POLAR EXPLORER PROGRAMME

WHAT COULD I BE?

A STEM CAREERS RESOURCE FOR PRIMARY CHILDREN 7-11

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WHAT COULD I BE?

The British Antarctic Survey (BAS), part of the Natural Environment Research Council (NERC), is a government organisation whose remit is to carry out world-leading interdisciplinary scientific research and surveys in the polar regions. It operates two ships, five aircraft and five research stations and employs over 500 highly skilled professional staff.

The RRS Sir David Attenborough, a new ship commissioned in 2014, designed by Rolls-Royce and built at Cammell Laird, Birkenhead, will commence sea trials in 2019. It will be one of the most advanced polar research ships in the world. The new ship will support scientific research in extreme environments; such studies help us to understand changes in our planet's climate, oceans and marine life.

What could I be? is an exciting STEM resource for pupils aged 7 to 11, based upon the new vessel, the work of the scientists carrying out world-leading research and the many dedicated staff who support them. The resource comprises six lessons, including a practical science investigation, an engineering challenge, team-building activities, choosing a career and applying for a job, a science-based design and build project and a board game.

The lessons may be taught in any order and provide opportunities for links with several areas of the curriculum, including art, computing, geography and literacy. The work of scientists, pilots, naval architects, engineers, electricians and others are an integral part of the activities.

It is hoped that the children, having learned about the satisfaction and excitement such work can bring, will be inspired to consider a future in a STEM-related career.

LESSON 1: PROPELLER BOAT CHALLENGE | 90 MINS

Background

RRS Sir Ernest Shackleton in Antarctica, BAS

Ships working in the polar regions endure severe conditions. They need to be designed to be able to cut a path through thick ice, keeping the route clear to deliver vital supplies. Naval architects and engineers work as part of a team responsible for designing, producing and repairing safe, seaworthy ships or underwater vessels.

In this lesson, the children take on the role of engineers to work scientifically; they use propeller boats to investigate whether the number of winds of the propeller affects the distance travelled by the boat; they later investigate changing the shape of the bow or size of the propeller, suggest improvements and test their own ideas.

Curriculum links

- Science: Working scientifically, Forces
- Maths: Measures

Objectives

- Work scientifically to carry out a fair test investigation
- Measure and record data
- Use results to draw conclusions
- Recognise that forces can make things move, speed up or slow down

LESSON 1: PROPELLER BOAT CHALLENGE | 90 MINS

Resources per group of four children


Polystyrene tray eg chip tray


Length of guttering, sealed at each end


Rubber bands x 2


Coins x 3


Measuring tape

Advance preparation

Follow instructions on Activity sheet 1 to make a simple propeller boat and try it out. The children can make their own but may need a little help cutting out the propellers. Check that the guttering is sufficiently wide to allow the boat to travel. Trim the boat if necessary.

Activity

Introduction: Listen to naval architect/engineer Matt Slater talking about his job – **https://www.stem.org.uk/resources/collection/421982/engineering-careers-cammel-laird** – OR read his biography on Activity sheet 2.

Show the children the images of RRS Sir David Attenborough – **https://www.stem.org.uk/polar-explorer-educational-resources** – and discuss some key features:

- the ship is 129 metres long – or more than five tennis courts
- it weighs 15,000 gross tonnes – that's one and a half times the weight of the Eiffel Tower
- it has 900 cubic metres of space for scientific cargo – that's almost three squash courts
- it will have 30 crew and 60 scientists and support staff
- its electric motors drive two five bladed propellers, with blades that can be rotated around their long axis to change the blade pitch
- it has ice-breaking capability of up 1 metre thickness at 5.6km/hr

Explain that the ship was designed by Rolls-Royce, its engines built by Rolls-Royce and is being built at Cammell Laird, Birkenhead, providing 400 jobs and 80 apprenticeships. Watch the video of the building of RRS Sir David Attenborough, showing the progress of construction.

https://www.youtube.com/watch?v=XDwGS8t9BKo

LESSON 1: PROPELLER BOAT CHALLENGE | 90 MINS

Today the children are going to take on the role of engineers. Explain that the job of ship engineers is to test and redesign (if necessary) every aspect of a new ship. Show the children the polystyrene boats and propeller and allow time for them to work out how the boat moves. What is providing the energy to make the boat move? Can they change the direction of travel? Explain that they are going to investigate whether there is a link between the number of winds of the propeller and the distance the boats travel across the water. Encourage the groups to make predictions. What must we keep the same? What will we measure? The children may record their results in a variety of ways or they may like to use the example on Activity sheet 3.

Plenary

Display the results for each group and discuss. What did they discover? What problems did they encounter and how did they solve them? How would they improve the boat designs? What else could they change and investigate?

Read the biography of Chief Engineer, Luke Parnell and Deck Engineer, Simon Wright on Activity sheets 4 and 5.

Watch the RRS James Clark Ross in Antarctica **www.stem.org.uk/lx8z6j**

Extension activities

The children can try some of their ideas for improving the boats. They may suggest changing the shape of the bow; this is easily done by cutting the front of the tray; try pointed or curved shapes. They may suggest testing smaller or larger propellers, or even changing the number of propellers or rubber bands.

LESSON 1: PROPELLER BOAT CHALLENGE | 90 MINS

Teacher information

Energy is stored in the rubber bands when the propeller is wound and released as the bands unwind, causing the propeller to turn. As the propeller pushes against the water, the boat moves in the opposite direction.

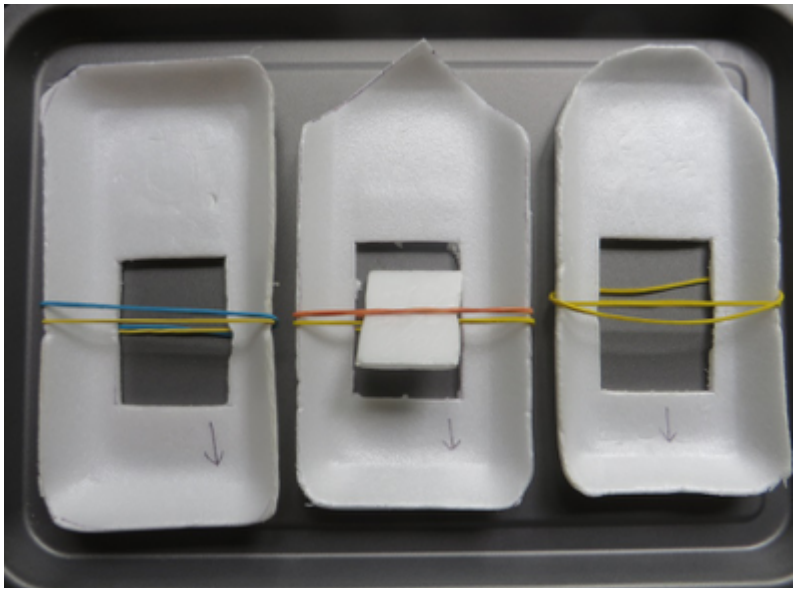
When investigating whether the shape of the bow affects the distance travelled, it is helpful to add a small weight such as a coin to the bow to ensure that the bow is in the water rather than resting above.

Always hold the boat under the surface as you release the propeller; this prevents the rubber bands unwinding too soon!

ACTIVITY SHEET 1: PROPELLER BOAT CHALLENGE

Instructions for making the paddle boats

- Cut a rectangle from the centre of the tray. This rectangle will be the propeller
- Reduce the size of the propeller slightly so that it is smaller than the hole
- Put two identical rubber bands across the centre of the tray; use rubber bands that are not too tight to allow you to wind the propellers several times
- Insert the propeller between the rubber bands and wind up



Y5 pupils from Smithdown Primary School, Liverpool, investigating propeller boats

ACTIVITY SHEET 2: PROPELLER BOAT CHALLENGE

Matt has been with Cammell Laird, Birkenhead, since August 2014.

He joined as a graduate naval architect after graduating from the University of Southampton. His degree was in Ship Science with honours in Naval Architecture and he achieved a 2.1 classification.

He gained ten GCSEs grade A-C which included Maths (B) and Science (AA – Double Award). He also gained three A levels in Physics (A), Maths (B) and Geology (A*).

Matt is a keen sailor and model maker; some of his models are in Cammell Laird's Technical Office.

ACTIVITY SHEET 3: PROPELLER BOAT CHALLENGE

Q. Will the boat travel further if we increase the number of turns of the propeller? What will you keep the same?

Turns	Distance (cm)	Distance (cm)	Distance (cm)	Mean (cm)

Our results show that...

Q. Does the size of the propeller affect the distance travelled? What will you keep the same?

Size of propeller	Turns	Distance (cm)	Distance (cm)	Distance (cm)	Mean (cm)
Large					
Medium					
Small					

Our results show that...

Q. Does the shape of the bow affect the distance travelled? What will you keep the same?

Bow shape	Turns	Distance (cm)	Distance (cm)	Distance (cm)	Mean (cm)

Our results show that...

ACTIVITY SHEET 4: PROPELLER BOAT CHALLENGE

A ship's engineer

Expeditions in polar regions can face many challenges. Problems may include the breakdown of a ship's turbines, electronic controls failing or freezing water flooding into the engineering compartments. These problems require skilled engineers who can work under pressure to solve problems quickly and effectively.

Meet Luke Parnell who works as a chief engineer, solving problems ships face when travelling in extreme conditions.

Luke Parnell, Chief Engineer, in blue overalls, first left

An interview with Luke Parnell, Chief Engineer for RRS Sir David Attenborough

1. What is your job? What does it involve?

As the Chief Engineer of the ship, I oversee the maintenance and operation of all equipment on board, from the main generating engines to the FW evaporator, to ensure that all the regulations, which range from environmental to safety, are complied with.

ACTIVITY SHEET 4: PROPELLER BOAT CHALLENGE

With the operating areas of British Antarctic Survey ships ranging from polar to equatorial regions, this includes both anti-icing and air conditioning, to maintain availability of all services as required for the particular scientific research being undertaken, to the comfort and safety of the staff on board.

2. What made you choose this career?

From a young age I have been dismantling and mending all sorts of equipment, and combined with a love of the sea, I was recommended to consider a career in the Merchant Navy.

The potential for travel around the globe was a strong attraction and became reality when I started a cadetship.

3. What qualifications did you need/obtain?

To become an engineering officer, I completed a three year cadetship with a large shipping company, sailing on its vessels to obtain the necessary sea time, on completion of which the CoC (Certificate of Competency) is taken as a combination of exams, both written and a final oral.

Further to this initial qualification sea time allows higher levels of CoC to be studied with success opening up the potential for promotion in rank.

The training route has changed since I started and is best checked on the MCA (Maritime Coastguard Agency) and training college websites, as there are different access routes for varying levels of prior experience.

To work with systems where colours are critical (eg electrical systems) it is necessary to take and pass a colour blindness test.

4. What key skills and personal qualities does it require?

Having an interest in how things work is key, and experience with basics like fixing a bicycle is an advantage, together with common sense.

Life on a ship is very different from working at home. It is important to be a resilient person, as a ship needs to be self-sufficient, and working in remote areas can be an isolated environment, making teamwork, both on and off duty, a key quality.

5. What do you like best about your job? What is difficult/not so good?

I enjoy working the challenging times of refits when re-commissioning systems and returning the ship to sailing condition. Being a part of the science cruises that the ships carry out is a great feeling and assisting others to get the job done, whether that be shoreside staff at an Antarctic station, or scientists on board, provides job satisfaction.

On the negative side being away from family can be difficult when something happens at home and both you and they are really wishing you were there to help, but modern communications with telephone and email does help with this.

6. What advice would you give to anyone thinking of one day wanting a STEM career and maybe working in polar regions?

The modern world is increasingly technical and there is such a huge choice of speciality within the STEM area that my advice is to start looking into the options to see where your interest lies as there is bound to be something to suit you.

ACTIVITY SHEET 5: PROPELLER BOAT CHALLENGE

An interview with Simon Wright, Deck Engineer for RRS Sir David Attenborough

1. What is your job? What does it involve?

I trained as a marine engineer; these are people who look after all the machinery on a ship to allow it to move, do its jobs and to enable people to live on it.

When I joined the British Antarctic Survey I decided to specialise as a deck engineer. This means I look after and help operate all the cranes, winches and other equipment on the ship that lower the scientific equipment into the sea to take the samples that the scientists need for their experiments. I am responsible for looking after and operating this equipment on the RRS Sir David Attenborough, which is currently in construction at Cammell Laird shipyard in Birkenhead.

2. What made you choose this career?

I have always wanted to go to sea from a very young age and enjoy working on machinery and so becoming a marine engineer seemed the best choice. It also allowed me to travel around the world and see many different places, especially now when I'm able to see places and things that very few people get the chance to.

3. What qualifications did you need/obtain?

To become an engineering officer, you would need to apply to a marine engineering or shipping company to be sponsored through your training.

The training would lead to a higher qualification, in marine engineering. It would also include the Certificate of Competency, which says you are qualified and safe to work at sea.

The training route you take would depend on the qualifications you have already and any experience.

To get onto a training course, you would normally need GCSEs (grades 4-9) including maths, English and a science (preferably physics), and possibly one or two A levels or equivalent qualifications.

You would also be expected to pass a medical, including an eyesight test, before being accepted onto a training course. Check with the individual training providers for exact entry requirements.

ACTIVITY SHEET 5: PROPELLER BOAT CHALLENGE

4. What key skills and personal qualities does it require?

Having an interest in how things work and wanting to work with your hands is an advantage. Living on a ship is different from a job on land, as it means that you work and also live with the same people for long periods of time, so being able to get on with everyone is important.

5. What do you like best about your job? What is difficult/not so good?

I enjoy working with the scientists who come on the ship and helping them to carry out their research, which is helping us all to understand the world around us. It is also very satisfying when you find a problem or someone brings a problem to you and you are able to sort it out.

I personally enjoy taking photographs of all the wildlife I am lucky enough to see.

On the negative side, it may not be very nice if a problem happens when you are in bed. You then have to get up and go outside, having just woken up to fix it. It is especially unpleasant if it is cold, windy and rainy, if not snowing as well. The other hard thing can be being away from home and your family for long periods of time. It is not just that you miss them, but they can also miss you, especially at special times such as birthdays and their holidays.

6. What advice would you give to anyone thinking of one day wanting a STEM career and maybe working in polar regions?

My advice would be, if you are interested in taking up a career in a STEM subject, to try and do it. If at first you don't succeed, don't give up as there are many different ways and opportunities to achieving a career you are interested in. As for working in the polar regions, remember, we need the skills of many different STEM careers to allow us to work in these remote places.

LESSON 2: CAREER CHOICES – WHAT COULD I BE? | 60 MINS

Background

Expeditions to the polar regions involve not only many different kinds of scientists but also the teams who maintain the research stations, pilots and naval personnel transporting people and equipment, communications experts, engineers and medical experts.

In this activity, the children learn about the skills, qualities and qualifications required in a variety of polar-related careers and consider which they might choose in the future. They identify their own skills and qualities, make a job application and attend an interview!

Curriculum links

- Reading: for understanding, enjoyment and information retrieval
- Speaking: participate in discussions and improvisations
- Writing: for a purpose, selecting the audience and appropriate format

Objectives

- Explain the difference between skills and qualities
- Consider future career choices
- Compose a job application

LESSON 2: CAREER CHOICES – WHAT COULD I BE? | 60 MINS

Activity

Introduction: Ask the children to describe a friend or relative in terms of his or her skills and qualities. What is the difference between a skill and a quality? After the groups have discussed, list their suggestions on the whiteboard. Explain that a skill is the ability to do something; qualities are personal characteristics. They are very important to employers and for future careers. Can they name a few skills and qualities needed in the following jobs: vet, teacher, mechanic?

Next, listen to the short video of Tom Harts, a marine biologist describing his job – **https://www.stem.org.uk/rxtgu** – and discuss the skills and qualities required.

In groups, the children sort into two sets the skills and qualities from Activity sheet 1. Do all groups agree? Were any difficult to sort? Discuss.

The groups are given the images of polar-related careers shown on Activity sheets 2 and 3. After discussion, they try to match the skills and qualities from Activity sheet 5 to the images and job description. (A master copy for teachers is provided on Activity sheet 4.) Allow time for the groups to explain their choices to the class.

Finally, they list their own top four skills and qualities and, after reading about the jobs advertised on Activity sheets 6 and 7, they decide which one most appeals to them and for which they are most suited, before completing an application using the application form on Activity sheet 8.

Plenary

Read one or two applications to the class, without revealing the author and ask the children to consider whether the skills and qualities of the particular application match the requirements of the job.

Extension

Listen to polar scientists talking about their jobs on this website: **https://discoveringantarctica.org.uk/science-and-exploration/understanding-antarctica/contemporary-understanding/**

Set up interview panels. Groups decide on the job they will advertise. Each group composes a set of appropriate interview questions and then interviews candidates interested in that job. They take turns as interviewee and as members of the interview panel.

ACTIVITY SHEET 1: CAREER CHOICES – SKILLS AND QUALITIES

Cut out each and give a complete set to each group. Sort into skills and qualities

Skills	Qualities
Speaking a language	Calm
Communicating	Kind
Repairing things	Caring
Design technology	Patient
Computers	Punctual
Maths	Hard working
Singing	Friendly
Photography	Teamworker
Playing a musical instrument	Responsible
Getting along with others	Honest
Drawing	Sensitive
Investigations	Well organised
Sport	Leader
Remembering facts	Enthusiastic
Mental arithmetic	Polite
Looking after others	Imaginative
Solving problems	Adaptable
Following directions	Trustworthy
Making things	Conscientious
Reading	Confident
Writing stories	Strong minded
Science	Determined
Planning my work	Enterprising

Skills (things someone can do)

Qualities (these describe someone)

ACTIVITY SHEET 2: CAREER CHOICES – POLAR CAREERS CARD SETS

Palaeontologist

Job description: studies fossils of ancient life forms

Qualifications: 2-3 A levels including maths and geography
University degree in geology, then a PhD

Salary: £25,000 to £30,000

Helicopter pilot

Job description: carrying workers or supplies, rescuing stranded people

Qualifications: GCSEs in english, maths, science and a pilot's licence after training

Salary: £25,000 to £45,000

Doctor

Job description: diagnose and treat patients

Qualifications: excellent A levels in science subjects
University degree 5 years

Salary: £80,000 to £100,000

Chef

Job description: prepare meals for all working at research station, check food freshness, plan menus

Qualifications: NVQ certificate plus food safety qualification

Salary: £22,000

ACTIVITY SHEET 3: CAREER CHOICES – POLAR CAREERS CARD SETS

Meteorologist

Job description: understand, interpret, observe and predict earth's atmosphere

Qualifications: A levels in physics, maths and science – good degree in maths, environmental science or meteorology, then PhD

Salary: £20,000 to £60,000

Geophysicist

Job description: study the composition of the earth, including atmosphere, oceans, earthquakes, magnetic and electrical fields

Qualifications: A levels in science and maths Degree in geology, maths, geoscience

Salary: £25,000 to £75,000

Mechanic

Job description: carry out repairs, service and maintain research station vehicles

Qualifications: NVQ or BTech in a mechanical subject; must have a driving licence

Salary: £24,000

Diver

Job description: collect samples of marine invertebrates and sediment, use data loggers to measure temperature or pressure, take photos

Qualifications: Scuba dive certificate, 100 dives, first aid certificate, degree in marine biology or oceanography for scientific diving

Salary: £24,000

ACTIVITY SHEET 4: CAREER CHOICES – SKILLS AND QUALITIES

Match the skills and qualities to the jobs

Teachers' copy

Palaeontologist

Skills: computers, communication and fieldwork

Qualifications: interested in ancient living things, patient

Helicopter pilot

Skills: excellent hand-eye co-ordination, making decisions

Qualifications: has good concentration, calm in a crisis, confident

Doctor

Skills: making decisions, practical skills, solving problems, communicating

Qualifications: kind, friendly, helps others, compassionate, calm under pressure, confident

Chef

Skills: basic maths, organising, communicating, using kitchen equipment

Qualifications: creative, honest, hardworking, teamworker

Meteorologist

Skills: solving problems, computers, maths, getting on with others

Qualifications: loves weather, flexible, good communicator, accurate

Geophysicist

Skills: computers, maths, working under pressure

Qualifications: precise, enjoys travel, hardworking, flexible

Mechanic

Skills: repairing things, computer diagnostics, teamworking, managing time

Qualifications: honest, reliable, trustworthy, fit, quick to respond, punctual

Diver

Skills: excellent swimming ability, concentration, following safety guidelines, working alone and in teams

Qualifications: fit, calm in a crisis, has stamina

ACTIVITY SHEET 5: CAREER CHOICES – SKILLS AND QUALITIES

Match the skills and qualities to the jobs

Children's copy

Skills:	computers, communication and fieldwork
Qualifications:	interested in ancient living things, patient

Skills:	excellent hand-eye co-ordination, making decisions
Qualifications:	has good concentration, calm in a crisis, confident

Skills:	making decisions, practical skills, solving problems, communicating
Qualifications:	kind, friendly, helps others, compassionate, calm under pressure, confident

Skills:	basic maths, organising, communicating, using kitchen equipment
Qualifications:	creative, honest, hardworking, teamworker

Skills:	solving problems, computers, maths, getting on with others
Qualifications:	loves weather, flexible, good communicator, accurate

Skills:	computers, maths, working under pressure
Qualifications:	precise, enjoys travel, hardworking, flexible

Skills:	repairing things, computer diagnostics, teamworking, managing time
Qualifications:	honest, reliable, trustworthy, fit, quick to respond, punctual

Skills:	excellent swimming ability, concentration, following safety guidelines, working alone and in teams
Qualifications:	fit, calm in a crisis, has stamina

ACTIVITY SHEET 6: CAREER CHOICES – JOB ADVERT

HERE'S YOUR CHANCE TO SAIL ON RRS SIR DAVID ATTENBOROUGH!

The RRS Sir David Attenborough team is looking for a computer manager who will take part in sea trials and cruises of the new vessel. The Cambridge-based British Antarctic Survey (BAS) is the United Kingdom's national Antarctic operation and operates five research stations, two ships and five aircraft in the polar regions.

BAS has announced a unique job opportunity, based in Cambridge, that will see you involved in sea trials and rehearsal cruises on the RRS Sir David Attenborough, Boaty McBoatface's home during polar missions.

Before then, you will be required to develop a computer system for the vessel, ready to start polar research cruises immediately following completion.

The ideal candidate will:

- have data-handling experience and knowledge
- be experienced in computer programming and software solutions
- be medically fit to participate in trials of the ship

If you are qualified with a marine or biology degree or experience in data-handling systems, the BAS want to hear from you.

ACTIVITY SHEET 7: CAREER CHOICES – JOB ADVERT

JOB OPPORTUNITIES IN ANTARCTICA

British Antarctic Survey has opportunities for scientists, engineers, doctors, nurses, firefighters, electricians, chefs, pilots, mechanics, computer programmers and other support staff.

Scientists:

- Glaciologist
- Geologist
- Chemist – studying snow, ice, fresh water
- Geophysicist
- Atmospheric physicists
- Meteorologists
- Oceanologists
- Biologists – land or marine
- Palaeontologist

Other professionals:

- Electrician
- Carpenter
- Computer programmer
- Engineer
- Mechanic
- Radio operator
- Doctor
- Nurse
- Diving officer
- Pilot
- Firefighters

BAS headquarters, Cambridge

Applicants must possess suitable qualifications, key skills and qualities and be prepared to become part of a dedicated team.

If you think you match our high standards, we would love to hear from you.

Rothera research station, Antarctica

Applicants must use the application form and be prepared to travel to Cambridge for interview.

ACTIVITY SHEET 8: JOB APPLICATION FORM

British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Job applied for		
First name	**Surname**	**Date of birth**
My skills		
My qualities		
I am applying for this job because		
My interests		

Send your completed application form to:
Human Resources Team, British Antarctic Survey, High Cross, Madingley Road, Cambridge CB3 0ET

LESSON 3: ICE STATION DESIGN CHALLENGE

Activity aims

To work scientifically by using model systems in the design and testing of thermal insulation and an electric light system wiring circuit. To consider the different roles played in the design and construction of an ice station.

Upper KS2 curriculum links

Science

- set up practical enquiries, comparative and fair tests
- make careful observations
- record findings using appropriate tables and charts, and draw conclusions
- construct electrical circuits using switches, wires, bulbs and batteries
- use recognised symbols when representing a simple circuit in a diagram

Teachers' activity notes

The context for this activity is the construction of a new ice station to be located in the Antarctic. As construction in the Antarctic is difficult, the designs are first to be tried and tested using model systems in the classroom. Encourage children to design, test and modify their designs in an iterative process. This will help to reinforce the process of working scientifically. In these activities, children are set one or both of the following challenges:

Thermal insulation

A small plastic drinks bottle, containing water at room temperature, is used as a model for the internal rooms of an ice station. It is placed into a container of ice to represent the conditions in the Antarctic. Children investigate different materials and construction to keep the water inside the bottle warm for as long as possible.

Lighting circuit

A show box or other similar box is used to represent a room in the ice station. Children are challenged to design a light circuit that contains three lights that can be independently switched on and off. The complexity of the rooms and lighting can be tailored as required.

Resources and preparation

Video clip of Ice Station Halley construction – view at: **https://youtu.be/nWgCVi3am-c**
Please note that the commentary for the video starts after 30 seconds.

Thermal insulation activity:

- Ice station insulation stimulus sheet (one per group)
- Small plastic drinks bottle (one per group)
- Alcohol-type thermometer or similar (one per group). Give instruction on safe and correct use of the thermometer. Alternatively a datalogger and temperature probe can be used

LESSON 3: ICE STATION DESIGN CHALLENGE

- Ice cubes or crushed ice (can be purchased from supermarkets)
- Bowl containing ice and a little water (two or three in class)
- Stop clock or timer

Lighting circuit activity:

- Ice station lighting circuit stimulus sheet (one per group)
- Shoebox or other similar (one per group)
- Selection of wire with connectors at each end
- Three light bulbs or LEDs (per group)
- Three switches (per group)
- Battery pack
- Scissors (take care)
- Electrical circuit symbols sheet (give to groups if required)

Activity structure

View the video clip of the British Antarctic Survey new research station 2013 Feb Halley VI – **https://www.youtube.com/watch?v=nWgCVi3am-c**. Note that the commentary starts at 30 seconds. The video describes how the ice station has been designed and constructed. It also considers some of the problems associated with working in the Antarctic environment. Use the video clip to introduce the idea of constructing a new ice station and also some of the conditions (in particular cold) from which they should be protected.

Finally, have the children consider the best way to construct a new ice station. Would they build their designs straight in the Antarctic? How would they know if it would work? How would they make sure they had taken enough material, or indeed, not taken too much? Would it be a good idea to make a model and test it before they go to the Antarctic?

In this context, a scientific model does not need to be like a scale model. A scientific model allows researchers to test individual components and ideas about the construction methods. Introduce the two models that the children will be using to test the thermal insulation and to design a lighting circuit.

Each activity has a stimulus sheet that introduces the challenge and gives some direction. These can be tailored as required, for example by removing the description of the model or the table for results in the thermal insulation investigation.

Once the thermal insulation investigation is concluded, each group can report back to the class to describe which material they found gave the best insulation. Have children consider how they would need to keep themselves insulated and warm if they went outside the research station. Conclude by viewing the video 'How to dress for the Antarctic' at **https://www.theguardian.com/science/antarctica-live/2013/dec/05/keeping-warm-antarctic-peak-layering** which shows the different layers of clothing needed to keep warm in the Antarctic.

Conclude the light circuit activity by talking about how light circuits are designed in the school and at home. How are switches in convenient places? Also use as an oppurtunity to highlight safety issues around mains electricity.

ICE STATION DESIGN: KEEPING WARM

I am an architect and my job is to design and make buildings.

I have been given an unusual challenge.
Can you help me with it?

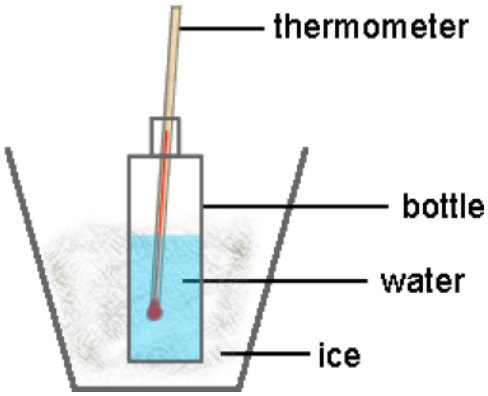
I have to design a new scientific research station that will be built in the Antarctic, where it is very cold.

The building needs to be well-insulated to keep the people inside warm.

What is the best way to insulate a building?
Use a scientific model to try out your designs.

Your scientific model does not need to look like an ice station building.

1. Put some water in a plastic bottle. This represents the ice station building.
2. Put the bottle into a bowl of ice. This represents the cold Antarctic.
3. Start your timer.
4. Use a thermometer to measure the temperature of the water.
5. Complete the table to see how quickly the water cools down.



Time	At the start	2 minutes	4 minutes	6 minutes	8 minutes	10 minutes
Temperature (°C)						

Test different materials to insulate the bottle. Find the best way to insulate the bottle and keep the water warm for as long as possible. How will you make your tests a fair comparison? How will you show your results?

ICE STATION DESIGN: LIGHTING CIRCUIT

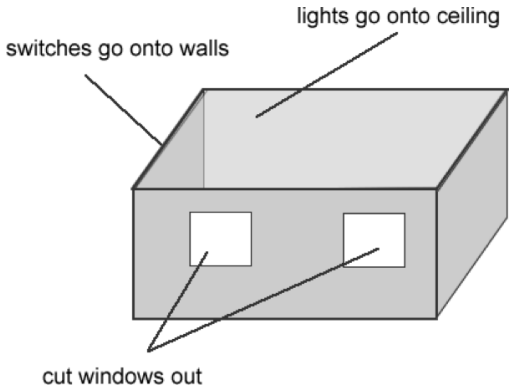
I am an electrical engineer and my job is to design electrical circuits.

I need to design a circuit for lights in the new Antarctic research station.

Can you help by designing and testing a lighting circuit?

Design and make a light circuit for one of the rooms in the Antarctic research station.
The circuit must have three lights. Each light can be switched on and off on its own.

Use a shoebox to represent the room in the research station.



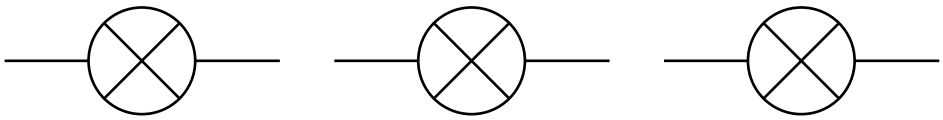
How will you make the circuit using the least wire?
How will you draw a plan of the circuit to give to the electrical engineers who are building the research station?

ICE STATION DESIGN: LIGHTING CIRCUIT

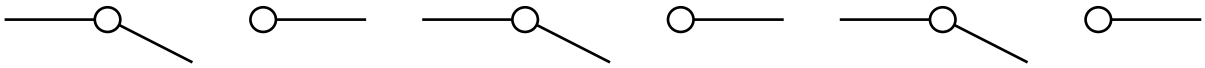
Cut out each component and stick them in place onto a piece of paper. Draw wires to connect the components and complete the circuit diagram.

Electrical circuit symbols

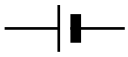
Bulb



Switch



Cell / battery



Wire

LESSON 4: STRANDED!! A TEAMWORK CHALLENGE

Background

Scientists and engineers working in polar research stations and going out on expeditions for research must share their knowledge and expertise. It is important that individuals have the skills and qualities to be able to work together as teams. These activities are based upon a rescue mission in the Antarctic. Firstly, the pupils must work as a team to co-operate to solve a problem. They learn about the work of pilots working for the British Antarctic Survey. In the second challenge, they use their skills to build a bridge that will span a crack in 'an iceberg' and is sufficiently strong to support a load. They are introduced to the job of a structural engineer.

Introduction

Using the Powerpoint presentation 'Stranded!' show the children the image of the RRS Sir David Attenborough; it will be carrying out scientific research but will also be available for search and rescue missions. It can push through thick ice and can carry a helicopter.

Introduce the slide showing a search and rescue pilot. Ask the children to discuss the skills, qualities and qualifications they think this career requires. Show the BAS Twin Otter plane used in the Antarctic. The following slide features BAS pilot Jonathan Bowland, together with a brief biography. Point out the importance of good communication skills, co-operation and teamwork. An interview with Jonathan can be found on Activity sheet 1. Introduce the following challenges:

Activity 1 — 30 mins

This is a fun, co-operative team-building challenge. It is best carried out in a hall or outside. Introduce the following scenario: The ice has cracked and a member of your expedition has been stranded on an iceberg. The helicopter rescue team will be delayed by bad weather. The stranded person needs vital supplies to help them survive. You have a few pieces of equipment that may help. Can your team use the equipment to transfer vital supplies to the stranded team member?

Resources per team of four

- PE rope
- Small plastic bucket
- Beanbags x 4 (adapt for groups of 4+)
- Crate or box

LESSON 4: STRANDED!! A TEAMWORK CHALLENGE

Advance preparation

Organise the class into teams of four.

Mark out a gap just shorter than a rope for each team.

Explain the challenge and allow planning time. All teams begin together.

Instructions

One member of the team stands on one side of the gap, the remaining team members on the other side.

No one must cross the gap.

The team must use only the bucket and rope to transfer the supplies (beanbags).

Throwing of beanbags is not allowed.

On receiving a beanbag, the recipient places it in the container.

The team members take turns sending the supplies.

Repeat the exercise until all have taken a turn as the stranded team member.

As an alternative, start with each member of the team stranded on separate 'icebergs'. One has the rope, bucket and beanbag (supplies). Supplies must be sent from one member to the next in turn without anyone stepping into the gaps. The first group to complete the task is the winner.

Activity 2 – Teams of four **60 mins**

In this challenge, the children take on roles of project manager, communications manager, structural engineer and health and safety manager. They use their scientific, technology, engineering and maths (STEM) skills to build a bridge that will span a crack in 'an iceberg' and be sufficiently strong to support a load. They learn about the job of a structural engineer.

Objectives

- Work scientifically to answer questions
- Identify effective shapes used in bridge design
- Follow the engineering process by suggesting ideas, designing, testing and adapting
- Learn about the skills and qualities of structural engineers

LESSON 4: STRANDED!! A TEAMWORK CHALLENGE

Resources per group of four

- A4 paper x 6
- Scissors
- Sticky tape 1 metre
- Straws x 10
- Ruler
- Paper cup
- Marbles or coins
- Activity sheets 2, 3

For the extension activity

- Pulley/spool for winding
- String
- Toy figure

Introduction

Using the Powerpoint slides or Activity sheet 2, show the images of icebergs and ice sheets showing cracks. A video clip of natural 'calving' of giant icebergs could also be viewed: **https://en.wikipedia.org/wiki/Ice_calving**

Read together the message sent by a team out on a scientific expedition in Antarctica. One of the team has been separated from the rest by the sudden appearance of a crack in the ice sheet and must be rescued. The team asks for help. Can the groups step up to the challenge?

In this activity, the children will be modelling a real situation, using only the materials available, to build a bridge. Resources are limited to those listed. The bridge must span a gap of 30cm between two tables, cannot be attached to the tables and must be able to support a load, represented by marbles or coins in a cup. (Increase the test load if necessary, according to the load-bearing capabilities of the bridges produced.) To help the children with their designs, show them the slides featuring examples of bridge designs. Explain that structural engineers design and test load-bearing structures such as bridges. They design structures that must withstand stresses and pressures; they build and test models before a project is agreed.

Activity

Challenge the children to find ways of increasing the strength of a sheet of paper by changing its shape in some way. Discuss and demonstrate some of their suggestions; ideas may include rolling, folding or producing concertina shapes. The children take on job roles for the challenge. In pairs they make initial sketches of possible designs for a bridge to span the gap and as a group must agree on one. A sample recording sheet is provided on Activity sheet 3. They build their models and test, adapting where necessary.

LESSON 4: STRANDED!! A TEAMWORK CHALLENGE

Plenary

Each group presents its bridge design to the class. Test the strength of each model by placing a paper cup containing marbles or coins in the centre of each bridge. Discuss the features of each. What was difficult? What kinds of shapes were effective in the design? Which design could support the greatest load? What improvements could they make?

Point out that the cracking of ice is part of a normal process in Antarctica and does not necessarily indicate a change in climate. Read about the skills and qualities required by structural engineers on Activity sheet 4.

Extensions

The groups adapt and improve their bridge designs and test their effectiveness.

Can the groups devise a system to transfer an injured member of the team (represented by a toy figure) across the bridge? They might suggest pulleys, winches or conveyors.

Teacher information

Bridge designs vary according to where the bridge is to be built, the materials used and its function. Examples include simple beam, suspension, truss, cantilever or arch. A truss bridge uses triangular shapes to provide support and strength. Suspension bridges are suspended from cables. Cantilevers use beams supported at one end. Arches have abutments or supports such as walls at each end.

Triangles are frequently used in building bridges and other structures due to their ability to withstand strong forces without deformation.

Additional team-building game suggestions

- Against the clock relay to complete a jigsaw. Team members take turns to dress as a polar explorer, adding layers, jacket, boots and gloves, with the help of the rest of their team; once dressed, they may collect a jigsaw piece and then remove and pass the polar clothing to the next team member. The first team to collect all jigsaw pieces and complete the jigsaw is the winner.
- Each team has a bucket placed at a distance from the team. On a signal, members of each team take turns to throw beanbags into their bucket. After each successful throw, teams may collect a piece of jigsaw. (Jigsaws prepared in advance and cut into a few pieces; ideally images of RRS Sir David Attenborough or Boaty McBoatface or related polar themes.) First team to complete the jigsaw wins.
- Position icebergs (eg sheets of paper) at increasing distances from each team. Place a paper cup on each iceberg. First member of each team throws a snowball (eg marshmallow) into the nearest cup; they continue to take turns until the marshmallow lands in the cup. They can then aim at the next cup and so on, until all cups have a marshmallow. The winning team is the first to complete the challenge.
- Play a relay game, collecting vital 'supplies' from 'icebergs' set out in front of each team.
- Find a way to transfer objects/supplies eg beanbags, from one iceberg to another, using the equipment provided. Provide equipment such as two lengths of cane to lift the supplies. Quickest team wins.

STRANDED! ACTIVITY SHEET 1

Meet Jonathan Bowland, Deputy Chief Pilot, BAS

1. What is your job? What does it involve?

I am a pilot with the British Antarctic Survey. We have a fleet of five aircraft (NOT planes – no proper pilot ever uses the word PLANE!) – four Twin Otter aircraft and one Dash 7.

It's possible to get to Antarctica by ship, but it takes a long time and can be uncomfortable if the seas are rough. Sea ice conditions can also make it difficult. It's quicker to travel to Antarctica by air, and in my opinion it's more fun. My job is to fly the Dash 7 aircraft that brings our people into Antarctica. Once in Antarctica, the only way to travel long distances is by air. Our Twin Otter aircraft have skis so they can land almost anywhere – we fly our science teams with all their food and equipment to wherever they need to go to do their work, keep them supplied while they are out in the field, and bring them home again when they are finished.

2. What made you choose this career?

I've always loved planes, even before I discovered that they are really called AIRCRAFT. And the first time that I saw a picture of a red Twin Otter landing on snow in Antarctica, I knew that I wanted to do that one day. So it's a dream come true.

3. What qualifications did you need/obtain?

I got into flying by joining the Royal Air Force as a pilot. The minimum standard at that time was two A levels, and then you have to pass a strict selection process. I went to university and got a degree as well, but this isn't essential. You need a reasonable grasp of maths and science, up to GCSE level, but to be honest you don't have to be super clever. Just prepared to work hard.

4. What key skills and personal qualities does it require?

To fly in Antarctica, which is quite a testing place, you need to be an experienced and proven pilot; it's not something that you do for your first flying job. To be good at it, you need to be flexible and independent in your thinking, and a team player. You have to be willing to get your hands dirty, not be afraid of hard physical work, and be able to keep your sense of humour when cold, tired and uncomfortable. You also have to have patience, and have the judgement and moral courage to make the right decisions when the weather is bad or things aren't going to plan.

STRANDED! ACTIVITY SHEET 1

5. What do you like best about your job? What is difficult/not so good?

On good weather days I love the freedom of flying in the most beautiful place that I can imagine. On poor weather days, when flying is challenging, I enjoy testing my skills and experience to get the job done. Above all I enjoy the teamwork and sense of achievement that comes from working with talented enthusiastic people doing important work in a place that really matters. And elephant seals – I absolutely love elephant seals.

What is not so good is the time away from home – I am away for six months without a break every year, and I miss my wife and children. And although the food on station is wonderful, just occasionally I miss chocolate biscuits. And watching Manchester City.

6. What advice would you give to anyone thinking of one day wanting a STEM career and maybe working in polar regions?

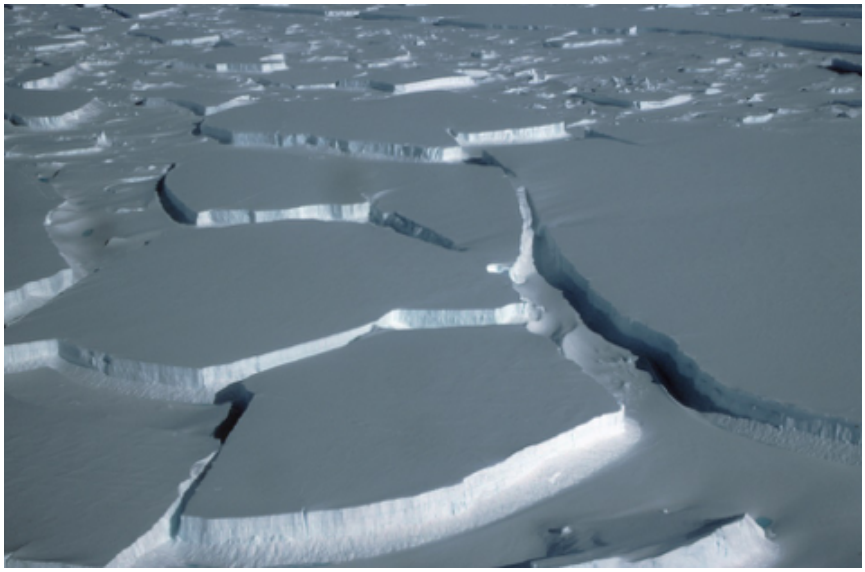
Remember that you don't have to be a scientist to go to the Poles. The science is supported by a whole range of skills: chef, vehicle mechanic, diver, pilot, plumber, doctor, everything that's needed to make a small town run smoothly at the end of the earth, and get our science teams out there and back with the stuff they need to do their amazing work. So choose whatever job excites you, but whatever it is, BE THE BEST AT IT THAT YOU CAN BE.

Few of us left school thinking we would end up in Antarctica but, if you work hard at your career, always try to get on with people and keep an open mind and a spirit of adventure, you will be ready to grab the opportunity when it comes along.

Jon Bowland
Deputy Chief Pilot, British Antarctic Survey

STRANDED! ACTIVITY SHEET 2

Help! We are scientists on an expedition in Antarctica. A crack has appeared in the ice, leaving one of our team stranded on the opposite side. We need to get across to her. The gap is getting wider. The rescue helicopter is delayed by bad weather. A bridge might be a good idea. Can you help us by testing a few designs and advising us which is best?



STRANDED! ACTIVITY SHEET 3

Design a bridge to cross a gap of 30cm.
It must be able to support a cup containing marbles or coins.

Test the bridge. Draw how you could improve your design.

STRANDED! ACTIVITY SHEET 4

Structural engineers

They design, plan and manage the construction of new buildings and structures.
They must make sure that the buildings and structures are safe and able to withstand stresses and loads.

Key skills – computer and maths skills, paying attention to detail, good communication, teamworking, understanding building rules, can manage a budget.

Key qualities – creative, gets along with others, careful worker.

Qualifications – GCSEs and apprenticeship after leaving school OR a degree in structural or civil engineering.

Then work for an employer to become a chartered engineer.

LESSON 5: TEAM EXPEDITION ANTARCTICA – DESIGN A FLAG

Image: BAS Club

Activity aims

To encourage children to consider the different jobs and skills needed for a successful Antarctic expedition team.
To have children design and draw a mission flag and individual mission patches to represent the team members and outcomes of the mission.

KS2 curriculum links

Art and design

- Use a range of materials to creatively design and make products
- Use drawing and painting to share ideas

Teachers' activity notes

This activity challenges children to design and draw a flag to represent a mission to Ice Station Halley. This design then forms the basis for a personal mission patch, that each child produces, which incorporates a representation of a chosen role in the team.

The context for the challenge is a mission to study living things in the Antarctic. However, the materials could readily be tailored to accommodate any suitable curriculum context. For example, the mission could be related to astronomy and linked with earth and space, or to look at the effects of climate change when considering human impacts on the environment.

Extension activity

As well as drawing their designs, there is an opportunity to produce the flag using fabrics, or to make a display using a range of materials. This will enable children to practise their making skills.

LESSON 5: TEAM EXPEDITION ANTARCTICA – DESIGN A FLAG

Resources and preparation

The activities use the following materials:


Polar expedition and skills stimulus sheet (one per group)


Mission patch template (one per child, copy onto thin card to make more durable)


A4 paper (one per group)


Drawing materials and scissors (care needed with scissors)

A brief PowerPoint presentation is provided that can be used to introduce the activity.
Additional craft materials may be needed if the flag is to be painted or made using fabrics and other items.

Activity structure

Use the presentation to introduce the activity and as a basis for discussion prior to designing the mission flag and patches. The presentation contains six slides and will take just a few minutes, depending on the discussion:

Slide 1

Reminds children of the location of the Halley Research Station. Challenge children to recall the types of conditions that explorers will encounter (cold, ice, snow, wind, isolation). How would they cope in such an environment?

Slides 2, 3 and 4

A concept cartoon poses a question about living things in the Antarctic. Have children suggest some of the things that can survive in the extreme conditions of the Antarctic, such as penguins, seals, a range of fishes and whales. How could these be studied?

Slide 5

Sets the challenge. Discuss with children the types of skills and jobs needed in their expedition team. How could they study living things in the Antarctic? What types of living things could they find out about? These are to be represented on the expedition flag and patch.

Slide 6

An example of an expedition badge or patch. This is from UK astronaut Tim Peake's 2016 mission to the International Space Station (ISS). Use it to illustrate how different aspects of the mission are represented on the badge. The elements depict space and rocket travel to the ISS, Tim's home country and the link with gravity through Isaac Newton's book (Principia was the mission name) and the apple.

LESSON 5: TEAM EXPEDITION ANTARCTICA – DESIGN A FLAG

Have the children work in small groups and first complete the prompt sheet to give them time to consider their design of a mission flag. These can be drawn on A4 paper and exhibited to the class. A 'show and tell' from each group can explain their design.

Each individual child should also make a mission patch for themselves. This can be done alongside the group flag design or follow-on from the group work. Children choose a role they would like to play in the team and their patch should incorporate an element to designate their job.

A template is provided and children can cut out their mission patch to attach it to a display, workbook or other personal item.

Team Expedition Antarctica: design a mission flag

Use the presentation to introduce the activity and as a basis for discussion prior to designing the mission flag and patches. The presentation contains six slides and will take just a few minutes, depending on the discussion:

Your expedition is going to the Halley Research Station to study the living things in Antarctica.

What jobs will people need to do in your team?

Discuss the jobs that need to be done when exploring Antarctica.

Write down three of the most important jobs.

1

2

3

What living things will you study in the Antarctic?

Discuss how you will find out about the living things around the Halley Research Station. Remember they could live on the ice or in the Antarctic Ocean.

Write down three living things you could study or three ways to find out about living things in the Antarctic.

1

2

3

LESSON 5: TEAM EXPEDITION ANTARCTICA – DESIGN A FLAG

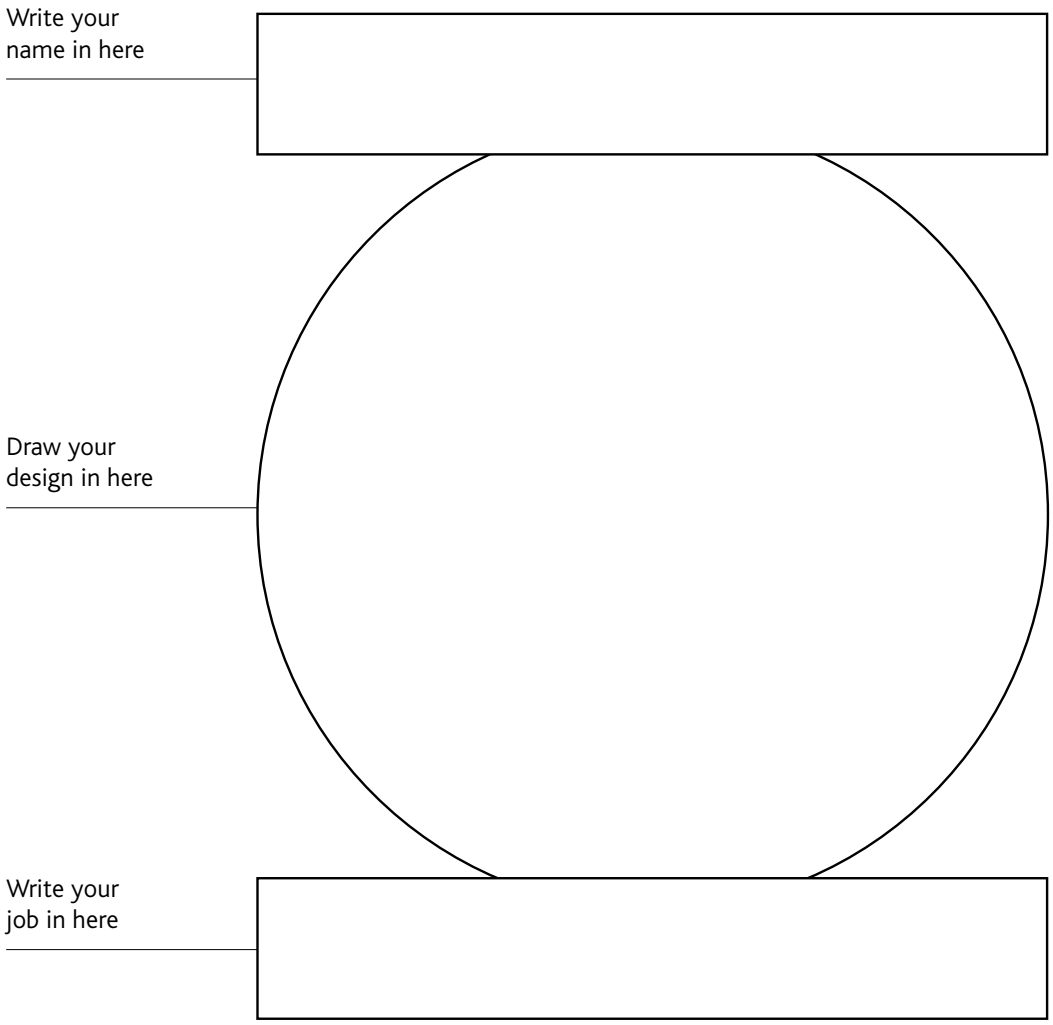
Design an expedition flag

Your flag should help people understand the skills in your team and what your expedition is going to study.
Draw your design on a piece of paper.

Team Expedition Antarctica: design an expedition badge

Choose one of the team jobs that you discussed with your group. More than one of you can do each job.
Team Expedition Antarctica members have their own expedition badge. Design a badge that tells people about the expedition and your job in the team.

Cut out the outline below. Use it to design and draw your expedition badge.



LESSON 6: RACE TO ANTARCTICA – POLAR EXPEDITION BOARD GAME

Activity aims

To give children an opportunity to answer questions based on their knowledge and understanding of the polar regions and the types of roles played by polar researchers and support staff.

To reinforce the understanding of the location, wildlife and geography of the polar regions.

KS2 curriculum links

- Science: Animals and habitats
- Geography: Location knowledge

Teachers' activity notes

This is a board game for two to four players. The aim is to move along a path, divided into squares, which depicts a journey from the British Antarctic Survey (BAS) headquarters in Cambridge, England, to the Halley Research Station in the Antarctic.

Players have counters which are moved a number of squares according to the throw of a dice. Counters represent different researchers, engineers and support staff working for the BAS. It is recommended that there is a maximum of four players per game.

Players take turns to roll the dice and move along the board.

Accompanying the game is a set of 36 question cards. These are multiple choice questions, relating to the polar regions and work of the BAS, along with an indication of the correct response.

As the players move along the path, they encounter 'question' squares. When landing on a question square one of the other players takes the top question card and asks the question. If the person on the question square answers correctly they take a bonus roll of their dice and move forward. If they get the answer incorrect, they take a penalty roll and move backwards.

The question card is placed at the bottom of the stack and the next player takes a turn. It does not matter if the question cards complete a full cycle and are repeated as this will help to reinforce the correct answers.

The winner is the first person to reach Halley Research Station.

Extension activity

There is also a page of blank cards so that children can add their own questions. This could form part of an extension activity. Shuffle the cards before each game.

LESSON 6: RACE TO ANTARCTICA – POLAR EXPEDITION BOARD GAME

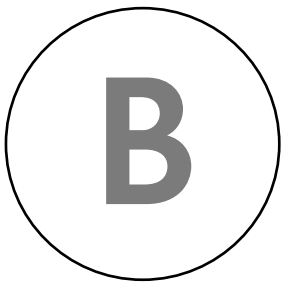
Resources and preparation

The activities use the following materials:

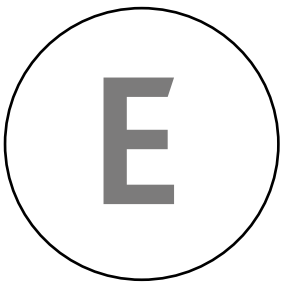
- Instruction card (set of brief instructions for players)
- Board – copy and enlarge to A3 size
- Set of 36 question cards (photocopy and cut out)
- Set of blank question cards for children to create their own questions (extension activity)
- Set of four markers (photocopy and cut out) or use any suitable marker
- Six-sided dice

To improve the longevity of the game, use light card or laminate if possible.

Markers

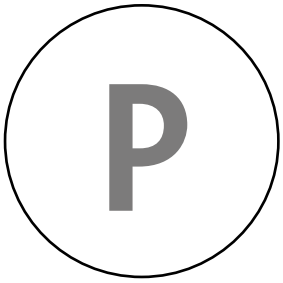


Biologist



Engineer

Geologist



Physicist

LESSON 6: RACE TO ANTARCTICA – POLAR EXPEDITION BOARD GAME

How to play the game

Can you be the first one to get to the Halley Research Station in Antarctica?

1. Choose your marker.

2. Start with your marker at the British Antarctic Survey headquarters in Cambridge.

3. Roll the dice to see how many squares to move forward.

4. If you land on a question square, get one of your playing partners to take a question card. They should read out the question and options on the card. You must choose one of the options to answer the question correctly.

If you get the question right – bonus roll to move forward.

If you get the question wrong – roll the dice to see how many squares you must move backwards.

Put the question to the bottom of the pile.

5. Take turns rolling the dice. The winner is the first one to reach the Halley Research Station.

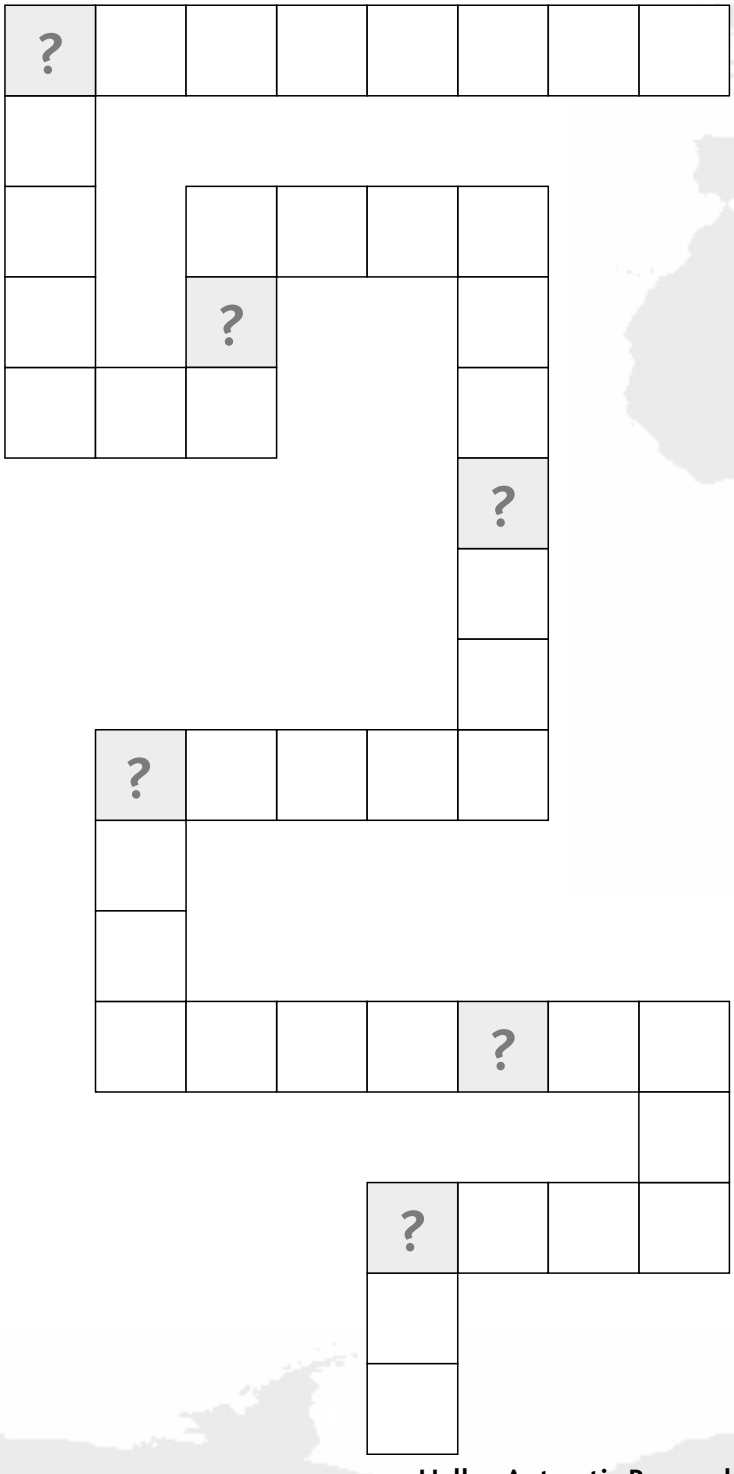
LESSON 6: RACE TO ANTARCTICA – POLAR EXPEDITION BOARD GAME

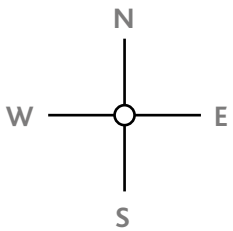
Start in Cambridge. Can you be the first one to get to the Halley Research Station in Antarctica?

Land on a question mark and answer a question.

Correct answer
Take a bonus roll forward

Wrong answer
Take a penalty roll back





QUESTION CARDS

Where is the Antarctic?

A Northern hemisphere (North Pole)
B Southern hemisphere (South Pole) ✓

Where is the Arctic?

A Northern hemisphere (North Pole) ✓
B Southern hemisphere (South Pole)

You are on the RRS Sir David Attenborough and want to send a message to BAS headquarters. Which person will you get to send the message?

A Mechanical engineer
B Communications engineer ✓
C Geologist
D Chef

Which animal could you see on an expedition to the Antarctic? Choose just one.

A Polar bear
B Reindeer
C Wolf
D Penguin ✓

Which animal could you see on an expedition to the Arctic?

A Polar bear ✓
B Penguin

What type of scientist would study the weather in Antarctica?

A Geologist
B Astronomer
C Biologist
D Meteorologist ✓

QUESTION CARDS

What type of scientist would study the animals that live in Antarctica?

A Geologist
B Astronomer
C Biologist ✓
D Physicist

What type of scientist would study the landscape at the Antarctic?

A Geologist
B Geographer ✓
C Biologist
D Physicist

What type of scientist would study the effect that humans are having on Antarctica? For example, plastic waste pollution.

A Environmental scientist ✓
B Astronomer
C Physiologist
D Physicist

What type of scientist would study how the human body reacts to conditions in the Antarctic?

A Geologist
B Astronomer
C Physiologist ✓
D Engineer

You are in the British Antarctic Survey office Cambridge, England. In which direction is Antarctica?

A North
B South ✓
C East
D West

How cold is it in the Antarctic? Compare it with the temperature where you live.

A Warmer
B About the same
C A lot warmer
D A lot colder ✓

QUESTION CARDS

What do the initials BAS stand for?

A British Air Services
B British Antarctic Survey ✓
C Base At South Pole
D Boats At Sea

Which person would look after all of the light and power at the Halley Research Station?

A Electrical engineer ✓
B Communications engineer
C Geologist
D Chef

Which person would look after all of the tractors, vehicles and machinery at the Halley Research Station?

A Electrical engineer
B Communications engineer
C Mechanical engineer ✓
D Carpenter

Which person would make sure that all the people working at the Halley Research Station had a good diet?

A Biologist
B Environmental scientist
C Geologist
D Head cook ✓

What type of clothes do polar researchers wear when they are outside their Antarctic Research Station?

A T-shirt and shorts
B Warm coat and trousers ✓
C Hoodie with jeans
D Trainers and long jacket

What is the RRS Sir David Attenborough?

A A research and supply ship ✓
B A holiday cruise ship
C An oil tanker ship
D A container ship

QUESTION CARDS

What is the main job of the RRS Sir David Attenborough?

A Take television crews to the polar regions

B Take holidaymakers on whale-spotting cruises to the Arctic

C Carry researchers and supplies to the polar research stations ✓

What is the land like at the Arctic (North Pole)?

A A very thick layer of ice floating on the sea ✓

B A very thick layer of ice covering solid ground

What type of work does a geologist do?

A Makes radio equipment

B Studies rocks and minerals ✓

C Designs buildings and bridges

D Studies oceans and seas

What type of work does an electrical engineer do?

A Makes communications equipment ✓

B Studies rocks and minerals

C Designs buildings and bridges

D Studies oceans and seas

What is the land like at the Antarctic (South Pole)?

A A very thick layer of ice floating on the sea

B A very thick layer of ice covering solid ground ✓

Where are the headquarters of the British Antarctic Survey?

A London

B Paris

C Cambridge ✓

D Cardiff

QUESTION CARDS

Scientists visit the Antarctic to study climate change. What is climate change?

A Changes in the earth's climate due to human air pollution ✓

B Changes in the weather conditions from winter to summer

C Differences in the weather at the North Pole and South Pole

What type of work does a biologist do?

A Studies rocks and minerals

B Studies the stars and space

C Designs buildings and bridges

D Studies plants and animals ✓

Who would be involved in designing and making a new Antarctic research ship?

A Architect

B Astronomer

C Shipbuilder

D Marine engineer or naval architect ✓

What type of food do penguins eat?

A Grass and seeds

B Worms

C Insects and bugs

D Fish ✓

Who would you ask to design a new Antarctic research station?

A Architect ✓

B Astronomer

C Shipbuilder

D Marine engineer

How could a software engineer help with polar research?

A Write articles for newspapers and magazines

B Write computer programmes to control robot submarines ✓

C Take video and photographs to show conditions in the Antarctic

QUESTION CARDS

How could a photographer help with polar research?

A Write articles for newspapers and magazines

B Write computer programmes to control robot submarines

C Take video and photographs to show conditions in the Antarctic ✓

How could a public relations officer be involved with polar research?

A Write articles for newspapers and magazines ✓

B Write computer programmes to control robot submarines

C Take video and photographs to show conditions in the Antarctic

Which person would be in charge of building a new research station in the Antarctic?

A Head biologist

B Chief astronomer

C Head of public relations

D Construction manager ✓

Which person would be in charge of keeping people healthy and well at the research station?

A Medical doctor ✓

B Head cook

C Electrical engineer

D Head biologist

Which person would help to keep all the computers running at the Halley Research Station?

A Mechanical engineer

B Software engineer ✓

C Head physicist

D Marine engineer

In the Antarctic, what does a surveyor do?

A Measures the land and makes maps ✓

B Asks people questions to find out how they are feeling

C Monitors the food that the researchers are eating

QUESTION CARDS – BLANK

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