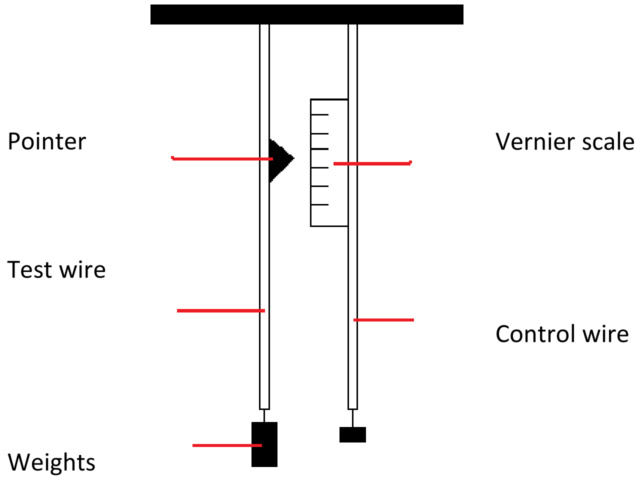
Young's modulus:

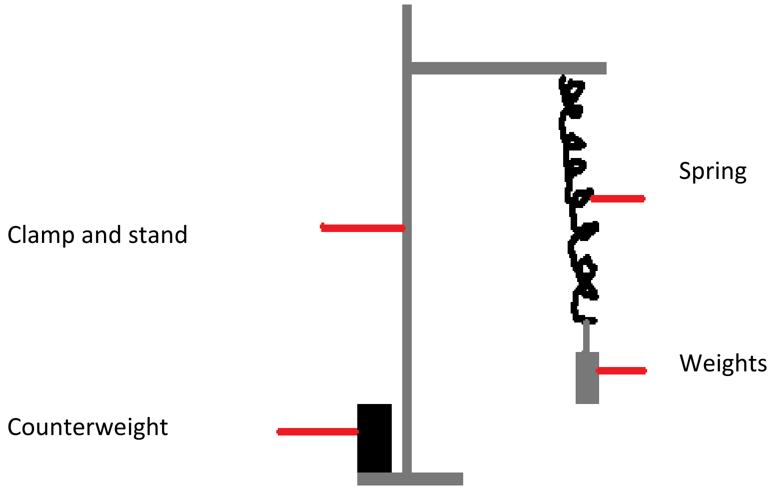
- Set up Searle's apparatus as below:



- Using a metre rule, measure the initial length of the wire.
- Using a micrometer, measure the diameter of the wire in 5 positions along its length. Calculate the mean diameter then use $0.25\pi d^2$ to calculate the cross sectional area of the wire.
- Then apply a mass of 200g to the end of the test wire.
- Calculate the tension, T using T=W=mg, so the 200g weight gives T=2.0N
- For the applied weight, find the new length of the wire by reading off the vernier scale, which gives the change in wire length (extension = final length-initial length). The mirror alignment method can be used to reduce parallax error.
- Carry out this procedure for masses up to 2kg.
- Repeat for each mass by unloading, tabulating the tension and extension for each weight, and calculate a mean extension for each weight.
- Calculate stress from tension/cross sectional area, and strain from extension/original length, for each applied mass.
- Then plot a graph of stress (y axis) against strain (x axis).
- Young's modulus can be found from the gradient of the straight line region.

Hooke's law:

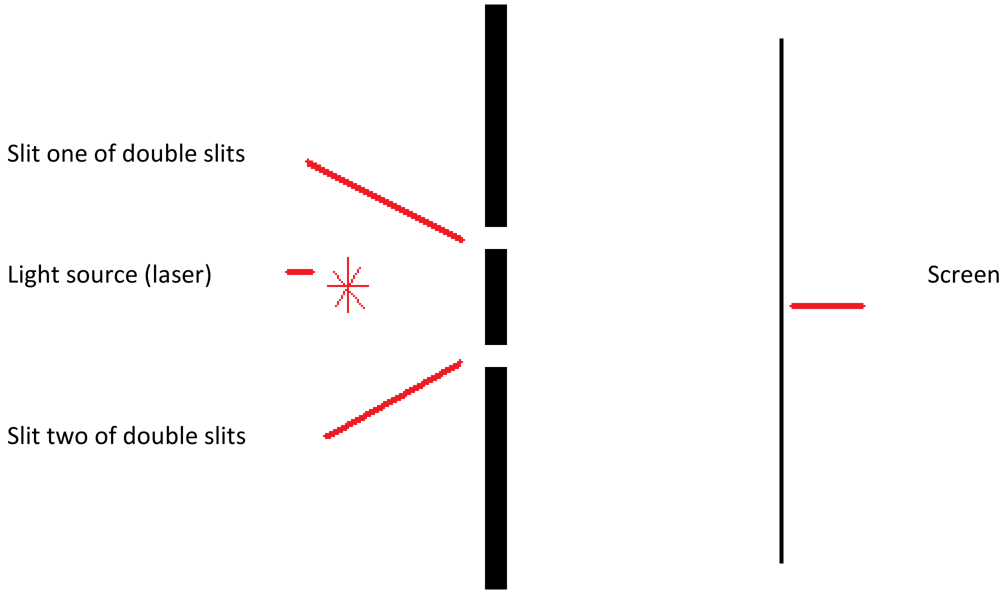
- Set up the apparatus as below:



- Measure the original length of the spring using a metre rule.
- When measuring the spring length, use a set square to read off the length more accurately.
- Attach a mass of 100g to the end of the spring.
- Record the force acting on the spring by calculating its weight, using mass x gravity.
- For this 100g mass, measure the new length of the stretched spring, again with the metre ruler. The mirror alignment method can be used to reduce parallax error.
- Calculate the spring's extension by doing *new length – original length*.
- Carry out this procedure up to masses of 1kg, again recording the force and extension.
- Then repeat the experiment for each mass when unloading.
- Calculate an average extension for each mass used.
- Then finally plot a graph of force (y) against extension (x).

Determining the wavelength of a monochromatic source of light from Young's double slits:

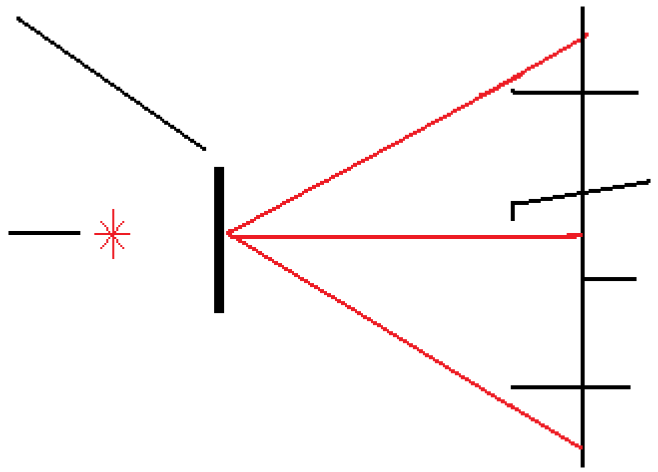
- Set up the apparatus as below:



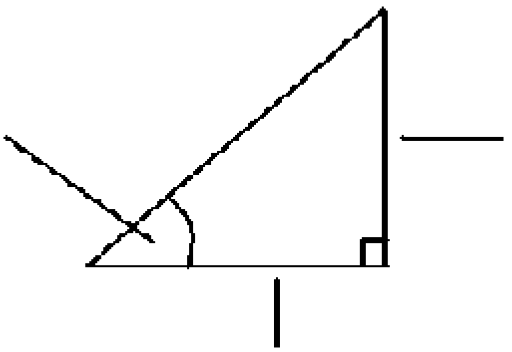
- Switch on the light source, and bright and dark fringes should appear on the screen. A dark room is needed.
- Measure, using a metre rule, the distance, D, from the slits to the screen in metres. A set square could be used to do so. Ensure that the value of D is at least two metres.
- Then using a vernier calliper, measure the slit spacing, s, which is the distance from the centre from on slit to the next, and convert to metres.
- Then using the fringe pattern on the screen, measure the distance across as many fringes as possible, such as eight, from the centre of one bright fringe to the one eight along.
- From this, find the fringe separation, W, by dividing the distance by the number of fringes measured across, such as eight, and get W in metres.
- Then use the equation $W=\lambda D/s$, and rearrange to get $\lambda=Ws/D$
- Substitute in the obtained values of W, s and D to find the wavelength of light used.
- This experiment can then be repeated using double slits with a different slit spacing, or using a different Slit screen distance, which will give different fringe separation.
- Repeat the process, and calculate a mean wavelength.
- And also for safety, when using laser light, don't look along the line of the laser, even after reflection.

Determining the wavelength of a monochromatic light source using a diffraction grating:

- Set up the apparatus as below:



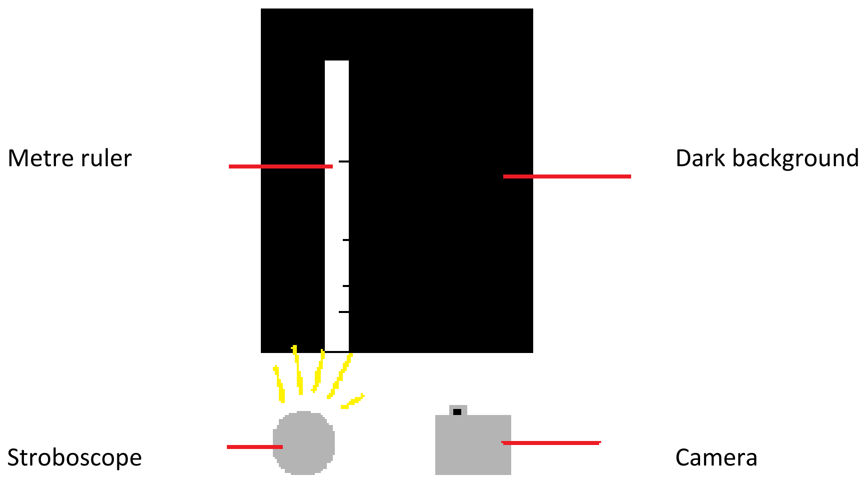
- Turn the light source on, and a pattern forms on the screen. Ensure the room is dark.
- Measure the distance,d, between the zero order beam and the first order beam on the screen. This should be done from centre to centre, in metres.
- Also measure the distance, D, from the diffraction grating to the screen in metres. A set square will improve the accuracy of this measurement.
- Then a triangle is obtained as below, where the angle x is the angle of diffraction for the first order beam.



- You can then calculate angle x, using Tanx=d/D.
- This gives you the angle of diffraction for the first order beam.
- The use the equation dsinx=n λ, and rearrange to get λ=dsinx/n.
- When using the first order beam, n=1, and the value of x has been calculated.
- To calculate the grating spacing, d, do 1/N, where N is the number of slits per mm, then convert to m.
- Then substitute all values into λ=dsinx to find the wavelength of light.
- Repeat the experiment for the second order beams and third order beams, and different distances from the screen, then calculate a mean wavelength of light.

Determining the value of acceleration due to gravity:

- Set up the apparatus as below:



- The stroboscope must flash at a known rate.
- Drop a ball from the top of the metre ruler.
- The camera takes photos after each flash and these can be analysed.
- Drop the ball 5 times in total to improve reliability.
- Tabulate the data by comparing distance fallen with the time taken.
- Time taken can be identified by calculating the number of time for one flash from the number of flashed per second.
- Then for each number of flashed, and hence time, calculate the mean distance fallen by reading from the metre ruler.
- Ensure the ball is dropped from rest, such as rolling it horizontally of a ledge so it has no vertical component of velocity.
- Then considering the graph of $s=ut+0.5at^2$ for this scenario, it is know that u=0, so $s=0.5at^2$.
- Then plot a graph of s against t^2.
- Calculate the gradient of the graph to find 0.5a and multiply by two to find a, which should equal close to $9.81ms^{-2}$.