BRITISH SCIENCE WEEK

NATIONAL SPACE ACADEMY

Diverse jobs

Astronaut hovercraft experiments

About this activity

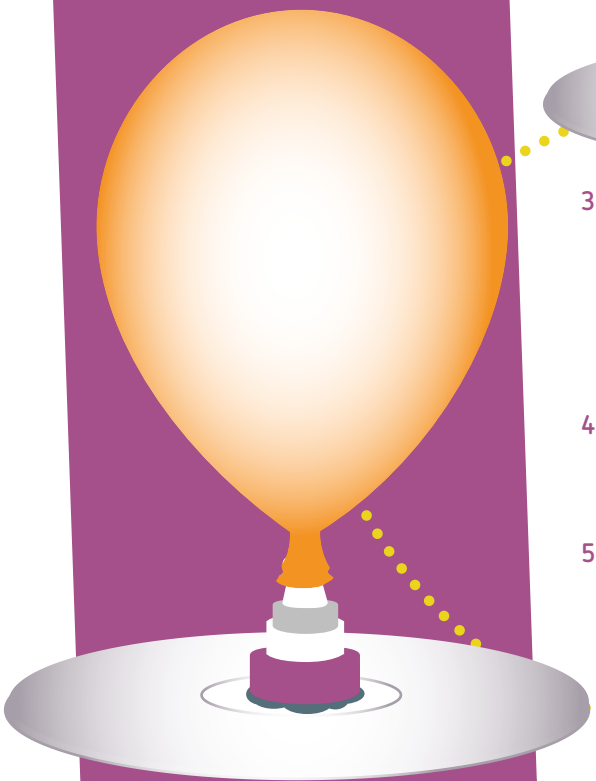
In March 2020 there is a cargo resupply mission to the International Space Station (ISS). The ISS was built by space agencies from countries around the world.

In this activity you'll look at some of the experiments that UK European Space Agency (ESA) astronaut Tim Peake completed onboard the ISS, before you have a go yourself!

Kit list

- 1 x CD
- 1 x pull-up bottle lid (such as on a sports drink)
- 1 x balloon
- 1 x blob of Blu Tack
- Stopwatch or camera (optional)
- 2 x one metre rulers (optional)

Time: 1 hour

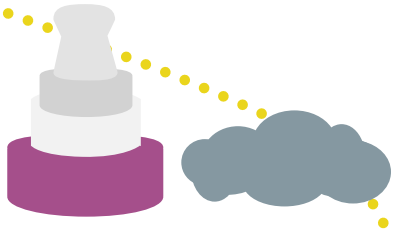


Instructions

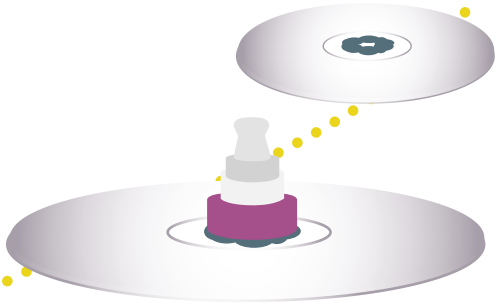
First, head to astroacademy.org.uk/resources/collisions to watch Tim Peake's demonstrations of elastic and inelastic collisions between objects of different masses.

Now it's your turn

1 Roll the Blu Tack into a sausage shape and press it around the edge of the bottom of the bottle lid.



2 Push the bottle top down onto the middle of the CD so that it sticks to the CD with no gaps for the air to escape, except through the hole in the CD.



3 Blow up the balloon reasonably full, but not completely, and then twist the bottom round several times (so the air doesn't come out while you're attaching it to your hovercraft base!)

4 Stretch the balloon over the top of the bottle top with the bottle top closed. Untwist the balloon.

5 When you want your hovercraft to go, pull the bottle lid into the open position. Push your hovercraft gently and watch how far it glides!

6 Just like Tim did in the video, try (gently!) colliding two hovercrafts. What happens and why?

Next steps

- What happens if you increase the mass or velocity of your hovercraft? Can you think of a way to record data from your experiment to show what is happening?
- Download the CAPCOM GO! app by NSC Creative in the app store to see an augmented reality rocket launch.

At home

Visit spotthestation.nasa.gov to see when the ISS will be visible in your area.

We would love to see your hovercraft experiments. Ask your teacher to share them with us.

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To find out more about us visit

nationalspaceacademy.org

By Natalie Tunnicliffe, Physics Teacher at the National Space Academy

BRITISH SCIENCE WEEK

ARMY BE THE BEST

Diverse jobs

Frontline biology

About this activity

Soldiers use a lot of energy as they work, so they need regular meals and snacks to keep going. Many soldiers must work far away from their Army base, so they won't always have time to stop to prepare food. In this activity, you will design them a high-energy snack they can eat 'on the go'.

Context

The Army fulfills many roles in different parts of the world. Following a severe earthquake over 100,000 people are without shelter, food or clean water. In situations like this the British Army gets deployed to provide urgent relief. Soldiers build temporary bridges and shelters. They also distribute emergency blankets, food and water. Time is always of the essence as the soldiers and other Army personnel work around the clock. They need to keep their energy levels high.

Kit list

- ☑ Ingredients from the table on the following page – ideally all of them, or as many as possible.

Time: 1 hour

Watch out!

We do not advise eating the food you have made. If you do you should follow the guidelines in The ASE booklet Be safe! (4th edition), which has a Safety Code for food hygiene.

Instructions

1 Think about what you want your snack to contain, and any other criteria it needs to meet. For example, it should:

- ☑ Contain between 250 and 300 calories.
- ☑ Contain less than 25g of sugar, as this releases energy too quickly and can be bad for soldiers' teeth.

2 Now it's time to design your snack. Use the ingredients on the key facts page to choose what will go into your snack.

3 Make sure you remember to:

- ☑ Calculate how many grams of total sugar and calories your snack will contain.
- ☑ List your ingredients and why you have chosen each one.

Using the table on the next page design your snack.

Use as much or as little as you like of each ingredient e.g. 10g, 20g or 30g

- ☑ Add up the total carbohydrates, sugar and calories your snack will contain.

Next steps

Learn more about the diverse careers the army has to offer:
army.mod.uk/careers

BRITISH SCIENCE WEEK

Work sheet

Now choose your ingredients!

ARMY BE THE BEST

Make sure you consider:

- Which ingredients will go well together to make a tasty snack?
- Which ingredients will make up most of your snack?
- Which ingredients will you include just a little of?
- Choosing at least one bonding ingredient to hold your snack together.

Ingredient	Quantity	**Carbohydrates** (Starch) Provide energy	**Carbohydrates** (Sugar) Spike blood sugar and damages teeth	**Fat** Provides slow release energy	**Protein** Builds and repairs muscles	**Calories** total energy provided by food
Oats	10g	7g	0g	1g	1g	40
Whole wheat flakes	10g	8g	2g	0g	1g	35
Brown rice syrup*	10g	8g	8g	0g	0g	50
Honey*	10g	9g	9g	0g	0g	30
Dark chocolate*	10g	5g	2g	4g	1g	60
Milk chocolate*	10g	6g	5g	3g	1g	55
White chocolate*	10g	6g	6g	3g	1g	55
Crisped rice	10g	9g	8g	0g	1g	40
Sultanas	10g	8g	6g	0g	0g	30
Dates	10g	8g	6g	0g	0g	30
Dried apple	10g	7g	6g	0g	0g	25
Coconut	10g	1g	1g	6g	0g	60
Dried berries	10g	8g	7g	0g	0g	30
Peanut butter*	10g	2g	1g	5g	2g	60
Almonds	10g	2g	0g	5g	2g	60
Hazelnuts	10g	2g	0g	6g	1g	60
Mixed seeds	10g	2g	0g	5g	2g	60

* = bonding ingredient

BRITISH SCIENCE WEEK

ROYAL MUSEUMS GREENWICH

Lloyd's Register Foundation

Diverse jobs

Conservation matter(s)

About this activity

Can you protect your favourite objects from the agents of deterioration?

The Prince Philip Maritime Collections Centre (PPMCC) at Royal Museums Greenwich has a diverse collection of historic objects, which need careful storage depending on the material they're made from. In this activity, you will play the role of a conservator and use your creativity and knowledge of specific material types to design ways of preventing irreversible damage.

Kit list

- List of agents of deterioration (found on following page)
- Condition report, downloadable from **rmg.co.uk/see-do/british-science-week**
- A range of everyday items made from materials with different characteristics, including natural and man-made. These could be wood, stone, paper, plastic or metal
- Extension activity – materials to build the protecting casing.

Time: 1 hour

Instructions

1 Working as a pair, select three items from those provided. Make sure each item is made from a different material.

2 Investigate each object using the condition report via the link in the Kit List. Follow the questions of the report to identify the object's condition. Notice how the material of each item has different characteristics.

3 As a conservator, your aim is to protect your items from deterioration. Read the list of common types of deterioration and discuss with your partner. List on your report the deteriorations you think your items are most susceptible to.

4 Now you have identified the agents of deterioration, you need to think about how you are going to prevent them damaging your objects. You will notice that some materials are more vulnerable to multiple types of deterioration than others. To prevent further damage, you must design a container for each object that will reduce any risk to the item - whether it's pests, temperature, light, humidity and/or humans.

5 Present your design to your classmates. When making the presentation, ensure that you back up your choices and designs with scientific knowledge. Present reasoned explanations, including explaining the data behind your predictions of how your object may be damaged when exposed to different types of deterioration.

For example:
This comic book is susceptible to light damage. The evidence shows this because the exposed front page is lighter than the pages on the inside, which are usually hidden from light; therefore, my container will be made from U.V protective glass.

6 How are the needs of each of your three items different?

BRITISH SCIENCE WEEK

Supporting Information

Agents of deterioration

ROYAL MUSEUMS GREENWICH

Lloyd's Register Foundation

Objects can be damaged in many ways. Here are some examples you may wish to consider when thinking of how to protect your objects. Can you think of any other examples?

Human action

Often objects become damaged through misuse or not being stored properly. Physical force can damage artefacts directly by causing stress, breakage and pressure. This could be due to stacking objects on top of each other or accidentally knocking into an item. Staff at Royal Museums Greenwich prevent physical force damage by storing artefacts in cases or in cabinets. The most common cause of damage by humans is over-cleaning. Vandalism or theft are also a concern, especially for objects in public areas.

Light

Light damage can be caused by overexposure to either natural or artificial light. Light has the biggest effect on paper-based objects, and in the case of letters or manuscripts, can result in the object becoming unreadable. It's a shame if artefacts fade from exposure to excessive light, as it makes it harder to see what the artefact originally looked like. Staff at Royal Museums Greenwich try to minimise the amount of times light sensitive objects are exposed to light by rotating them from display and storing them in dark cabinets or containers.

Fire

Fire can cause smoke damage, or partial or total loss of the artefacts. As a result, it is important that fire prevention be given the highest priority possible. Staff at Royal Museums Greenwich use secondary housing to protect the objects from fires. Secondary housing means putting a container within another container to create an extra barrier.

Water

Water damage can result from natural occurrences, human intervention or plumbing failures. The museum stores its collection off the floor and inside cabinets, in anticipation of a leak or flood.

Pests

Pests such as insects and rodents can sometimes see the valuable collection as a nice snack rather than artefact. They are attracted to objects made from natural materials, such as plants and animals.

Before adding new objects into the collection, staff at Royal Museums Greenwich place all our organic items into quarantine. In quarantine the new objects are frozen which eradicates any potential pests and their eggs. All objects from natural based materials are then stored in containers which prevent aces of pests

Pollutants

Pollutants can be natural or man-made gases, aerosols, liquids, dust or dirt that are known to accelerate decay of the objects. Aerosols and liquids that are commonly seen around artefacts are household cleaners, bug sprays, and detergents. The chemicals within these sprays can attach to the objects and slowly cause it to decay.

Temperature and humidity

Incorrect temperatures and humidity can damage the objects. Depending on the material of the object, it can react in different ways to extremes of temperature and humidity. Warm and damp conditions may result in mould.

BRITISH SCIENCE WEEK

Diverse jobs

Design an Antarctic research station

UK ANTARCTIC HERITAGE TRUST
ANTARCTICA IN SIGHT

About this activity

Antarctica was first sighted 200 years ago. The early explorers were looking for new sources of seals and whales to exploit for their pelts and oil. In the last 100 years, through international science programmes, we now understand that Antarctica is pivotal in the Earth's climate system and a sensitive barometer of environmental change. In this activity, you will investigate the geopolitics of Antarctica and design a science station suitable for scientific research in Antarctica.

Background

There are few places on Earth where there has never been war, where the environment is fully protected, and where scientific research has priority. In 1959, the governing Antarctic Treaty, which unites over 50 nations, made Antarctica a continent dedicated to scientific research with a common aim: to encourage international cooperation and protect the environment for future generations.

Kit list

- Access to a computer or fact sheets on Antarctica
- Coloured pens
- A3 paper (for design)

Time: 2+ hours

Instructions

1. Start by doing some research on past and present buildings in Antarctica - what was their purpose and how were the stations are designed?

2. Think about the key scientific knowledge you will need for designing your station. For example:
   - What is the terrain like? Where would you locate it?
   - How cold can it get in Antarctica?
   - What temperature will it need to be inside the station? How will you heat the station? How will you maintain the temperature? Think about thermal energy and insulation.
   - What will the inhabitants be doing there? What equipment and rooms will the station need to accommodate them?

3. Consider what research will be completed in the station – look at the priorities of the countries involved in the Antarctic Treaty and the similarities/ differences between them. The station will need to be equipped for these kinds of research.

4. Consider what other elements might need to be included:
   - How will you reach your station?
   - Will researchers live in the station or will they have a separate building to stay in?
   - How and where will they eat, sleep, exercise etc?
   - How will researchers travel around?
   - How can you make the research station representative of all the nations involved?

5. Make a design for the station, incorporating everything you have considered above. How will you communicate your ideas?

6. You may also wish to consider how materials will be transported to the Antarctic to build your station.

Next steps

Use these links to research your survey station.

ukaht.org/discover/port-lockroy

ukaht.org/discover/other-historic-sites

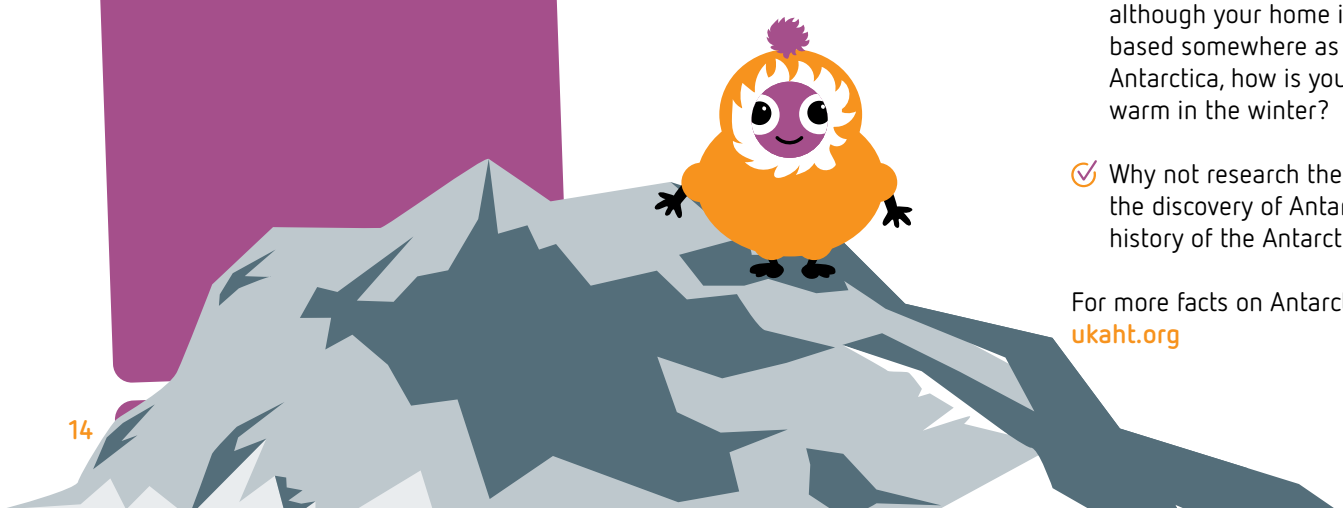
bas.ac.uk/polar-operations/sites-and-facilities/station

discoveringantarctica.org.uk/how-is-antarctica-governed/geopolitics/geopolitics-of-antarctica/

At home

- Look for examples of the knowledge you have from your everyday life. For example, although your home is likely not based somewhere as cold as Antarctica, how is your home kept warm in the winter?
- Why not research the history of the discovery of Antarctica, or the history of the Antarctic Treaty?

For more facts on Antarctica visit ukaht.org



BRITISH SCIENCE WEEK

UK ANTARCTIC HERITAGE TRUST

ANTARCTICA IN SIGHT

Fact sheet

Antarctica facts

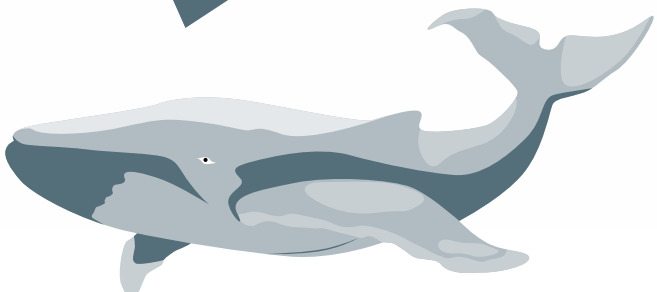
Since its discovery, Antarctica has had a chequered past. Once news of this new land was known, global exploitation of its abundant seal population began almost immediately; later it was whalers that would exploit the environment.

During the 20th century, the focus of human activity in Antarctica shifted to a new form of exploration, as scientists began to study the continent's environment and biodiversity and steps were taken to protect them. Today, scientific research in Antarctica shapes how we see and understand our world.

The Antarctic Treaty was set up in 1959 by 12 nations. Now, more than 50 countries have signed up to this unique set of principles.

Legal protocols have since strengthened the protection of the environment, forbidding mineral and oil exploration, controlling human activity in Antarctica.

Whilst the treaty does not have an expiry date, in 2048 any country can call for a conference to renegotiate the terms of its environmental protection.



BRITISH SCIENCE WEEK

Diverse people

Revealing fingerprints

About this activity

Every person's body is different, and this includes our fingerprints. This means they are very useful in identifying people, in particular those who have left fingerprints at a crime scene. In this activity you will investigate the best way to identify fingerprints on different surfaces.

Kit list

- Different surfaces to retrieve fingerprints from. e.g. crockery, glass, paper, gloss paint
- Ink pad
- Different types of adhesive tape, to test their effectiveness at lifting prints
- 'Dust' to use for lifting prints. e.g. cocoa powder
- Iodine vapour can also be used to reveal latent fingerprints. You could try this, but be careful what you expose to iodine – it may permanently stain some surfaces.

Time: 2+ hour

Watch out!

Iodine is **HARMFUL - avoid skin contact.**

Some powders and chemicals used to reveal fingerprints may be hazardous. Make sure you complete a risk assessment before you start your investigation and check it with your teacher.

Instructions

1 Start by testing how well you can see your own or others' fingerprints on the different surfaces listed in the kit list.

- Why do you think police take fingerprints from paper, not glass?
- Do fingerprints show up better on light or dark surfaces?
- Are prints more difficult to see clearly on a patterned surface?
- Does the answer depend on whether the fingers are clean or dirty? For example, with mud, oil / grease or printing ink after reading a newspaper.

2 If revealing fingerprints involves using chemicals, you may need to remove the print from the surface first, to avoid the chemicals damaging the surface. This is called 'lifting'.

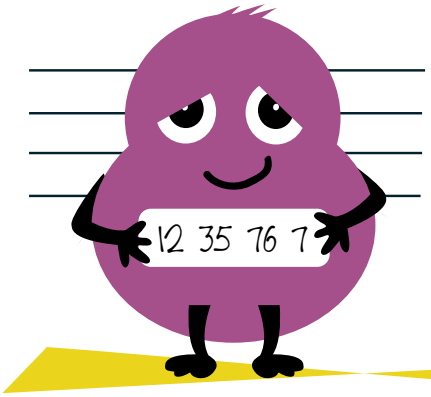
- You can 'lift' fingerprints using adhesive tape such as sellotape. Why not try different adhesive tapes to see which one is best for 'lifting' fingerprints.
- If revealing fingerprints involves using chemicals, you may need to remove the print from the surface first, to avoid the chemicals damaging the surface. This is called 'lifting'.
- You could investigate various types of adhesive tape to see which picks up the best impression of the fingerprint from different types of surface. You may need to find a way to 'develop' the print on the sticky surface to make it more visible.

3 Argue your case:

- Why not use your discoveries about identifying fingerprints to argue a case, identifying some fingerprints at a fictional crime scene?
- You will need some sample latent prints, and a record of prints from a suspected 'criminal'. Use your identification skills to argue that the 'suspect' was in fact at the scene of the crime.

Next steps

This activity can be put towards a CREST Bronze Award. For more information, follow this link: crestawards.org/crest-bronze



BRITISH SCIENCE WEEK

nsead

Diverse people

Peg and pen drawing

About this activity

All good STEM practice requires collaboration; the ability to work with others effectively, even when you may not necessarily see eye to eye. This fun exercise gets four people holding the same drawing pen with pegs, then asks them to draw a STEM themed image collaboratively. Will your drawing descend into chaos or will your diverse characters learn to work effectively together?

Kit list

- Four spring clothes pegs
- Felt tip pen
- Large A1 size paper - divided into nine equal squares
- Suitable photograph to copy - divided into 9 equal squares
- Masking tape

Time: 15-20 minutes

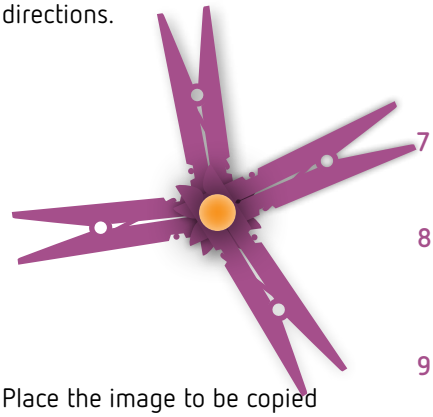
Watch out!

Be careful of getting felt tip on clothes.

This exercise was adapted from the book *Drawing for Science Invention & Discovery* by Paul Carney. paulcarneyarts.com

Instructions

1. Fix the piece of A1 paper to a desk.
2. Attach four clothes pegs to the felt pen so they face different directions.



3. Place the image to be copied (flowers and animals are good for this) near the A1 paper.
4. Get four people to stand around the paper, each holding their own clothes peg.
5. No talking is allowed at this stage – ask them to place their non-drawing hands over their mouth!
6. Now, try to copy the photo accurately using the squares to guide you - you're allowed 5 minutes to complete the task.
7. Evaluate the exercise. Was it difficult? If so why?
8. Now repeat the exercise (with a different photo if you prefer). This time you can speak to each other.
9. Evaluation: how does effective communication affect our ability to do this task better?

Next steps

For more resources visit nsead.org

At home

Practice drawing with a peg and felt pen at home to make more expressive, creative drawings.