The Science of Soap

LESSON PLAN

RECOMMENDED FOR YEARS 3 - 6

Lesson summary

In this lesson, students conduct a simple scientific investigation to find out what agitation does to soap and how effective it is for cleaning stains from a piece of material. By the end of this lesson, students will have a better understanding of why using soap and agitating it through rubbing and scrubbing is necessary for getting rid of germs.

Learning objectives

Students can explain why soap is necessary for getting rid of germs.
Students can conduct a simple investigation to find out what agitation does to soap.

Possible Australian Curriculum links

Science Inquiry Skills / Questioning and predicting / Planning and conducting / Processing and analysing data and information

STARTER

1. Ask students to identify different ways we can keep our bodies clean, such as washing our hands, taking a shower, or brushing our teeth. Discuss which of these strategies relate to preventing the spread of viruses and bacteria.
2. Fill a large bowl ¾ of the way with water. Add a couple of sprinkles of black pepper. You want a sufficient amount of pepper to be visible along the top of the water, but not so much that you can't see the water. Add a couple drops of dishwashing liquid to the water using a dropper and have students observe how the "germs" run away from the soap and cling to the side of the bowl. You might like to have students conduct this activity in pairs or small groups. Ask them to discuss what they observed and hypothesise why they think that happened.

BODY

1. Explain to students we are going to find out if agitation or no agitation is the best way to remove a stain from a piece of material. Ensure students understand what agitation means (the action of briskly stirring or beating something). Elicit ideas from the class about how we could investigate this question.
2. Using the planning template, have students identify what variables need to be changed and what variables need to be kept the same. Have students carry out the investigation in pairs. You can tweak how teacher-led or child-led the investigation can be, depending on year level.
3. Ask pairs to put a small amount of tomato sauce or equivalent stain on each strip of material, using the back of a teaspoon to rub the stain in (you can leave the stain in for 24 hours before the investigation to obtain better results). Have them add the same amount of cold water and laundry detergent to each of the two buckets and stir this in using a teaspoon. Emphasise how everything needs to be kept the same, including the amount of time the soapy water is stirred, to ensure a fair investigation.
4. Have students use labels to label one bucket as 'agitated' and the other as 'non-agitated'. You will also need one stained material set aside for the control, to compare with the washed strips at the end of the experiment. For the 'non-agitated' bucket, have one student in each

Resources

- Black pepper
- Large bowl
- Water
- Dropper
- Dishwashing liquid
- Buckets or tubs – 2 per pair
- Small strips of material all the same size
- A suitable stain (e.g. tomato sauce or mud)
- Cold-water laundry detergent
- Teaspoon
- Paper or masking tape for making labels

Health and safety

Ensure students clean up any spills immediately to avoid accidents.

pair place the strip of material in the soapy water. At the same time, the other student dips the material in and out of the 'agitated' tub. Perhaps pairs could identify how long the material should be washed in the buckets (e.g. 20 seconds) but this needs to be specified as a variable prior to conducting the investigation.

5. Have students remove the strips of material at the same time and place on labelled paper. As a whole class, compare the agitated and non-agitated strips to the original stain (control). Discuss which methods of cleaning produced the cleanest strip of material and why this might be. Have students record their observations and reflect back to their original predictions on the planning sheet.

PLENARY

Recap students' understanding of the need for 'agitation' or thorough rubbing when using soap to wash our hands and remove germs. In small groups, have students create a hand-washing song or dance routine. Explain to students that their song or dance needs to be aimed at younger children to encourage them to maintain effective hand hygiene. There are plenty of handwashing dance routines and songs online that you can show students for inspiration.

Cross-curricular opportunities

Learn about how people kept clean in the past, before soap was invented. Research about how people washed themselves and their clothes and explore how cleaning equipments, such as a washing machine, have changed over time. HASS / History

Question prompts

Why does soap wash better than just water alone?
What happens to soap when you start to agitate it?
Is detergent better than no detergent for removing stains?
Does warm water or cold water work best for cleaning a stain?

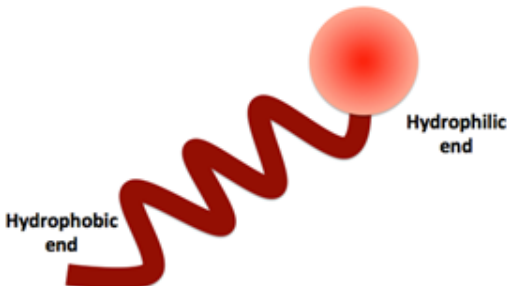
Students could perform their song or dance to a younger class or at an assembly to encourage whole school hand hygiene.

This plenary activity links to outcomes in Health and Physical Education / Contributing to healthy and active communities.

WOW Lesson!

THE SCIENCE BEHIND THE ACTIVITY

Soaps are a type of surfactant containing large molecules that look a bit like a tadpole and consist of two basic parts: the hydrophilic head and the hydrophobic tail. The tail of the molecule is nonpolar (does not have a charge) and does not like water. Hence, it is called hydrophobic or 'water fearing'. It is structurally very similar to oil and thus is soluble in oil. The head of the molecule is called hydrophilic as it is 'water loving'. It has a slight charge (and is called polar) making it soluble in water.



These water fearing and water loving properties of soaps are essential to how soap works. When used for cleaning, soap works by making the oil or dirt mix with water, which can then be separated from the article being cleaned and washed off. Germs stick to the oils and grease on our hands. Washing your hands with water alone won't remove much of the germs on our hands because water and oil don't like each other, so they won't mix. When you wash your hands with soap, the soap molecules act as a mediator between the water and oil, binding with both of them at the same time. When you rinse everything off, the soap carries away the germs with the water. This means that soap doesn't actually kill germs on our hands, but instead removes them.

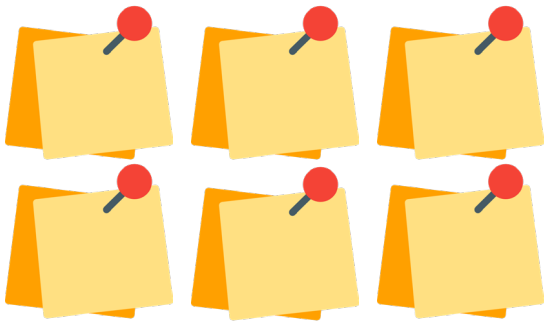
Dr. Asha Bowen, an infectious diseases researcher at the Telethon Kids Institute and paediatrician at Perth Children's Hospital, recommends that our best defence against the spread of infection is to wash our hands well with soap and water. It is important to work up a lather when washing our hands because it helps lift the dirt and oils from our skin. "Washing your hands with soap and water after coughing or sneezing is really critical during the COVID-19 pandemic. On those occasions when you are out and do not have access to soap and water, an antibacterial gel is a good thing to have available. But do not panic if you cannot find any, because soap and water do the job just as well." Dr. Bowen recommends that parents and kids wash their hands for 30 seconds. The best way to do this is to make lots of bubbles and sing a song such as happy birthday out loud from beginning to end!

INVESTIGATION PLAN

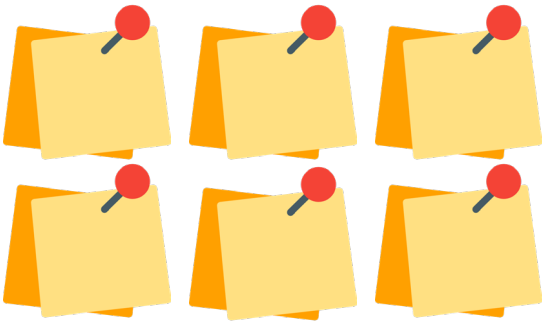
Name: _____ Date: _____

We are investigating:

What variables can we change?



What variables could we measure/observe?



What if we change...?

What are we going to see happening?

We will change:

We will observe/measure:

Our question is...
Think about including your change and measure in this.

We will keep it fair by keeping these the same:

Our prediction is...
(This is what we think will happen and why)

I think that...
I think this because...
Can you describe and explain using scientific vocabulary?

Key words:

INVESTIGATION PLAN

EXAMPLE

We are investigating:
what is the best way to remove a stain out of a piece of material

What variables can we change?

- agitation or no agitation
- type of detergent or soap
- how we agitate the material
- temperature of water
- length of time
- amount of detergent or soap

What variables could we measure/observe?

- size of stain
- colour of stain
- time it takes to remove stain

What if we change...?

We will change: agitation or no agitation

What are we going to see happening?

We will observe/measure: size of stain

Our question is...
Think about including your change and measure in this.

Does agitation affect the size of a stain on a piece of material?

We will keep it fair by keeping these the same:
Type of detergent, how we agitate the material, temperature of water, length of time, amount of detergent and soap

Our prediction is...
(This is what we think will happen and why)
I predict that agitating the material will result in a smaller sized stain because agitating will produce foamier water, which will help remove the stain faster.

Key words:

Agitation
Soapy
Foamy
Lather