Custard

Download the teacher notes,
student workbook and technician notes
that accompany this resource at
rsc.li/3zcwpLy.

ROYAL SOCIETY OF CHEMISTRY

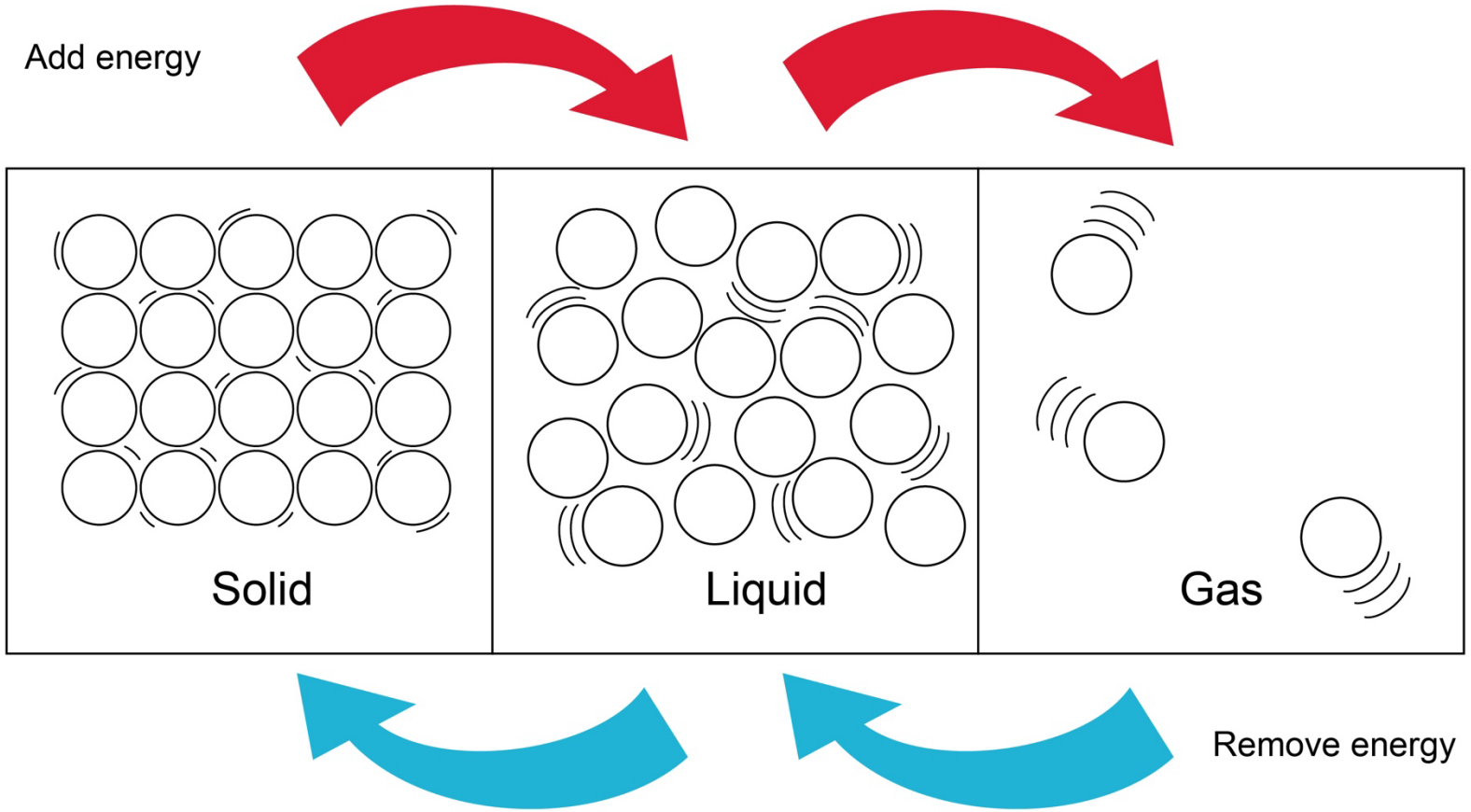
Learning objectives

By the end of this session, you will be able to:

- Explain what a non-Newtonian fluid is.
- Describe conditions where powders may become explosive.

Recap

What are the three main states of matter?



What is a Newtonian fluid?

- Newtonian fluids are those that follow Newton's laws of physics.
- The properties of Newtonian fluids are the same as we would expect them to be based on the normal properties of solids, liquids and gases.
- For example, when a person jumps into a pool of water, they sink straight away, rather than float.

What is a non-Newtonian fluid?

Non-Newtonian fluids do not demonstrate the normal behaviour we would expect based on the properties of liquids.

Viscosity is a measure of thickness. A liquid with a high viscosity is very thick and does not pour easily.

Newtonian fluids cannot change their viscosity no matter how you change the amount of pressure or stress the fluid is under.

However, the viscosity of a non-Newtonian fluid can change depending on the conditions they are in.

Can you walk on custard?

Activity 1

Custard slime

See student workbook

Custard slime

You are now going to make some custard slime and use your observations to decide whether it is acting as a Newtonian or a non-Newtonian fluid.

Method

1. Measure out 25 g of custard powder into the beaker using a balance.
2. Measure 15 ml of tap water using the measuring cylinder.
3. Add the water to the custard in the beaker and mix them until you have formed a paste.
4. If the mixture does not form a paste, add more water drop-by-drop until it does.
5. Play with your slime – experiment with mixing, rolling it into balls and pushing it sharply.

Questions

(a) What does your custard slime feel like when you stir it? Is it acting like a Newtonian fluid or a non-Newtonian fluid?

(b) What happens when you stop stirring the custard slime? Is it acting like a Newtonian fluid or a non-Newtonian fluid?

Answers

(a) When custard slime is stirred, a force is being applied by the spoon/rod and it behaves as a non-Newtonian fluid.

(b) When stirring stops, there is no longer a force on the custard slime, so it acts like a Newtonian fluid.

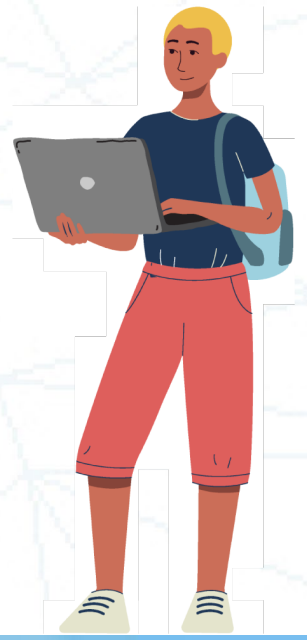
Activity 2

Custard bomb demonstration

See student workbook

Activity 2

Custard bomb demonstration



Questions

(a) Did the custard bomb work? If not, why not?

(b) What could you change to improve the custard bomb?

(c) Was the design in the video reliable? Can we always trust what we see?

Implications of non-Newtonian fluids

- Some types of clay can turn into a runny liquid during an earthquake. Why is this a problem?
- Body armour can be made with material that behaves like a liquid until a sudden stress is applied. How are non-Newtonian fluids useful in this case?

Career link

Consumer products technician

Watch the video to meet Robert, a consumer products technician. He uses his understanding of materials, such as non-Newtonian fluids, to develop desirable properties for consumer products, including cosmetics, adhesives and cleaning products.

Acknowledgements

This resource was originally developed by the University of Reading to support outreach work delivered as part of the Chemistry for All project.

To find out more about the project, and get more resources to help widen participation, visit our Outreach resources hub: rsc.li/3CJX7M3.