



BRONZE AWARD PROJECT IDEAS



typically 10 hours of project work



Fraud detection – testing metals

Before you start your investigation, you should carry out a risk assessment and have it checked by your teacher. For help with this, read through our health and safety information and look out for health and safety warnings in the text.

When Archimedes stepped into a full bath it overflowed. This gave him a clue to solving a king-sized problem - how to determine whether or not the new royal crown was pure gold. “Eureka!” he cried, meaning “I’ve found it!”. Read about Archimedes to find out how the overflowing bath helped him to determine the density of the crown, and thus solve the problem. In this project you will use a modern version of Archimedes’ method to investigate the composition of copper, silver and gold items.

Getting started

Doing experiments in a public bath is not very convenient, so a portable version of a bath was developed. It is called a ‘Eureka can’ after Archimedes’ exclamation. Find out what a Eureka can (or specific gravity can) is used for, and how to use it.

Copper coins

- Work out how to use a Eureka can to prove that a modern 1p or 2p ‘copper’ or ‘bronze’ coin is neither pure copper nor bronze.
- Are modern 1p and 2p coins made from the same metal?
- How does the density of these modern 1p and 2p coins differ from those minted before 1992? Suggest an explanation, and a reason why the composition of the coins was changed - a magnet should help.
- Were the original decimal coins (pre-1992) made from the same metal as pre-decimalisation pennies and halfpennies (1d and ½d)?

Silver coins

- Devise a way to improve your method to make your measurements more precise.

You need to be able to calculate the density of a coin as precisely as possible, ideally to at least 3 decimal places. Make sure that you understand the difference between ‘precise’ and ‘accurate’. Using a calculator to get an 8-figure answer does not mean the answer is accurate. You will probably need to discuss this with your teacher.

- Use your improved method to compare 5p, 10p, 20p and 50p ‘silver’ coins. Show that the coins are not real silver. Are they all the same?

Testing gold

It’s most unlikely that anyone will lend you a crown to test, but you can follow in Archimedes’ footsteps at a more modest level using gold rings or pieces of jewellery. An important point about this method is that it is non-destructive testing - you don’t need to damage the item.

- Find out about measuring the purity of gold in carats. Work out how to determine the carat value using your improved version of Archimedes’ method. Test some rings or jewellery to decide their carat value. Compare your results with the items’ hallmarks if it has one.

- Find out how the purity of gold or silver is checked at an Assay Office before it is granted a hallmark. Just as in Archimedes' day, this is an official test procedure as a precaution against goldsmiths and silversmiths cheating their customers.

