Science Investigations

When you carry out science investigations you are working scientifically and this involves lots of different skills, which you will use and develop this week.

Investigations

Option A

- Go to this website: https://www.rigb.org/families/experimental
- Look through the list of different experiments
- Choose one you are interested in
- Watch the video
- Download the instruction sheet
- Have a go at the experiment!
- Write up your experiment using the framework in this document

Option B

- Look through the activities in this document
- Choose one you are interested in
- Carefully read though all the information
- Have a go at the experiment!
- Write up your experiment using the framework in this document

Working Scientifically

- I can take accurate and precise measurements using a range of equipment

- I can record data and results using tables and graphs

- I can use test results to make predictions

- I can report on my findings and make conclusions

Investigation

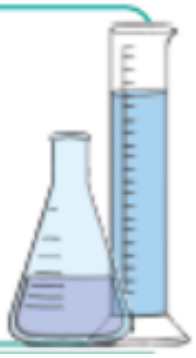
Equipment

My Prediction

Method

Results

Conclusion



IndusTRY AT HOME!

About this activity

In this activity you will investigate how to make the 'best bubble' by trialling, adapting and evaluating mixtures of different liquid ingredients and finding the average lifespan of the bubbles. Just like scientists in industry, you will use your research to improve your recipe for the product... bubble mixture! You could try this activity inside or outside... or both!

Kit List

- ☑ Washing up liquid
- ☑ Water
- ☑ 4-6 small containers (e.g. yogurt pots)
- ☑ Bubble wand (could be homemade – see examples)
- ☑ Teaspoon (could use a pipette or medicine syringe if you have one)

Time: 30 Minutes+

Watch out!

- Take care not to get bubble mixture in your eyes when observing the bubbles closely.
- This activity could be quite messy if tried indoors and could also make some floor surfaces quite slippery so make sure you clean up afterwards.
- If you colour the mixture with food colouring, be aware that clothes could get messy too.

The best BUBBLE

Important words to understand:

- industry
- liquid
- mix
- mixture
- investigate
- compare
- ratio
- repeat
- adapt
- improve
- evaluate
- product

Not sure what they mean? You could use a dictionary to check (paper or online).

The Bubbles Company need a 'best bubble' mixture to make the longest lasting bubble. Can you make one?

OUR METHOD

- We mix washing-up liquid and water together (teaspoons/pipettes/syringes)
- We use as much water as possible to keep costs low

Make 4-6 different mixtures using different ratios of the ingredients. When you have discovered the ideal mixture, you must convince our directors that you have the best product.

THEY WILL WANT TO KNOW...

- How did you carry out your tests and make them fair? Think about force of breath, landing surface and size of bubble wand.
- How did you test each bubble mixture?
- What are your results?
- Average bubble lifespan (B1+B2+B3 ÷ 3)
- Which recipe makes the longest lasting bubbles?
- Why do you think your recipe is the best?

Write a short report or make a video to share your results with The Bubbles Company.

Share it with us @ciecyork

Recording your Results

	Ratio of bubble mixture (in teaspoons/pipettes/syringes)		Life span of bubble (in seconds)			
	Washing up liquid	Water	Bubble 1	Bubble 2	Bubble 3	Average
1	:					
2	:					
3	:					
4	:					
5	:					
6	:					

Follow up investigations:

- Design and make different bubble wands with a pipe cleaner or craft wire. Does the shape of the bubble wand make a difference?
- Does adding food colour to your bubbles affect your results?
- How could you create the biggest bubble?
- How long can you keep a bubble afloat for? Try blowing it or fanning it with some paper to keep it in the air.
- If you have some glycerine at home, how does adding this to your mixture change your results?

Things to think or talk about:

- What makes a bubble the 'best bubble'? The largest? The longest lasting? The most bubbles from one blow?
- Are all bubbles the same? How are they different?
- Which surfaces do bubbles last longest on?
- Can you catch a bubble without popping it?
- Do bubbles float or fall?
- Why does a bubble take longer to fall than a football or tennis ball?
- Can you find anything which falls slower than a bubble?
- Take a science selfie and share it with your friends and family.

Time to Investigate

1. Get your equipment ready.

2. Check you have everything you need.

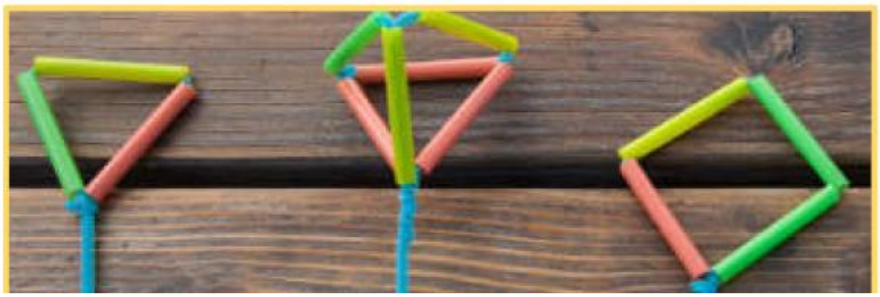
3. Measure out your ingredients.

4. Try your bubbles out!

5. Adjust your recipe and try again.

6. Time to report your results.

Bubble Wand Inspiration



IndusTRY AT HOME!

About this activity

In this activity you will learn about how we use filters to separate things. You will test different materials to find which ones are best at cleaning murky water. Just like scientists in industry, you will prepare samples, carry out a fair test and record measurements.

Kit List

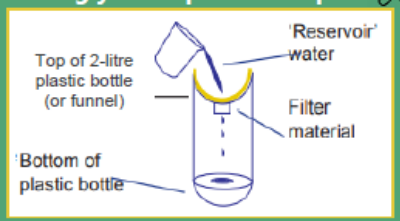
- ☑ 'Reservoir water' (see instructions below)
- ☑ Small plastic cup and containers e.g. small pop bottles and empty jars (see-through if possible)
- ☑ Timer (tablet, phone or watch)
- ☑ Funnel (can be home made from bottle top – see instructions on next page)
- ☑ A selection of filters – choose from:

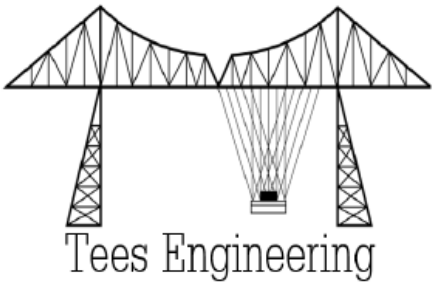
colander	sieve
fishing net	tea strainer
old nylon tights	old sock
muslin cloth	kitchen roll
cotton wool	coffee filter
dish cloth	J-cloth
anything else you can find at home	

Make your own 'reservoir water':

Fill a bucket or other large container with tap water and use a stick to stir in a few handfuls of garden soil. Add a good mix of whatever else you can find, such as: leaves, twigs, stones, gravel, compost and sand. If you can't access a garden, go for a walk to your local park or field and collect your items from there.

Setting your experiment up:





Important words to understand:

- industry
- engineer
- filter/filtration
- murky
- clear
- reservoir
- separate
- sample
- solid
- liquid
- observation

Not sure what they mean? You could use a dictionary to check (paper or online).

Filter Hunt

Before we get started, take a look around your home for some common household filters. Here's a list to get you started. Can you find any examples of your own?

	sieve		**colander**		**tea bag**
	washing machine drum		**fishing net**		**kitchen sink strainer**

The engineers at 'Tees Engineering' are finding the murky water from a nearby reservoir is not clear enough to use for cooling their equipment. It needs to be clean, otherwise the particles in the water block the pipes and pumps. The water needs filtering to remove any solids. Speed of filtration is important but so is ensuring the filter does a good job. Can you help them find the best filter to clean the reservoir water?

OUR METHOD

- Set up your experiment (see diagram).
- Give the murky water a stir and then use this to fill a plastic cup.
- Pour the water in to the filter lined funnel and begin timing immediately (you may have to pour a little at a time to prevent overflowing).
- Stop the timer once all the water has filtered through into the clear container.
- Record the time and other observations in the table of results.
- Repeat these steps for each filter you are testing.

Make your own funnel:

If you don't have a funnel you can easily make one by asking an adult to cut the top off a 2-litre pop bottle. You will need to make the edge safe by wrapping tape around it or **asking an adult** to carefully use a flame to smooth the sharp edge as shown in this YouTube video:
https://www.youtube.com/watch?v=ucq75hj0aYw

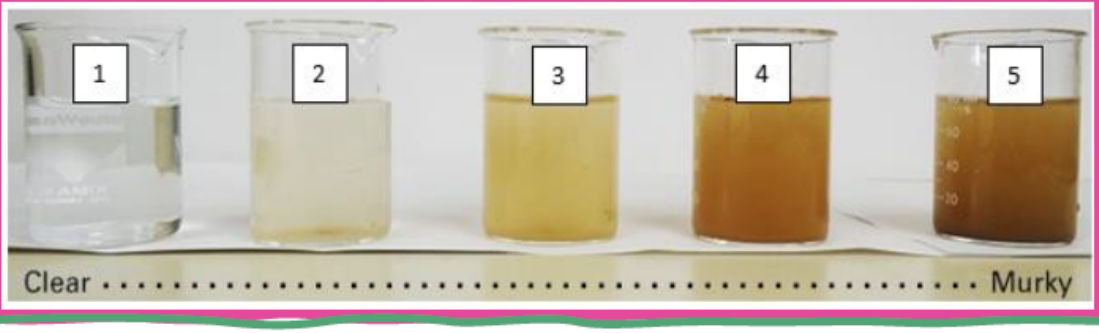
Watch out!

- You must wash your hands thoroughly after handling soil and 'reservoir water'.
- Do not rub your eyes or touch your mouth whilst handling soil and 'reservoir water'.
- If collecting the items to make 'reservoir water' outside of your home, remember to stay 2 metres away from people you do not live with and wash hands thoroughly when you get home.

Recording your Results – compare your filtered water to the samples pictured below to help you decide how clear it is and circle the number.

Filter type	Time taken	How clear?					Other observations
		1	2	3	4	5	
		1	2	3	4	5	
		1	2	3	4	5	
		1	2	3	4	5	
		1	2	3	4	5	
		1	2	3	4	5	

How do your samples compare to these?



Once you have carried out your investigation, you must convince the engineers that you have found the best filter.

THEY WILL WANT TO KNOW...

- How did you test each type of filter?
- How did you make your tests fair?
- What are your results?
- Which material made the fastest filter?
- Which material gave the clearest water?
- Which was the best overall filter? (fast and clear)

Write a short report or make a video to share your results with Tees Engineering. Share it with us @ciecyork

TAKING IT FURTHER

Follow up investigations:

- Make sure your filtered water is in a clean container. Shine a torch through on to a wall to check its clarity by seeing how many pieces of paper it takes to block out the torch light.
- Make your own filters by cutting holes of different sizes into card using a hole punch, scissors and a pin and folding it in to a cone shape. Now try using these to sort some other mixtures like flour, rice, raisins and seeds (avoid any personal allergens).
- Repeat the investigation using measured quantities of soil, gravel etc. to see if the filters perform differently.

Things to think or talk about:

- Is the time taken to filter the water or the water's clarity (how clear it is) the most important result? Why?
- Which materials made good filters? Which made bad filters? What properties do they have that make them good or bad?
- Why is the water unsafe to drink, even after filtering?
- Did any of the filters become blocked quickly? Why?
- What might engineers do when industrial filters get blocked?
- Were any of your results unexpected?

Visit our website to find out more about this investigation: http://club.cciproject.org/waterForIndustry/filter1.htm

IndusTRY AT HOME!

MediTech

About this activity

In this activity you will find out how mould can be useful in the medicines industry. You will investigate to find out the best conditions for mould growth. 'Conditions' means what a place is like to be in, such as hot/cold, dark/light etc. Just like scientists in industry, you will carry out a fair test, make careful observations and report your findings.

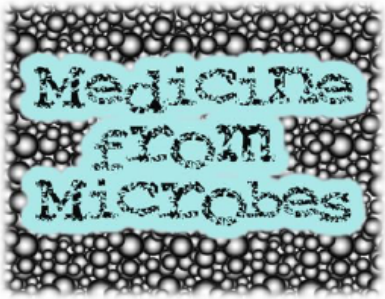
Kit List

- ☑ 6 freezer bags (must be see through and sealable)
- ☑ 3 slices of fresh bread
- ☑ A cup of water
- ☑ Permanent marker

Time: 30 minutes to set up
(+ 10 minutes daily observation for 2-3 weeks)

Watch out!

- Some microorganisms which cause food to decompose are not visible so keep bread samples sealed inside plastic bags at all times.
- Be aware of any allergens when choosing bread or any other items for investigation.
- Once the investigation is complete, dispose of all bread samples without opening the sealed plastic bags.



Important words to understand:

- Fair test
- Mould
- Microorganism
- Microbe
- Germ
- Infection
- Bacteria
- Antibiotic
- Extract
- Technology
- Industry
- Medicine

Not sure what they mean? You could use a dictionary to check (paper or online).

The Problem

MediTech, a biotechnology company, have been researching different plants and foods to extract ingredients which might make new medicines. Their latest discovery found that a mould growing on food seemed to stop other microorganisms (germs) growing close by. MediTech think this mould could be used as a medicine because it could stop bacteria, which are microorganisms too, from growing. If they are right, it could be used to make a new anti-biotic medicine to treat things like cuts which often get infected by bacteria and dirt.

Can you help by finding out which conditions produce mould the quickest and which conditions produce the most mould?

OUR METHOD:

- Cut each of your slices of bread in half to give six bread samples – the halves should be used to test opposite pairs of conditions.

Testing Conditions to Compare		
warm/cold	moist/dry	light/dark

- Prepare your samples by sealing the six halves in plastic freezer bags (sprinkle some water on one sample to test the 'moist' condition). Remember, samples **MUST NOT** be reopened again after the investigation begins!
- Decide where you will place your bread samples, choosing locations which are safe to reach and out of the way.
- Using the permanent marker, label each sample with details of the date, location, and test conditions (e.g. 10.06.20 – next to boiler – warm)
- Decide how you will record your results (see page 2 for ideas)
- Place the samples in your chosen locations and revisit them regularly to record results/make observations – approx. 10 minutes each day for 2-3 weeks

Make a Prediction:

Which conditions do you think will produce the most mould?
Which conditions do you think will produce mould the quickest?
Why do you think this?

How to keep your test fair:

To keep your test fair, you will only be changing one thing, where your bread samples are placed. Everything else will need to be kept the same:

Change	Keep the Same	Measure
Conditions the bread samples are kept in	Size of bread samples (half slice) Loaf of bread Types of plastic bag (sealable) Time between observations (24 hours) End of investigation	Amount of mould produced Scale 0-10 Sketch Photo/video diary

Adapted from: http://www.ciec.org.uk/resources/medicines-from-microbes.html

Recording your Results – Try recording your results in one or more of the following ways:

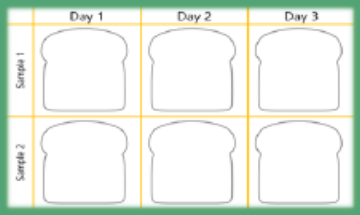
Table of Results (Copy this table out making sure you have enough rows for the number of days your investigation will last.)

Day	Mould covering (1-10)						Other observations
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	
1							
2							
3							
4							
5							

Use a 0-10 scale to describe how mouldy the bread is from no mould (0) to completely covered (10).

	= 0	No mould
	= 5	Quite mouldy
	= 10	Completely covered in mould

Sketch Diary



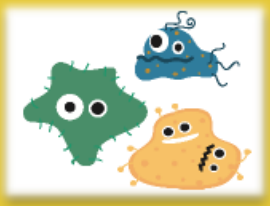
Draw the slices of bread and colour the areas of mould that appear. Try using a different colour for each bread sample.

Photo Diary

Video Diary

Reporting Your Results

Once you have completed your observations and recorded your results, it's time to advise the MediTech scientists which conditions are best for growing mould.



THEY WILL WANT TO KNOW...

- How did you test the different growing conditions?
- How did you keep your investigation fair?
- What are your results?
- Which conditions are the best for growing the most mould?
- Which conditions are the best for growing mould the quickest?
- Why do you think these conditions are the best?

Write a short report or make a video to share your results with MediTech
Share it with us @ciecyork

Did You Know?

Living things do not always do what we expect them to. When scientists set up investigations, they usually have some ideas about what they think will happen and use the investigation to check their ideas are correct. It can be really interesting when something unexpected happens! The scientists then have to go back and check their work for mistakes before changing their ideas and setting up a new investigation to see if the same thing happens again.

Follow up investigations and activities:

- Repeat the investigation using a different brand of bread or different bread product like a bagel or crumpet, or combine test conditions like warm and moist versus cold and moist.
- Turn numerical results into a line graph. You will need different colour lines to show the results for different test conditions.
- Find out about other plant materials which have medicinal properties e.g. dock leaves, willow bark or oat grains.
- Research some famous scientists who have made important biological and medical discoveries: Louis Pasteur, Edward Jenner, Dorothy Hodgkin, Rosalind Franklin, Sir Alexander Fleming and Florence Nightingale.

Things to think or talk about:

- Which other foods have you seen growing mould?
- Based on your observations, what conditions do you think might cause mould to grow?
- Where is food usually stored? Is it warm or cold? Moist or dry? Light or dark?
- What different places do you store food in your house? Why do you think those places are used?
- Investigations using living things like microorganisms (e.g. mould) don't always go to plan, why do you think this is?