WJEC England Physics GCSE

Specified Practical

Density

SP2A Determination of the density of solids and liquids

Equipment
- Balance
- Ruler
- 2 regular solids (e.g. a cube)
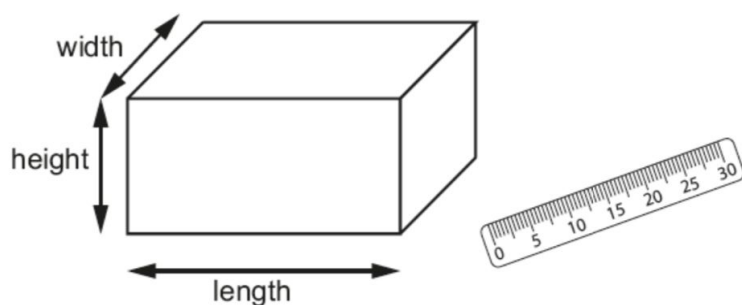- 2 irregular solids (e.g. an oddly-shaped stone)
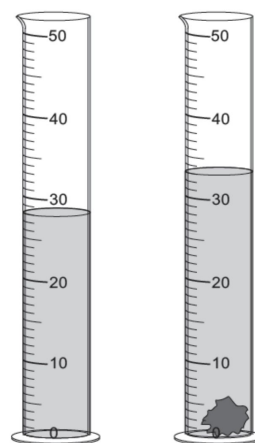- Measuring cylinder

Diagrams
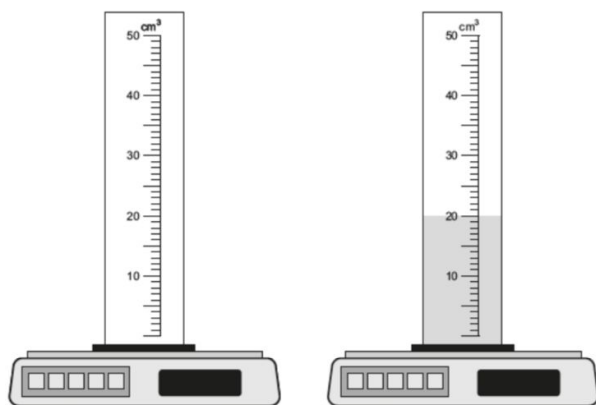

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Methods

Regular solids
1. Use the balance to determine the **masses** of the regular solids.
    ○ Ensure the balance is zeroed before placing the solids on top
    ○ Measure mass in grams
2. Use the ruler to measure the height, width and length of the solids and multiply them for each one (height x width x length) to obtain the **volume** of each solid.
    ○ For another shape, take the appropriate measurements and use a suitable equation to calculate its volume (i.e. radius and height of a cylinder for $\pi r^2 h$)
    ○ Ensure all measurements are in cm
3. Use the formula $density = \frac{mass}{volume}$ to calculate the densities of the solids.
    ○ Mass must be in g and volume must be in cm³

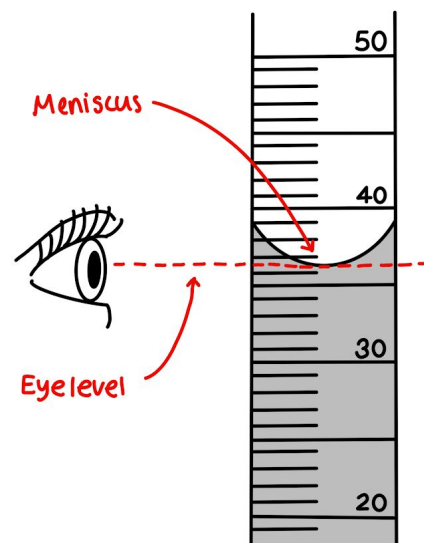**Irregular solids**
1. Use the balance to determine the **masses** of the irregular solids.
    ○ Ensure the balance is zeroed before placing the solids on top
    ○ Measure mass in grams
2. Start with a known volume of water in the measuring cylinder and place the first irregular solid into the water and measure the new volume.
    ○ Ensure no water splashes out of the cylinder, the amount of liquid inside must remain constant (although the reading will change)
    ○ The **change in volume** of the water is equal to the volume of the solid
    ○ 1ml = 1cm³
3. Repeat the process for the other irregular solid.
4. Use the formula $density = \frac{mass}{volume}$ to calculate the densities of the solids.
    ○ Mass must be in g and volume must be in cm³

Liquid
1. Use the balance to determine the **mass** of the liquid.
    ○ Place the **empty** measuring cylinder on the balance and zero it
    ○ Fill the cylinder with water and take the reading (this can be any volume of liquid but ensure that whatever volume you use is recorded)
2. Use the formula $density = \frac{mass}{volume}$ to calculate the density of the liquid.
    ○ Mass must be in g and volume must be in cm³

Tips
● Take all measurements for the liquid from the **meniscus.**
    ○ Water sits higher at the edges of a container compared to the centre. The meniscus is the **lowest point** of the water (the centre)
● When using a measuring cylinder, ensure the cylinder is on a level surface and take readings from eye-level to avoid parallax error.
● For solids that float, you can either push the solid down into the water until it is just fully submerged, or you can weigh it down with something of a known volume and subtract that value from the change in volume (this way is more accurate).

Safety Precautions

- Take care when pouring the water into the measuring cylinder to ensure that none of the water gets onto the electronic balance. Water can break the balance or cause a fire if it comes into contact with any of the wires.