Creating Science – Magma flows

What's the difference between magma and lava? Why does magma sometimes flow out through the crust of the earth? ***#CreatingScienceMagmaFlows***

Suggested Outcomes

(NOTE: This is by no means an exhaustive list of possible outcomes, neither is it intended that ONLY these outcomes can or should be met. Science is a deeply interrelated activity, and you may find cross curriculum links you can and should use.)

Science understanding

- Chemical sciences 2: Different materials can be combined, including by mixing, for a particular purpose.
- Chemical sciences 5: Solids, liquids and gases have different observable properties and behave in different ways
- Planning and conducting 3: Safely use appropriate materials, tools or equipment to make and record observations, using formal measurements and digital technologies as appropriate

Science inquiry skills

- Planning and conducting 5: Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks (ACSIS086)

Science as a human endeavour

- Nature and development of science 5: Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions (ACSHE081)

Science vocabulary words

Tier 3:

- Observation – something your senses detect, such as a smell or colour.
- Inference – the meaning you give to your observations, such as 'someone's making pizza'.
- Magma – the melted rocks underneath the earth's crust.
- Lava – magma after it has founds it way above the earth's crust and chemically altered due to the decrease in pressure and release of trapped gasses.
- Convection – a movement of liquids and gasses, where 'hot air rises' and 'cold air falls'. See also Creating Science – Slightly Dangerous Air Cannon.

Warning

- Try not to make a mess – good luck! You may want to use drop sheets, do it outside in good weather, wear gloves, and have a well-controlled situation.

Preparation

- A clear plastic tube for everyone (or at least groups of 2-3) who will be participating.
- Drop mats for all, and towels to clean up inevitable spills.
- Food dye
- Water
- Oil
- Things that fizz – alka seltzer® are excellent but pricy. Wizz fizz, Salvital®, fruit tingles®, etc. Vinegar and bicarb will also work.

Engage

Bring in some different rocks for students to examine.

- ⇨ Discuss floating and sinking (See Creating Science – Density for more).
- ⇨ Discuss how rocks form (see Creating Science – Growing crystals for more).

Explore

Set up the activity 'magma flows' as found in *Creating Science* page 61. Have students attempt explanations, and write students' questions down as they explore.

Begin performing the experiment from the next section 'Explain' below.

Explain

Thinking like a scientist: One important skill in science is knowing the difference between what you see, and making sense of what you see. In other words, **Observation** vs **Inference**.

Split a page in half (or use two pages) and title them "what we observed" and "what it means" (or "inference")

Have students draw **what** they observe, and then write down their reasons **why** it happens.

Re-perform the activity at the front, explaining each stage at it happens.

Drop in one drop of food dye.

This is your first observation. **What** happens to the drop? How long does it take to float down to the bottom and spread out into the water underneath?

This is your first inference. Can you theorise as the **why** the drop of dye behaved that way?

Theory: The oil and water are chemically different in that they don't mix. Food dye is a water based chemical, so will mix with water and not oil. To mix dye into oil you need to use oil based colours, or acrylic which can mix with both oil and water.

Now drop in your fizzy maker.

Next observation: **What** happens when you drop in the fizzy mix, and **why**?

Theory: The ingredients in the fizzy mix react with the water (and not the oil) to produce carbon dioxide gas. This gas has a strange yet entertaining effect on the coloured water. Usually water is denser than oil, so it stays at the bottom. But when the coloured water collects a few bubbles, its total density is now less than the oil. So it floats to the top.

Third observation: Once the coloured drops get to the top, **what** happens? **Why**?

Theory: The coloured water rises to the top due to the little bubbles stuck to it. The bubbles then pop once they reach the air. Thus, the water drops no longer have the air bubbles to help keep their density lower than oil, and they sink back down.

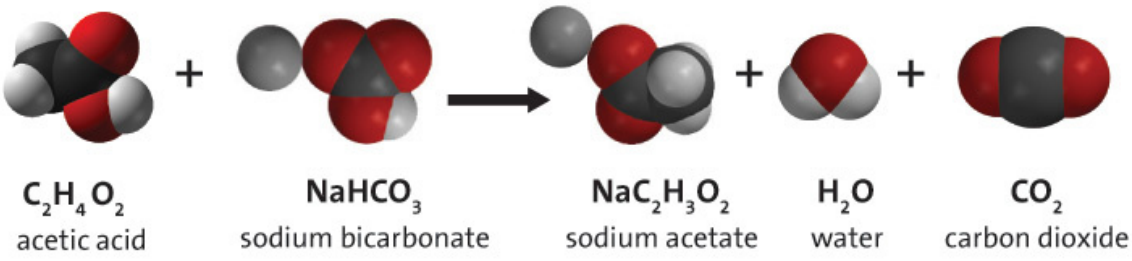
How is this like lava?

The Science skill of Modelling: The magma tubes act like real magma under the surface of the earth. It too has lots of gas trapped inside it. When magma is forced up to the surface of the earth it, too, can explode with literally tonnes of extra gas exploding outwards into the air, including carbon dioxide, sulphates, and water. The magma has now chemically changed, and we call the flowing liquid rock that is left 'lava'.

The difference between our model and the earth's crust is that the lava cannot always cycle back down to collect more gas. Lava tends to stay on the surface of the earth, forming new land or giant volcanoes. If it does recycle, it won't until millions of years have passed, or perhaps never…

What is this reaction?

For students wanting a more detailed explanation of this reaction, the following may help;



Taken 17 sep 18 from https://kaiserscience.wordpress.com/chemistry/chemical-reactions/baking-soda-and-vinegar/

This is oversimplified, and students may want to research the intermediate steps that make this reaction possible.

Carbon dioxide is the chemical that makes fizzy drinks fizzy, and too much in our lungs creates the suffocation feeling that tell our body it's time to take a breath!

Elaborate

Objects loosing density and rising up over other liquids is an important science fact in many disciplines. For instance, submarines can pump air into special tanks, thus decreasing their relative weight while keeping the same size. This makes the submarine less dense, and it rises up. Some fish even have swim bladders that perform a similar function to help them float.

This is a good demonstration of how magma flows, but it is not the only science involved. A big factor is also heat. Just as hot air rises, so do hot liquids (This phenomenon is called 'convection currents'). Rocks that are melted by the heat inside the planet will rise up and push against the hardened, cooler, crust of the earth. This is another factor that helps to form volcanoes and move the tectonic plates around.

Messing it up

Detergent, such as dishwashing soap, is a special chemical that can bond with oils and waters. What do you think will happen if we put some dishwashing detergent? (It will mix the oil with the water, and lessen the effect of the coloured water moving)

Still, detergent is a very important thing. When we wash our hands it only removes the water-based chemicals. If we want to get rid of the oil-based chemicals where germs can live, such as the oils our own skin makes, we need to use detergent.

So **don't** use detergent in your magma flows or it will mess them up – but **do** use detergent to get the oily dirt from off your hands.

- ⇨ Review with students what they felt they learnt from this lesson. Did they have any questions at the start that they feel were answered?

Success criteria

- ⇨ Review the Learning Intentions of this lesson with students. Was it met?

At the end of each class, review the learning objective and see how we did. Ask:

- ⇨ Did you achieve your learning goal?
- ⇨ What worked to help you achieve it?
- ⇨ What might you do better next time?

Assessment

Prior learning:

Find out what students already know and believe about lava, magma and volcanoes. Alternatively, older groups might also discuss what they know about convection currents, weather, and the difference between magma and lava.

Have students describe the safe setting up and handling of the materials in this activity, including oil, food colouring, and potentially pain killing medicine (i.e., Alka-seltzer tablets).

Formative:

Help students understand and explain the difference between lava and magma in terms of gas, density and chemical changes using the magma tubes.

Summative:

Help students consider ways they can communicate their new understanding to others, just as scientists need to do.

Encourage students to develop a poster to draw and describe the action of the magma tubes in terms of density, liquids and chemicals.

So what?

- When some chemicals (such as wizz fizz, vinegar, and bicarb) are mixed with water they begin to fizz, creating carbon dioxide gas.
- Liquids of lower density float up above liquids of higher density. Air bubbles can be used to make things that are normally denser than water, less dense than water. This is used in both science (submarines) and nature (the float bladder of fish)
- Some chemicals cannot be mixed, i.e. oil and water. (Unless you use detergent, which can chemically bond with both water and oils).
- Students must watch closely to observe the bubbles rising and popping on the surface.

Creating science

Science understanding

As we explored that some chemicals (vinegar and bicarb) when mixed with water begin to fizz, creating carbon dioxide gas, we learnt that;

- Chemical sciences 2: Different materials can be combined, including by mixing, for a particular purpose.

As we explored that;

- Some chemicals cannot be mixed, i.e. oil and water. (Unless you use detergent, which can chemically bond with both water and oils).
- Liquids of lower density float up above liquids of higher density.
- Air bubbles can be used to make things normally denser than water, less dense that water. This is used in both science (submarines) and nature (the float bladder of fish)

We were learning that;

- Chemical sciences 5: Solids, liquids and gases have different observable properties and behave in different ways

Science inquiry skills

As we learnt that science involves careful measurement, close observation, and careful safety protocols, we were reminded to;

- Planning and conducting 5: Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks (ACSIS086)

Science as a human endeavour

By carefully exploring, and then attempting to explain our observations, we experienced that;

- Nature and development of science 5: Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions (ACSHE081)

Scientist Name:
Date:

Magma Flows – worksheet

Thinking like a scientist: One important skill in science is knowing the difference between what you see, and making sense of what you see. In other words, **Observation** vs **Inference**.

Part 1: Drop in one drop of food dye.

This is your first observation. **What** happens to the drop? How long does it take to float down to the bottom and spread out into the water underneath?	*This is your first inference*. Can you theorise as the **why** the drop of dye behaved that way?

Theory: The oil and water are chemically different in that they don't mix. Food dye is a water based chemical, so will mix with water and not oil. To mix dye into oil you need to use oil based colours, or acrylic which can mix with both oil and water.

Part 2: Now drop in your fizzy maker.

Next observation: **What** happens when you drop in the fizzy mix	Second Inference: **Why** do you think what you observed happened?

Theory: The ingredients in the fizzy mix react with the water (and not the oil) to produce carbon dioxide gas. This gas has a strange yet entertaining effect on the coloured water. Usually water is denser than oil, so it stays at the bottom. But when the coloured water collects a few bubbles, its total density is now less than the oil. So it floats to the top.

Part 3: Magma flows

Third observation: Once the coloured drops get to the top, **what** happens?	*Third Inference*: **Why**?

Theory: The coloured water rises to the top due to the little bubbles stuck to it. The bubbles then pop once they reach the air. Thus, the water drops no longer have the air bubbles to help keep their density lower than oil, and they sink back down.

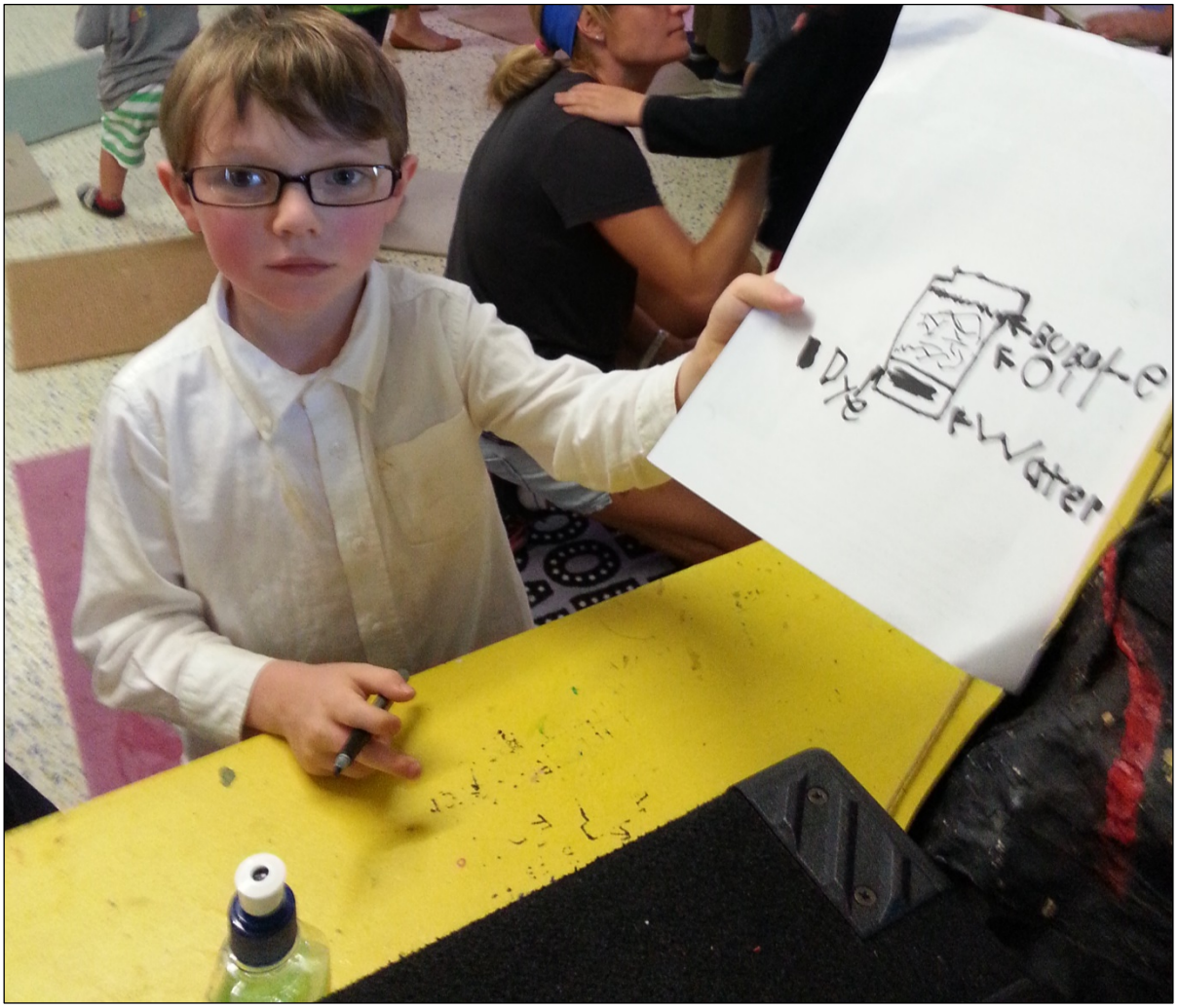
Tips from the Masters to make it work:

Careful recording pays off in science!

They look like this.

Sometimes they spill!

- Can two colours of dye separate in the Magma Flow?



Write it up carefully!

Bladder wrack, *Fucus vesiculosus*, is found on the middle part of the shore. The air bladders allow the seaweed to float upright when it is underwater. Taken 28th may 2014 from http://www.nhm.ac.uk/nature-online/british-natural-history/seaweeds-survey/