Structure of the Earth: probing anomalous balls

Learning objectives:

- problem solving
- team working
- generating hypotheses from evidence

Timing: 20 minutes

Health and safety: pin is sharp

Apparatus:

For each group provide:

- Plasticine™ ball ~2 – 3 cm diameter made of thin layer of Plasticine™ covering a 15 mm steel ball bearing.
- Ball of identical size and shape but different colour made entirely from Plasticine™.
- Digital balance.
- Eureka (displacement) can.
- Ruler and callipers.
- Optics pin or similar.
- Bar magnet.
- Plotting compass.

Each group is to investigate (non-destructively) the two balls and hypothesise what their form is.

- They should discover that average density of heavier ball is 3.4 g./ cm^3 while the Plasticine™ ball is 1.7 g / cm^3. It is useful to establish the significance of average density compared with specific localised densities.
- Probing with pin identifies that one ball has solid centre
- A bar magnet will pick up one ball but not the other
- A plotting compass needle is deflected by one ball but not the other

Outcome:

Pupils ascertain that one ball has a solid, magnetic, metal core while the other has soft, non-magnetic core (although they cannot say it is made of the same material throughout).

For further guidance on how this activity may lead to directed discussion and the relationship between present evidence and hypothesis refer to 'The Secrets of Plasticine Balls' in Physics Education (King, C. (2002) *The secrets of Plasticine balls and the structure of the Earth: investigation through discussion* Physics Education, 37, 485 – 491.)