Volcanic Activity

Dissolved gas ***D***

Use a large lemonade bottle to show that gas can be dissolved in a liquid and that it will exsolve when the pressure is lowered. Shake the bottle and then

release top slightly to lower pressure and allow the bubbles to exsolve.

Gas and explosions: lemonade bottle ***D***

You can show how the exsolution of gas can cause an explosion by using a lemonade bottle with a cork instead of screw top, dye the lemonade red for a more dramatic effect. Shake bottle. Best done outside or better just a photo of a champagne cork coming out.

Gas and explosions; exploding film canister ***D***

Half fill a film canister with bicarbonate of soda and add acid. Put the cap back on and leave on the bench. After a few min the cap bursts off. Alternatively use an Alkaselser tablet in the canister and add water. Check beforehand that it works because some canisters are not air tight.

Viscosity and speed of movement ***D***

Pour a desert spoonful of various liquids onto the top of a sloping board resting in shallow tray and watch their speed of movement down the board. Water, golden syrup, black treacle, ketchup etc are suitable.

Temperature and viscosity ***D***

To show the effect of temperature on viscosity place a spoonful of golden syrup at room temperature and a spoonful at 60^o C onto the top of a board and watch their speed of movement down board.

The viscosity of basic and acid magmas ***TE***

Basic magma at 1200^oC has a viscosity similar to golden syrup at room temperature whereas acid magma's viscosity is similar to peanut butter.

Vesicles and viscosity ***D***

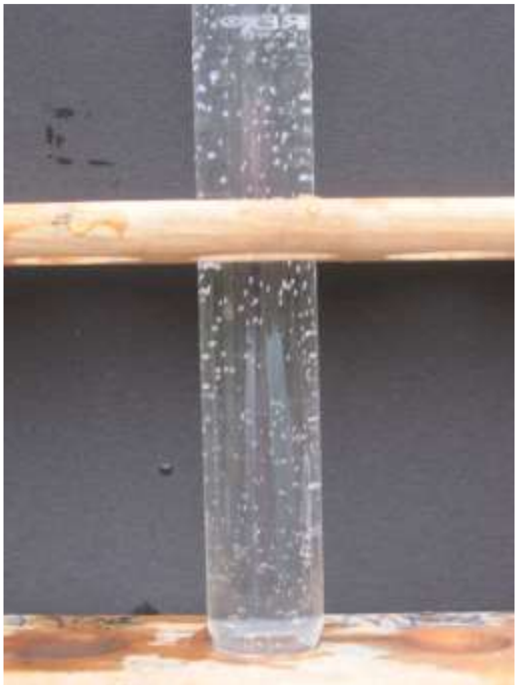
To show how bubbles can get trapped if the magma becomes too viscous. You will need a bottle of Johnson's baby oil gel and a bottle of water. Both are shaken, the smaller bubbles get trapped in the gel but not in the water.

Speed of rise and growth of vesicles *D*

Use a thin drinking straw to blow bubbles into a litre of glycerol or Fairy washing up liquid to see how the small bubbles rise slowly and the larger ones rise more quickly and catch up with and absorb the smaller ones.

Expansion of vesicles as they rise *A P 2 min*

Students must first predict with reasons, if the size of bubbles is going change as they rise up. Provide students with a boiling tube or tumbler full of lemonade. They should look at the size of bubbles at the bottom and then at the top. Larger bubbles can be introduced with a straw or pipette. Black paper held behind the tube will make the bubbles easier to see.



Size of vesicles *A P F 30 min*

The diameters of the vesicles on a slab of basalt are measured and the resulting data plotted on a frequency graph.

Speed of rise of vesicles in basic magma *E P [F] 20 min*

Bubbles are blown into the bottom of a column of glycerol and their size and speed of rise measured. Adjustments for the viscosity and density differences between glycerol and basic magma are made so that the speed of rise of vesicles in basic magma can be calculated.

Speed of movement of lava *Pe I 5min*
Students work out length and calculate speed of movement from a map of the Laki lava flow (Iceland 1783). It was basalt and therefore relatively runny. It formed in 4 days which gives a speed of 0.75km per hour, compare this to walking about 5km per hour.

Modelling the speed of lava *E P [F](F) 1 hour*
Students measure the time it takes for the golden syrup to run down the slope. Start with the syrup at 65°C and do one measurement for each 5°C drop in temperature. Alternatively keep the syrup at 45°C and change the angle of the board, say 12°, 9°, 6° and 3°.

Model of an eruption using party poppers *D F*
The volcano is a conical lamp shade with sand or ash glued to the surface. A party popper with the paper strips inside replaced with sugar. The lamp shade is placed over the junction between two desks and the string which fires the popper is pulled from below.

Champagne and the sequence of volcanic activity *TE*
For many volcanoes the sequence of activity is: gas emission, pyroclastics, vesicular lava, lava with few or no vesicles. Opening a bottle of champagne shows a similar sequence: gas, droplets, bubbly champagne, champagne with few bubbles.

Pumice eruption *D*
Use a can of shaving foam with the top part of the nozzle removed and a 1m strip of metal with a hole in it such that it presses down the lower part of the nozzle and releases the foam. Place the hole in the bar over the nozzle and press down on both ends. Foam shoots up in the air. Use newspaper to cover the desk.

Floating Pumice **D**

After the eruption of Krakatoa the sea was clogged up with floating pumice.

Take a few small pieces of pumice, less than 2g, and put them in a glass jar with the date on. See how long they take to sink. Some pieces will take several weeks.

Ketchup Lava fountain **D**

A bowl is filled with ketchup 5cm deep. A thin tube 60 cm long is inserted into the ketchup and air blown through the tube. This causes bubbles to form and burst spraying ketchup into the air like a lava fountain. Messy fun.

Pyroclastics **D**

Attach a round balloon to 40cm of 15mm copper pipe. Make a cone of slightly damp sand over the balloon but leave the other end of the pipe sticking out over the table. Blow into the pipe and chunks of sand are blown into the air leaving a crater.

Caldera *D*

Inflate a balloon so that it is about 7cm in diameter. Cover it with a cone of slightly damp sand but with only a thin layer on top. Use a sharp piece of wire to bust the balloon and a caldera will form.

Throwing sand and gravel *A P 5 min*

Students throw a handful of sand and gravel up in the air outside and note which goes highest; the larger or smaller particles. They then try to explain why the opposite happens in volcanic explosions.

Calculating the volume of pyroclastics *Pa I [F](#) 40 min*

Students are provided with a map of the distribution of pyroclastics with isopachs printed onto graph paper. Students calculate volume from the area within each isopach.

Calculating the volume lost though explosion *Pa I [F](#) 15 min*

Students reconstruct the original shape of Vesuvius from a profile of its present shape and then measure the height (h) and radius (r) of the cone that has been blown away. Then they calculate the volume using the formula $1/3\ \Pi r^2 h$ ***.***

Pyroclastic flow *D*

To simulate a pyroclastic flow pour milk into the end of a transparent tank of water

Calculating the percentage of vesicles *A P [F](#) 30 min*

Take a slab of vesicular basalt and fill the vesicles with Polyfiller. Photocopy the slab enlarging if necessary. Students place a ruler on the photocopy and note if there is basalt or vesicle below each centimetre line on the ruler at the edge. They should move the ruler down when they have completed one row. They should make 100 readings and then calculate the percentage of vesicles.

Size of vesicles *E P F 30 min*

Take a slab of vesicular basalt and fill the holes with Polyfiller. The diameters of the holes are measured and the resulting data plotted on a frequency graph.

Calculating the porosity of pumice *A P [F](#) 30 min*

You will need a piece of obsidian and a piece of pumice both with a nylon line attached to them. Weigh the obsidian in air and in water and calculate its density. Find the volume per gram (reciprocal of density). Repeat for the pumice. The amount of expansion is

$$\frac{\text{volume of 1g of pumice}}{\text{volume of 1g of obsidian}}$$

and the porosity of pumice is

$$\frac{\text{vol 1g pumice - vol 1g obsidian x 100}}{\text{vol 1g pumice}}$$

Speed of eruption cloud *Pa I [F](#) 30 min*

Using copies of the photographs of the Mount St. Helens eruption in "The 1980 eruption of Mount St Helens" by Lipman and Mullineaux 1981, USGS Professional paper 1250 students trace the outline of the lateral and *vertical blast and measure the distance travelled against the time of the photo.*

Reverse grading in pumice deposits *D*
Acquire several pieces of pumice of varying size and which float in water. Ask students which piece, if placed in water, will sink first. Measure and weigh each piece and place them in water. Record the day when each sinks. Large ones will take several days to sink.

Tiltmeter *D*
To make a tiltmeter you will need 80cm of clear thin polythene. The tube should be pinned to a board which has feet so it stands up. The sides of the tube should be not less than 15cm and the horizontal part about 50cm. Fill the tube with coloured water (ink or food dye). You will need stoppers for the ends of the tube to stop it spilling when moved.

Tilting of sides of a volcano *D*
Rest two thin books on an uninflated balloon. Two students hold clinometers on top of the books while a third blows up the balloon.

Volcanic Hazards Report *Pa I F 60 min*
Students are given the scenario of an island with a volcano showing signs of immanent eruption. They must predict the likely hazards and state what precautions the islanders should take to reduce the damage and loss of life.

Volcano research *Pa I 1 hour*
Each student is given the name of a different volcano and told to find out about it from books or the internet. They must write a report or tell the class their findings. It is often helpful to give students specific topics to report on e.g. location, size, eruption history, deaths, type of activity, tourism etc.

Geyser **D [F]**

A Bunsen burner heats the bottom of a water filled glass tube 1m long which has been drawn to a point at the top end and sealed at the bottom end. The top end just pokes through a hole in a saucer. A polythene sheet 1m square surrounds the saucer so that the water drains back into the saucer and then into the tube. Once the water in bottom of the tube turns to steam it pushes all the water above it out like a real geyser.