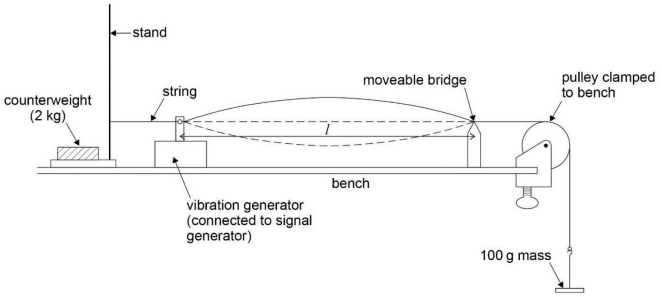
AQA Physics A-level

Required Practical 1

Investigation into the variation of the frequency of stationary waves on a string with length, tension and mass per unit length of the string

- Equipment:
  - Signal generator
  - Vibration generator
  - Stand
  - Pulley
  - Wooden bridge
  - 100g masses with holder
  - Metre ruler
  - 1.5m long string
  - Balance



- Method:
  - Set up the apparatus as shown in the diagram.
  - Adjust the length l so that it is 1.000m, measured using the metre ruler.
  - Increase the frequency f until the string oscillates at the first harmonic. Read and record f.
  - Reduce l by 0.100m and adjust f again until it oscillates at the first harmonic. Measure and record f and repeat this, reducing l by 0.100m each time down to 0.500m.
  - Repeat the experiment twice more and find and record the mean f for each l.
  - Measure the mass of the string on the balance and record it.
- Graphs and calculations:
  - Plot a graph of the mean value of f against 1/l and draw a line of best fit. The wave speed will be two times the gradient.
  - $\lambda = 2l \Rightarrow v = 2fl = \frac{2f}{\frac{1}{l}} = 2G$ where G is the gradient.
  - The tension of the string is equal to the weight of the hanging mass (if 100g, 0.981N) and its mass per unit length can be found by dividing the mass of the string by its length (1.5m).
  - The speed of the wave is also given by $v = \sqrt{\frac{T}{\mu}}$ which can be compared to the value obtained by the graph.
- Safety:
  - The stand could topple over and cause injury so a counterweight can be used if it is deemed unstable.
- Improvements and notes:
  - The experiment can be repeated with different masses to change the tension and different thicknesses of string to change the mass per unit length in order to investigate the effect of changing these parameters.
  - An oscilloscope can be used to verify the signal generator's readings.
  - The signal generator should be left for about 20 minutes to stabilise.