

Student sheet

In this practical I will be:

- Experimenting with plaster of Paris, to determine whose teeth (or which tool) left an impression.
- Reporting my observations of what happens to the plaster of Paris, throughout the experiment.
- Explaining why plaster of Paris goes through these changes, based on my scientific knowledge and understanding.

Introduction:

The year is 218 BCE and you are walking through the market where you see a stall where a man claims to be selling parts of the victims of Medusa, who would turn people into stone if they looked at her. On the stand you can see several hands and feet that appear to be made of a white, stone-like material. You decide to buy one. As you had over some denarii you see that the salesman has bandages on both of his hands, over what appear to be burns.

Whilst walking home it begins to rain and when you look at the stone hand you bought, it appears to be melting. It clearly isn't made of stone but you don't know what it is made of. Like all good science-artists, you decide to investigate.

Equipment:

A

- Eye protection
- Spatula
- Boiling tube
- Bunsen burner
- Clamp stand
- Clamp
- Key or coin
- Evaporating basin
- Piece of cardboard (10 cm x 10 cm)
- 10 small lumps of Gypsum (calcium sulphate)

B

- Eye protection
- Disposable cup
- glass stirring rod
- 200 g Plaster of Paris
- Apple or some other fruit with tooth indentations or a tool indentation
- 200 cm³ Water



Method:

Eye protection and gloves must be worn.

Food must not be eaten in the laboratory.

Do raise a dust or inhale any plaster of Paris dust

Do not make any cast of any body parts.

Food must not be eaten in the laboratory because of the risk of contamination.

You must not even bite an apple in the laboratory.

Before you go to the laboratory someone should bite the apple. Be sure to find a place where eating is allowed! The aim is to leave a clear set of teeth marks. This can take a little practice.

Alternatively your teacher might provide you with an apple/potato with indentations made by tools/utensils that need to be identified.

A: Making plaster of Paris

1. Use your spatula to place a few lumps of gypsum in the boiling tube. Clamp the boiling tube in position above a Bunsen burner (see diagram). Heat it strongly, until you see a change in the solid. What collects inside the boiling tube?
2. Allow the tube and its contents to cool. The solid in the tube should now be plaster of Paris. Compare its appearance with that of the gypsum.
3. Transfer the plaster of Paris to an evaporating basin. Add water until you have a thick smooth cream. Spread the paste thickly onto a piece of cardboard using the spatula. Press a coin or key into it.
4. Put it away to set. It will take 24 hours. You should leave the coin or key in place.

B: Whose teeth marks are in the apple?

1. One-quarter fill the disposable cup with water.
2. Mix in enough plaster of Paris to make a thick smooth cream. (A 3:2 ratio will make a good consistency)
3. Pour it carefully but quickly into the teeth or other indentations you have made in the apple or fruit.
4. Let the plaster set. This will take about 48 hours but it can be much less depending on the age of the Plaster of Paris.
5. After 24 hours cut the apple away from the plaster cast and rinse the cast under the tap.
6. Can you identify whose teeth or tool made the indentations in the apple?

Going further:

Try to find out about the lost wax process and see if you can devise a method of getting a lost wax impression of the teeth marks. Compare the wax approach with the Plaster of Paris and evaluate which gives the best impression.



Theory:

Like chalk and limestone, gypsum is found as a mineral rock. They are calcium compounds. Chalk and limestone are calcium(II) carbonate and gypsum is calcium(II) sulfate. Calcium(II) carbonate is used for sculpturing and calcium(II) sulfate is used for casting. Calcium(II) carbonate is also used to coat the surface of a support like wood or canvas to create a surface for painting on. This surface is known as the ground.

The crystals of calcium(II) sulfate are hydrated which means they have water molecules bound into the crystal. This is known as water of crystallisation.

If gypsum is heated gently some of the water is lost and the crystal becomes a white powder of almost anhydrous calcium(II) sulfate ($\text{CaSO}_4 \cdot 1/2 \text{H}_2\text{O}$). If water is added to the cold white powder the water recombines with the calcium(II) sulfate to form hydrated calcium(II) sulfate or plaster of Paris. As this happens the mixture gets hot which chemists call an exothermic chemical reaction. When water is added to the anhydrous calcium(II) sulfate it does not form the crystals but a white paste which then sets hard.

Artists use materials like calcium(II) sulfate for creating casts of objects.