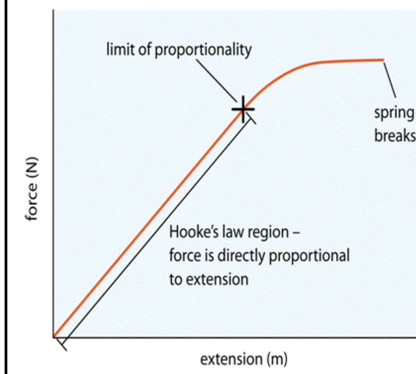
GCSE Physics Required Practicals Paper Two

Outline	Glossary and equations	Summary of method and context	Exam question example	Visual aid
6. Force and extension *An investigation into determine whether a material will obey Hooke's Law* *Video:* [Hooke's Law - REQUIRED PRACTICAL (GCSE Physics Paper 2)]()	**Hooke's Law** - an object will obey Hooke's law if the force applied is directly proportional to the extension, the object will no longer obey Hooke's law once it has passed the limit of proportionality **Directly proportional** - if one variable will change, the other one will change by the same amount each time **Elastic** - the process in which an object is stretched and returns to its original length **Inelastic** - the process in which an object is stretched and no longer returns to its original length, it will be permanently deformed **Limit of proportionality** - the point beyond which the extension of an elastic object is no longer proportional to the force applied, beyond this point the object will no longer obey Hooke's law **Spring constant** - the relationship between force and extension of a spring (represented by the letter k) Force (N) = Spring constant (N/m) x extension (m) Weight (N) = mass (kg) x gravity (N/kg)	1. Attach a spring to a clamp stand 2. Set up a second clamp stand with a meter ruler attached next to the original stand This prevents a possible source of inaccuracy of not measuring the extension correctly due to the ruler not being in the right place, another source of inaccuracy here could be a parallax error (misreading the value due to the angle that you are looking at it from) 3. Measure the original length of the spring and record this 4. Add a 100 g mass to the spring and measure the stretched length of the spring 5. Calculate the extension of the spring by finding the difference between the stretched and original lengths A lot of people will only plot stretched length and not extension, if your graph does not start at 0, you have made this error 6. Repeat this process, increasing the mass by 100 g each time until you reach 800 g or the spring deforms. 7. Calculate the weights of the masses using the equation weight = mass x gravity 8. Plot a graph of weight (force) vs extension It is possible for the axis of the graph to be the other way around, if the extension is on the Y axis and the force on the X axis, the area underneath the graph will be equal to the energy stored in the spring (elastic potential energy) This could also be put in terms of compression as well as extension, an example of this would be the compression of suspension springs in a car	A students carried out an investigation to determine the spring constant of a spring. Describe a method that the student could have used. Your answer should include any cause of inaccuracy in the data and may include a labelled diagram.	 

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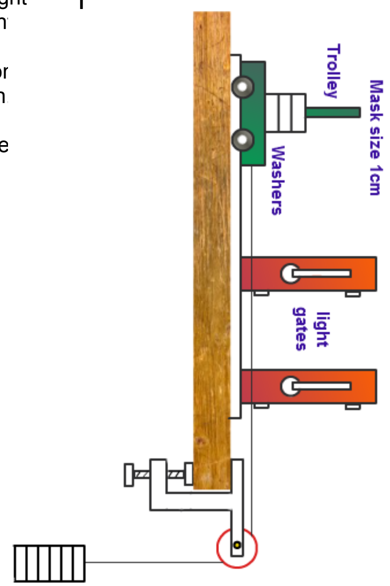
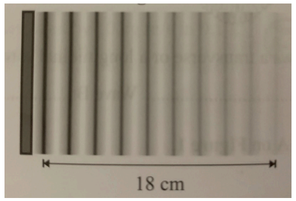
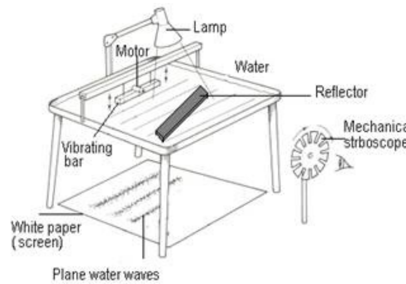
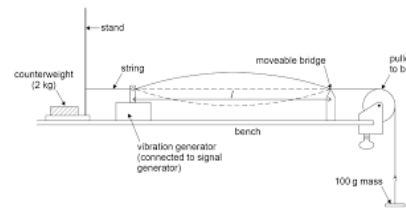
7. Acceleration *An investigation into the relationship between force, mass and acceleration* *Video:* [GCSE Physics Revision "Required Practical 7: Acceleration"]	**Uniform acceleration** - when an object's velocity is increasing at a constant rate **Newton's second law** - the force of an object is equal to the mass of the object multiplied by its acceleration **Light gates** - a set of sensors which detect when an object will pass through, calculating the velocities and or acceleration Force (N) = mass (kg) x acceleration (m/s^2) Acceleration (m/s^2) = change in velocity (m/s) / time (s) Final velocity^2 (m/s) - initial velocity^2 (m/s) = 2 x acceleration (m/s^2) x displacement (m)	1. Attach a piece of string to the trolley and to the weights which will hang over the side of the bench via the pulley 2. Hold the trolley still and make sure that it is lined up with the light gates 3. Let go of the trolley so that it accelerates towards the end of the bench Bear in mind health and safety at this point so that the masses do not fall on the feet of a person 4. Use the readings from the light gate and the data logger in order to calculate the acceleration of the trolley (acceleration = change in velocity / time) A technique with either ticker tape or chalk on a bench can be used, but data loggers improves the accuracy of the investigation as it removes an aspect of human error 5. Repeat with different masses hanging over the side of the bench Alternatively this investigation can be carried out by keeping the hanging masses the same and altering the masses on the trolley	A student investigates how the mass of a trolley affects its motion down a fixed ramp. The accelerating force on the trolley is the component of the trolley's weight that acts along the ramp. The studen masses to the trolley and each time measures its final speed at the bottor the ramp to calculate its acceleration Explain why this experiment will not correctly show the relationship betwe mass and acceleration of the trolley.	
8. Waves *Investigating the behaviour of waves* *Video:* [Waves - REQUIRED PRACTICAL (GCSE Physics Paper 2)]	**Wavelength** - the distance between two consecutive points on a wave **Frequency** - the number of waves passing a fixed point per second **Period** - the time taken for one wave to be produced, or for one wave to pass a fixed point Speed of light (m/s) = wavelength (m) x frequency (Hz) Wave period (s) = 1 / frequency (Hz)	**Method 1 - Ripple tank** 1. Fill the tray of the ripple tank with around 1 cm of water 2. Shine the lamp into the tray 3. Turn on the power and adjust the speed until you can see a clear separation between two waves 4. Measure the distance between the first and the last wave on the screen, divide this by the number of waves to calculate the wavelength 5. Count how many waves pass a point in ten seconds, divide this number by 10 to find the frequency 6. Substitute the values into wave speed = wavelength x frequency **Method 2 - Standing waves** 1. Measure the length of the string between the oscillator and the pulley 2. Turn on the signal generator and adjust this until you see one complete wave, note down this frequency The wavelength will be two times the length of the string between nodes	The signal generator on a ripple tank is set to 12 Hz. A student measures the distance between the first and last visible wave and this is 18 cm.  (a) The student finds it hard to measure the distance between the ripples because they are moving, suggest and explain what the student could do to make the measurement easier.	

		3. Repeat until you can see two, three and four waves on the string 4. Substitute the values into wave speed = wavelength x frequency	(b) Calculate the speed of the ripples in the water (c) Describe a method to measure the speed of waves on a string	

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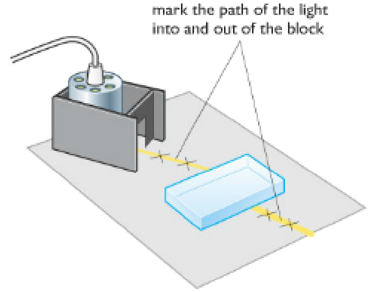
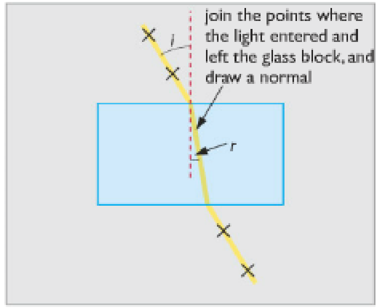
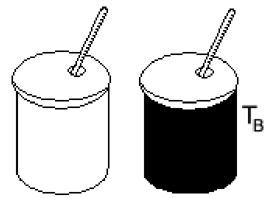
9. Light *An investigation into refraction and reflection of light* *Video:* [REFRACTION - Science GCSE Physics Required Practical]	**Reflection** - process in which a surface does not absorb any energy, instead it bounces it back towards the source **Refraction** - the change of direction of a wave when it hits a boundary between two different media at an angle (not perpendicular), when an object enters a more dense material it will bend towards the normal, when it enters a less dense material it will bend away from the normal **Normal** - the line at a right angle to a boundary, it is used to draw ray diagrams **Law of reflection** - states that the angle of incidence is equal to the angle of reflection	1. Place a glass block onto a piece of paper and draw around this 2. Draw a normal at 90° to the side of the glass block and measure the angle of incidence you are testing using a protractor This is better to be done on the long side of the glass block, for the normal use a dashed line that does across the boundary of the glass 3. Use a thin slit to shine a ray of light into the glass block at your plotted angle A thin ray of light is needed as this could be an inaccuracy, if this were to be thick, it would mean that the angle would not be measured accurately as you would not know for sure the centre of the ray 4. Mark where the ray of light leaves the glass block, remove the glass block and join the lines together 5. Measure the angle of incidence and the angle of refraction The angle of incidence is what you plotted, between the normal and the ray entering, the angle of refraction is the angle between the normal and the ray on the inside of the block 6. Repeat for a range of angles	The data given in the table below was obtained from an investigation into the refraction of light at an air to glass boundary. Describe an investigation a student could complete in order to obtain similar data to that given in the table above. Your answer should consider any cause of inaccuracy in the data. **Angle of incidence** / **Angle of refraction**: 20° / 13° 30° / 19° 40° / 25° 50° / 30°	
10. Radiation and absorption *Investigating the amount of infrared radiation emitted from objects of different materials* *Video:* [GCSE Physics Revision "Required Practical 10: Infrared"]	**Infrared radiation** - a type of electromagnetic wave which falls between visible lights and microwaves, the greater the temperature, the greater the amount of infrared radiation **Absorption** - the process in which matter takes in energy **Emission** - process in which energy is given out by matter **Perfect black body** - an object which would absorb all the radiation that falls on	1. Pour 200 ml of water from a kettle into a black can and into a silver can 2. Place lids on the can with a space for a thermometer A data logger may also be used, this may have a higher resolution (increment in which it increases is smaller), not need the lid to be taken off, remove human error and also may automatically plot the graph The lids will help prevent dissipation of energy to the surroundings 3. Measure the temperature of the cans every minute for 15 minutes Temperature change may be plotted	A student uses a Leslie's cube to investigate how different materials radiate energy, A Leslie's cube is a hollow cube whose faces are made of different materials. The student fills the cube with hot water and places his hand near to each surface. The four sides of the cube are matte black, shiny black, matte white and shiny white. (a) Predict which side the student's hand would feel the warmest in front of (b) predict which side the student's hand would feel coolest in front of (c) Suggest one way to improve the	

	it, it would not reflect or transmit any radiation	instead to enable a fair comparison as not all cans may start at the same temperature A variation on this experiment is investigate absorption rather than emission, this would mean a heater being placed an equal distance between the two cans of water at room temperature, this will result in a temperature rise instead of fall	student's experiment