

Newtons Nemesis : ilm

This demonstration shows the properties of polymers, in particular oobleck, a mixture of cornflour and water.

Year groups: 7-9 (ages 11-14)

Educational objective

To demonstrate the properties of polymers.

Running time approx. 3 mins.

If you are having trouble playing this video, you may need to upgrade to the latest version of the <u>Flash media player</u>.

Key student learning

- Oobleck is a non-Newtonian fluid it does not have a fixed viscosity, instead it acts like a liquid unless a force acts upon it when it becomes solid.
- The cornflour in the oobleck forms a suspension in the water, called a colloid.
- Materials vibrate at different frequencies, which can be seen as ripples and peaks.
- The oobleck is a type of polymer. 'Poly' means many, and 'mer' means unit, so 'polymer' means 'many units', i.e. long chains of identical molecules joined together.

Notes on using the films in the classroom:

When you are showing the films to the class, for example on an interactive whiteboard, consider pausing the film at various intervals to involve and extend your students, e.g.

- What do you think will happen next?
- Why has that happened?
- What chemical reaction has occurred? How would we write that?
- You may want to consider relating the demonstration to examples of work you have done in the class. If you prepare the materials in advance you could even get your students to conduct the demonstration alongside the film (see Safety information).

Try this in the classroom

Materials needed

- Oobleck (a mixture of cornflour and water in the ratio 3:2)
- Bowl
- Spoon
- Disposable plastic plate
- Loudspeaker
- Tone generator

Method

- In a bowl, make some oobleck from 3 parts cornflour to 2 parts water. Stir gently and slowly to mix it.
- 2. Connect the tone generator to the loudspeaker.
- 3. Lay the loudspeaker on its side and balance the plastic plate over the speaker. Make sure it is level.
- 4. Spoon a generous amount of oobleck onto the plate.
- 5. Turn on the speaker and adjust the frequency to approximately 40 hertz.
- 6. Explore the effect on the oobleck.

Safety information

Make sure that you wear goggles and appropriate protective clothing while conducting this experiment. For detailed safety information contact CLEAPSS .

Discussion

- What's happening?
- What will happen to the oobleck at a lower or higher frequency?
- What would happen if the music had a very loud, pounding beat?
- Oobleck is a word that was used by children's author Dr. Seuss in the book Bartholomew and the Oobleck. Now it is commonly used to describe the sloppy goo made when cornflour and water are mixed, as in this experiment.

Extensions

- Try this with other fluids of different viscosities.
- Try filming the oobleck reacting to different kinds of music. Can you tell what type of music is playing by looking at the patterns with the sound turned off?

Links to everyday life

Aerogel

Aerogel is an example of a colloid - a solid (in this case silica gel) dispersed in a gas. NASA use aerogel to trap space dust particles and to insulate spacesuits.





Sample of aerogel used to collect dust particles, Stardust comet mission, 1999.

SR Gibbs toothpaste c.1973.

Other fluids that change their viscosity

Toothpaste also changes its viscosity, but it behaves in the opposite way to oobleck. When you apply a force by squeezing the tube it flows, but when you leave it alone it will remain solid so won't drip off the brush. Paint behaves in the same way as toothpaste. These are both non-Newtonian fluids, but they are shear thinning fluids rather than shear thickening fluids like oobleck.

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Curriculum links Key Stage 3

This activity encourages practical enquiry skills in the area of 'Chemical and material behaviour', specifically:

- Varying solubility
- Link behaviour and nature of materials to particle structure
- Changes of state solid, liquid, gas
- Explanation of the different physical properties of each state

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