7th April – Part 1

1. An alternative method to determine the Young modulus for a material is to use Searle's apparatus. In this case, a steel vertical wire can be loaded with masses up to 10.0 kg. A second reference wire, also made from steel, hangs next to the test wire and (in this example) has a vernier scale allowing measurement of the extension produced to the nearest 0.01 mm.

   The diameter of the test wire is recorded, in mm, as 0.37, 0.38, 0.38 and 0.36.

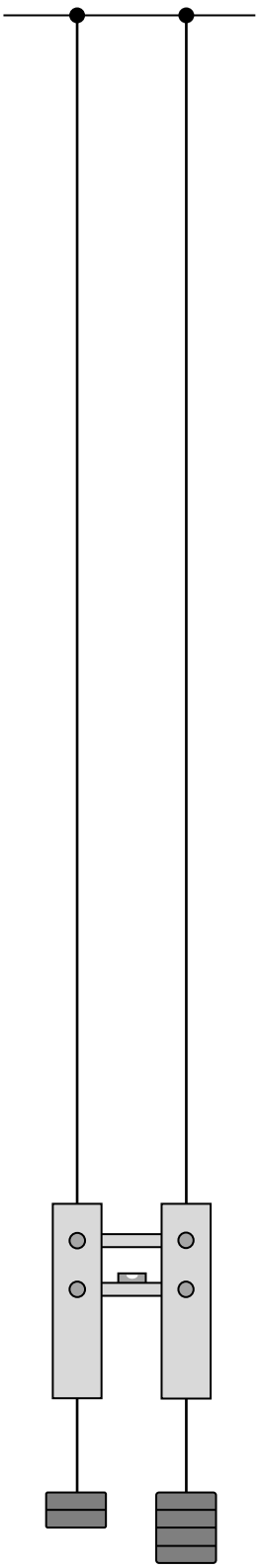
   a. Calculate the **average diameter** and its **absolute uncertainty**

   b. Calculate the **percentage uncertainty** in the diameter

   c. Suggest the **piece of equipment** that could have recorded these measurements

   d. Describe how these measurements of the diameter are taken to **improve accuracy**

   e. Calculate the **cross-sectional area** with its **uncertainty**



7th April – Part 2

1. A graph of load against extension is drawn using the recorded data and shows a directly proportional relationship.

   f. If the Young modulus of steel is 210 GPa and the wire was initially 2.00 m long, calculate the expected **extension** for a 10.0 kg mass hung on the wire

   g. Explain two **safety precautions** to allow this practical to be undertaken safely

Searle's Apparatus

Some schools have this equipment that can be used to measure the Young / Young's modulus of a material.

There are a few different types available. Some have a simple linear vernier scale between the two wires. Others have a spirit level that can be adjusted until it is perfectly level (as illustrated to the right).

When the test wire is loaded it will extend slightly, the spirit level can then be adjusted until it is once again horizontal using the screw gauge which shows the distance moved. This allows accurate measurements of extension to be recorded.