

SPEED OF LAVA FLOWS

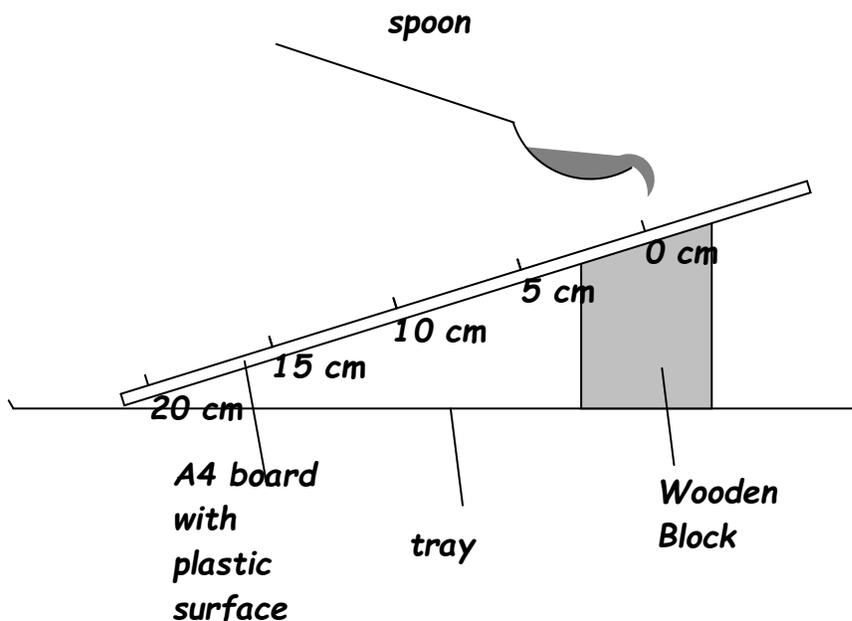
Purpose

Four short experiments to determine independently the effect of the following variables on the speed of a lava flow: temperature, crystal content, angle of slope, and volume..

Instructions

General

1. Mark A4 boards with lines going across 10cm from the top end and then every 5cm.
2. Select slope and set up board on a tray on newspaper.
3. Stir syrup and record temperature.
4. Pour the syrup as shown in diagram onto the zero line.
5. Start the timer when the syrup reaches the 5cm line and record the time it reaches the other lines.



For temperature

Select a medium slope board. Remove jug from water bath or from heater and record the speed of flow for every 5°C drop in temperature.

For crystal content

Select a medium slope board. Use the syrup at 45°C and the sand at the same temperature. Add 5ml sand and stir it in. Repeat adding 5ml sand each time for four times.

For angle

Keep the syrup the same temperature but pour it onto 4 or 5 boards with different angles.

For volume

Keep the same angle and temperature but use different sized spoons.

Plotting your data

Plot four separate graphs and on each plot the speed of flow (Y) against each of the other variables (X) and draw your conclusions.

Question

Find out the viscosities of acid and basic magmas. Which type of lava will flow fastest?



Boards and supports for lava flows

Teacher's Section

Requirements

4 one pint jugs half full of Golden syrup heated to 65°C in a water bath
A4 boards preferably plastic covered, mine are made from old white board. Draw lines across at 5cm intervals as on diagram.

timers, thermometers, permanent felt tip pen.

Trays large enough to take the boards.

50ml fine sand heated to 45°C.

Strips of wood to support the boards at angles varying from 1 to 12 degrees.

Desert spoons. 2 5ml tea spoons, 1 table spoon

Notes

Syrup heats up quicker and cools more quickly if kept in the tin

Things can get quite sticky so have some newspaper to put the boards on and have some water and a cloth available. Clean the boards as soon as they are finished with.

The syrup should be about 45°C for the sand to be added otherwise it sinks too fast in the syrup.

Black treacle can be used, it has a more appropriate colour but requires a higher temperature (70 degrees)

Movement is very slow below 35 degrees.

Spoons should be put in the syrup beforehand and kept there otherwise they cool the syrup.

The syrup which has not had sand added can be reused.

When the flows are moving slowly it is possible for students to record upto three flows at the same time using either 3 timers or noting the clock time.

Glycerol can be used instead of syrup. Since its viscosity is known a much more mathematical treatment can be made, see Teaching Earth Science 2004 vol 28(3) 26.

Results

The syrup flows faster if the: the temperature higher because of reduced viscosity, the slope is steeper because of increase pull by gravity, the volume greater because of the greater distance of the main flow from the boundary layer. Sand slows the flow because of increased friction. Basic lava and will therefore flow more quickly.

Time

Between 30 and 60 minutes for one variable.