

Activity 2: The metal in me - calcium

Introduction: What makes our bones hard? Try removing the 'hardness' and flame testing the solution that results.

Key Stage: Chemistry KS4.

National Curriculum Ref: Sc3 2g

Time: 20 minutes

Pupil learning outcomes: Know how a few elements, including calcium, can be identified in their compounds by use of the flame test. Know that a major role of calcium in the human body is as a component of bones, and that phosphorus and oxygen are also needed for bones. Understand why regular intake of calcium compounds is essential in the diet, and how this fits into the recycling of calcium compounds in nature.

Context: The mass of calcium in the body (1 kg in a 70 kg person) is mainly there as one of the elements in bone. This calcium is slowly cycled into and out of the bones, and of course more calcium is needed by children who are still growing. So calcium compounds form an important component of the diet.

Common misconceptions: Although pupils are usually aware of the three major organic components of the diet (carbohydrates, proteins and fats), they often fail to understand that minerals are also an important component, and among these calcium compounds make the largest contribution.

Resource list:

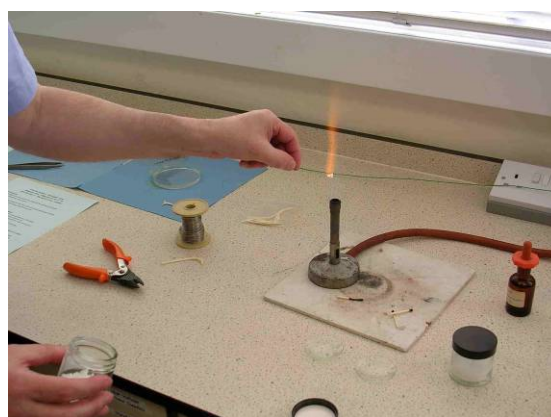
- Participant Card
Small thin bones from e.g. rabbit or chicken. Immerse the bones in the acid about one hour before the activity takes place. It would also be sensible to set up a bone in acid some time earlier, eg. the day before.
- Hydrochloric acid (1M)
- Tweezers
- Any calcium salt
- Crushed limestone

- Bunsen burner and heat proof mat
- 10 cm lengths of clean thin 'nichrome' wire (NB It is not necessary to mount these in glass rod holders if they are long enough - they can be held between the fingers at the far end from the flame, and the other end can be snipped off between tests to ensure a fresh piece of wire for each test). Also the wires are best cleaned in preparation for each test by dipping in 5M HCl on a watchglass, then 'flaming' them off - but pupils will have to make do with 1M HCl for safety reasons)
- Wirecutters/tinsnips
- Watch glasses, 5 cm diam

Lead-in: We have a lot of calcium inside us - Why? Calcium is a reactive metal so there is likely to be a lot of one or more calcium compounds inside us, but where? Can we find out what they are doing inside the body?

Activity: Show a sample of elemental calcium and a sample of a compound containing calcium. Note the different chemical characteristics of the metal as an element and in a compound. [You may wish to show them again the reaction of calcium with water that they may have seen at KS3].

Then ask them to carry out the 'bendy bones' and flame testing activities described on the Participant Card.



Flame testing for calcium (*Activity 2*)

Follow-up: Discuss the flexibility of bone when calcium is removed, such as the issues of

calcium deficiency and osteoporosis. Note:
'brittle bones' are caused by protein deficiency.

In the context of the 'big picture', where does the calcium in our bones come from? Here is an example of how the 'calcium trail' might work:

- Underlying strata containing calcium compounds are weathered
- Calcium is incorporated into the soil profile
- It is absorbed through the roots of plants
- Grass is eaten by cows
- Cows produce milk
- Cheese is made from milk
- We eat the cheese - and the calcium from it is cycled into our bones

Activity 2: The metal in me - calcium

Introduction:

What makes our bones hard? Try removing the 'hardness' and flame testing the solution that results.

We can't use our bones for this test, so we are using animal bones instead because they have the same composition as ours.

Use eye protection.

Activity 2A: Removing the 'hardness'

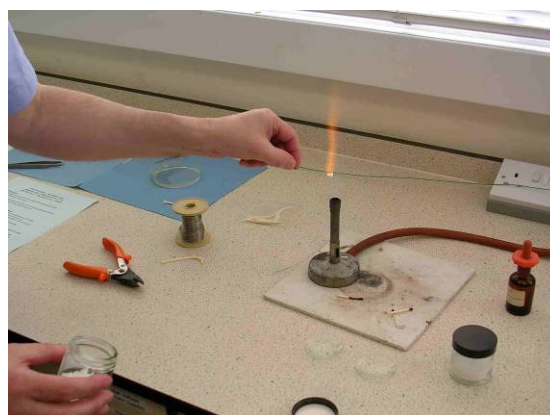
- You have been given a small bone that has been covered in 1M hydrochloric acid and left for an hour or so.
- Remove the bone from the solution with tweezers, rinse it off and dry it. Then compare it with an untreated bone.
- Pass the treated and untreated bones around the group.

Activity 2B: Flame testing

- Conduct flame tests on the known calcium salt provided and on crushed limestone, as follows:
 - Dip the flame test wire in hydrochloric acid on the watch glass.
 - Holding the wire firmly at the far end, touch the tip of the wire into the bottom corner of a strong blue Bunsen flame, and

hold it there until any colour from the wire in the flame dies away.

- Repeat this until the wire gives no colour to the flame - the wire is now clean.
- Now dip the wire into acid, and then into a sample of a known calcium compound. What colour does it give to the flame now?
- Clean the wire again as before, and when clean repeat the test using a sample of powdered limestone. Is the colour given to the flame the same?
- Now use this flame testing method to discover if there is calcium in bones. Dip the wire into the solution from activity 2a and carry out the flame test. Does this give a calcium colour?
- Where might the calcium in our bones have come from?



Flame testing for calcium