



Why are some lavas runnier than others? The Treacle Test.



The aim of this experiment is to investigate factors that control the behaviour of lava during volcanic eruptions. Successful prediction of how a volcano is likely to erupt can be vital in saving lives. We shall use treacle or golden syrup to model the lava, since it behaves in a similar way

You will need: three boiling tubes (with bungs) containing golden syrup. (One has a few drops of water added, and another has had a little sugar added). *Keep boiling tubes right way up - do not try tipping them upside-down yet!*

You will also need: a rack to hold the boiling tubes, tongs, Bunsen burner, tripod & gauze, a beaker of water (about 1/3 full), thermometer, spatula, teat pipette, stop-clock, safety glasses.

Your teacher will probably discuss how to compare the time taken for the syrup to run from one end of the boiling tube to the other when it is turned upside-down. Think about ways you could make the syrup move faster down the boiling tube (this involves changing the **viscosity** of the syrup)

It may help to know that geologists have identified three factors affecting the viscosity of lava:

- amount of dissolved liquids and gases (e.g. water) in the lava,
- presence of crystals (formed in cooling magma before eruption),
- the temperature of the lava.

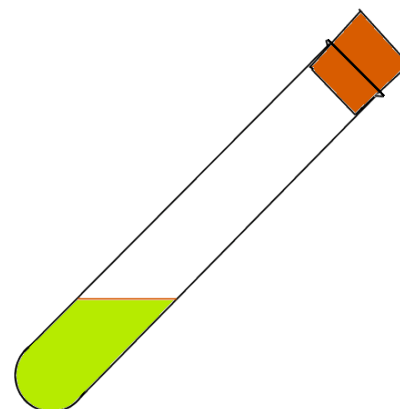
1. Compare the viscosity of the three samples of syrup that you have been given (you only need the stop-clock for this).

Which sample is runniest?

Why?

Which sample is most viscous?

Why?



2. Design an experiment to investigate the effect of changing *temperature* on the viscosity of your sample of "pure" syrup.
 - How will you safely heat the syrup?
 - How will you measure the temperature?
 - At what temperatures will you measure the viscosity? How?
 - How will you record your results? Prepare a results table.
 - How will you show your results? Could you draw a graph?
 - What safety precautions should you take, during & after the experiment?

Discuss your ideas with your teacher before you carry out the experiment.
BE SURE TO REMOVE BUNGS BEFORE HEATING THE TUBES – but replace them before turning upside-down!

When you have finished, you should be able to explain in some detail what effect changing temperature might have on the viscosity of lava erupted from a volcano.

Teacher/Technician Notes:

1. Background:

See web pages on Crystallisation of magma and formation of Igneous rocks, and notes in Teachers' Zone on Viscosity of magma.

2. Preparation of syrup samples:

Each boiling tube should be $\frac{1}{4}$ filled with syrup. Three or four drops of water should be added to one of each set of three, and a small spatula of sugar to another. A glass rod can be used to mix. Replace bungs firmly and leave in racks overnight .

3. Preparation for experiment:

Some preparatory discussion is clearly required to introduce students to the experiment and to give them the idea of "measuring viscosity" by timing how long it takes for syrup to run from one end of the inverted boiling tube to the other. (N.B. Best to invert tube to a steep angle rather than vertical, so syrup runs down side of tube).

The degree of guidance given for the temperature experiment will depend on the ability profile of the group.

Note that the time required for this experiment depends not only on how long it takes to set up and to heat the water, but also on time needed for the measurements and for the syrup to return to the bottom of the tube each time. It's a good idea to try it for yourself first, and consider how time can be used most efficiently.

4. Follow-up:

Further discussion of the important role of dissolved gases (see also "Cola demonstration") in controlling eruption style will help students understand why volcanoes may erupt in different ways, sometimes effusively (flowing lava) and sometimes explosively.

Students should also gain some idea of how scientists now play a vital role in disaster mitigation through their efforts to predict not only when a volcano might erupt, but also how dangerous the eruption is likely to be.