

Lava Lamp Experiment

Safety and First Aid

This section will only deal with the specific safety issues regarding the chemicals involved; there are likely to be other safety issues that will need to be addressed outside the scope of this section. A full risk assessment should be performed prior to undertaking the experiment.

- Students should not ingest any of the experiment; good lab practice starts young!
- There are no specific safety hazards associated with any of the chemicals used in this experiment
- Depending on your brand of food colouring, spillages may stain surfaces, clothes and upholstery
- This experiment uses cooking oil. Spillages on surfaces can be cleaned with warm soapy water. It should be noted that spillages on cloths and upholstery may be difficult to remove
- *First Aid* – wash the affected area with water

Glossary

- *Effervescence* – to give off bubbles of gas
- *Immiscible* – does not form a homogenous (all the same) mixture when mixed
- *Density* = $\frac{Mass}{Volume}$

Suggested Teaching Points

- *States of matter* – this experiment involves solids, liquids and gases.
- *Acids and bases* – this experiment involves the reaction of an acid and a base
- *Effervescence* – this experiment involves the release of gas
- *Density* – this experiment involves immiscible liquids of different density passing through each other
- *Immiscible liquids* – this experiment depends on water and cooking oil forming an immiscible mixture

What to Expect

Please see the video for a detailed depiction of the experiment. It should be noted that this experiment is not an accurate representation of the mechanism by which lava lamps actually work.

This experiment will reproduce a lava lamp effect by small droplets of water rising through a layer of cooking oil, before falling back down to the bottom. The droplets of water are propelled upwards through cooking oil when the indigestion tablet is added due to the release of carbon dioxide produced as the tablet dissolves in the water. Once the water droplets reach the surface of the cooking oil, the gas escapes from the experiment. The water droplet then falls back to the bottom of the container due to its greater density, resulting in circulating water droplets.

As shown in the video, we found that adding the tablets directly to the experiment resulted in a large number of very small water droplets being produced. Through experimentation, we found that slowing the rate of gas release provided larger water droplets that gave a more desirable effect.

Equipment and Chemicals

- A container about $\frac{1}{2}$ full with tap water
- Cooking oil
- Indigestion tablets that fizz when placed in water
- Food colouring

Supplementary Instructions

- The exact ratio of water to cooking oil is not essential for this experiment. However, we recommend using a greater volume of cooking oil to water so that the droplets have further to travel.
- The number of tablets needed to provide the desired effect is dependent on the size of the container used. The brand of tablet used will also affect this reaction.
- In our video, we found that fixing half a tablet to a coin slowed the release of carbon dioxide from the tablet and provided a slower but larger stream of droplets. This was one method we tried; there will be a number of alternatives

Once this experiment has been set up, it can be used indefinitely. After using the apparatus, simply leave the container to stand until the two layers have completely separated. Once the layers have separated, add another indigestion tablet.

Suggested Questions for Students

- *Why don't water and oil mix?* – in chemistry, a general rule is that the strongest bonds win. In water, the bonds between individual water molecules are very strong, whereas the bonds

between oil molecules are much weaker. If oil was to mix with water, it would break these strong bonds between water molecules and make the system less stable; therefore, oil does not mix with water.

- *Why does surface area affect the rate of reaction?* – in order for a chemical reaction to occur, the reactant molecules need to collide; therefore only molecules on the surface of a solid can react. By increasing the surface area, a greater number of molecules are exposed and able to react.
- *Why is water denser than oil?* – density is a measure of the amount of mass present in a specific volume for a given substance. In the case of water, the strong bonds that exist between the individual molecules means they are close together. For oil, the individual molecules are much further apart because the forces between the individual molecules are much weaker. As a result, there is a greater number of molecules of water, and therefore mass, in the same volume as there are oil molecules, resulting in water having a higher density than oil.

Suggested Improvements / Student Challenge

- *Improve the lava lamp effect* – students could investigate different methods to slow the release of carbon dioxide and provide larger droplets. This could be used to introduce the idea that surface area affects the rates of chemical reactions.
- *Investigate alternatives to indigestion tablets* – students could investigate alternative methods for the release of gases and their effect on the lava lamp effects. One possible alternative is to replace the water with vinegar and add baking soda instead of using indigestion tablet (see the Volcano experiment).
- *Introduce a third layer to lava lamp* – students could investigate introducing a third layer to the experiment. Liquids with a lower density and immiscible with cooking oil (e.g. rubbing alcohol) could be used.

Clean up and Waste Disposal

DO NOT wash the waste cooking oil down the sink as it will cause blockages. Decant the waste cooking oil into a suitable container (e.g. a plastic sandwich bag) and dispose of in a bin.

Waste water can be disposed of in the sink.

Spillages can be cleaned with soapy water and paper towel.