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| **How polar animals keep warm?** |
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| Understanding how polar animals keep warm in icy conditions |
| **Stay safe** |
| Whether you are a scientist researching a new medicine or an engineer solving climate change, safety always comes first. An adult must always be around and supervising when doing this activity. You are responsible for: • ensuring that any equipment used for this activity is in good working condition• behaving sensibly and following any safety instructions so as not to hurt or injure yourself or others  Please note that in the absence of any negligence or other breach of duty by us, this activity is carried out at your own risk. It is important to take extra care at the stages marked with this symbol: ⚠ |
| **Subject(s):** Design and Technology,Mathematics, Science**Approx time:** 60 - 90 minutes |  | **Key words / Topics:** * Arctic/Antarctic
* blubber
* graphs
* heat loss
* insulation
* interpreting data
* polar
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| **Suggested learning outcomes** |
| * To understand how polar animals keep warm in very cold conditions.
* To understand what blubber is and how it helps polar animals to survive.
* To be able to record experiment data using tables and graphs.
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| **Introduction** |
| This is one of a series of resources designed to allow learners to use the theme of the festive period to develop their knowledge and skills in Design and Technology, Science, Mathematics and Engineering. This resource focuses on constructing a model to find out how blubber can help keep an animal warm in the icy waters of the North or South Poles.Many polar animals need to keep their body temperature high, despite freezing cold temperatures. How do you think they do this?! |
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| **Purpose of the activity** |
| In this activity, learners will construct a very simple model of a polar animal and use this to investigate how they keep themselves warm. They will gain an understanding of how well a layer of blubber can insulate an animal and see how the heat loss is reduced against an uninsulated animal.This activity could be used as a main lesson activity to teach about the effects of insulation and heat transfer. It could also be used as part of a wider scheme of learning, focusing on how animals react to the world around them.  |
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| **Activity** ⚠ |  | **Teacher notes** |
| **Introduction (10-20 minutes)**Teacher to explain that learners are going build and test model seals to investigate how animals keep warm in the icy seas. Learners could try putting their hands in ice water to see how it feels.**Discussion – why do animals live at the poles? (5-10 minutes)**Class discussion about what animals live at the poles. Why live there at all? Which live at the North Pole and which at the South?**Conducting the experiment (40-50 minutes)** ⚠Learners to draw up a table (Slide 5) ready for their results. Teacher to hand out resources required for the task to learners. * **Step 1** – Preparing the Seals

Each team needs two margarine tubs, one completely empty and another with enough margarine to cover the sides in a layer at least 1 cm thick. * **Step 2** – Prepare the Arctic Ocean

A large tray or dish is filled with cold water and, if possible, ice cube ‘icebergs’ should be added. * **Step 3 –** Making the warm ‘blood’

Mix warm and cold water together to get as close to 37oC as possible. * **Step 4** – The experiment

Place the two model seals in the icy water carefully and immediately take the temperature of the blood. Every 2 minutes take their temperature again and write down the readings.* **Steps 5 and 6** – The results

Evaluating the results and plotting a graph.**Plenary (5-10 minutes)**Tidy up and discuss the results of the experiment. Compare one animal with another. Did all the experiments agree with each other or were their differences? Why? What does this tell us about how animals keep warm and the function of blubber? |  | This activity could be carried out in pairs or small groups. The main activity is covered by the teacher presentation slides 1 to 11. Subsequent slides are extension work and links.It is recommended that the food product is disposed of after this activity – it should not be consumed for hygiene reasons. Spreadable butter or similar products could be used as an alternative to margarine.Step 2 - The dish should not be too deep or there is a chance that the seals will topple over.Step 3 - This can take a while, but it is a good opportunity for the learners to practice reading the thermometers.Step 4 - The water only (skinny) seal will cool very quickly so test that one first if they only have the one thermometer. It can help to have two learners for this stage so that one can operate the stopwatch, whilst the other takes the readings.  |
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| **Differentiation** |  |  |
| **Basic**  |  | **Extension** |
| * Give weaker learners a partly completed table for them to complete the missing data from their experiment.
* Remove the margarine from the tub acting as one of the seals in advance.
 |  | * Make a list of the ways in which the experiment could be improved.
* Research how blubber helps polar animals to float on water and report findings to the class.
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| **Resources** ⚠ |  | **Required files** icon-docicon-pdficon-ppt |
| * An empty margarine tub
* A full margarine tub
* A large flat dish
* Warm water
* Cold water with ice
* A thermometer
* A stopwatch or smart watch timer
* Graph paper
* Pencils and differently coloured pencil crayons
 |  | icon-ppt How polar animals keep warm presentation |
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| **Additional websites** |  |  |
| * **Abyss scuba diving:** An article about how seals keep themselves warm in cold water compared to scuba divers. <https://www.abyss.com.au/en/blog/viewpost/185/seal-temperature-regulation>
* **Animals – How do seals survive in Antarctica:** A website exploring the various ways seals have adapted to life in the freezing water. <https://animals.mom.com/seals-survive-antarctica-7385.html>
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| **Related activities (to build a full lesson)** |  |  |
| **Starters** (Options) * Identify different animals that live in the polar regions. Why do they live where they do and what do they need to survive?
* Discuss the conditions in the polar regions of the Earth. What are the temperatures at different times of the year and how does this affect the animals that live there?
 | **Extension** (Options)* Make a list of the ways in which the experiment could be improved.
* Research how blubber helps polar animals to float on water and repent findings to the class.

**Plenary*** Discuss the results of the experiments and the meaning of the findings. What does this tell us about how animals keep warm and the function of blubber?
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| **The Engineering Context** film |
| * Engineers must be able to investigate the natural world to understand how it works. This allows them to design solutions that both benefit the environment and learn from it, such as suits for divers that can keep them warm.
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| **Curriculum links** |
| **England: National Curriculum**Design & Technology * KS3 3c, 4a

Science* KS3 Experimental skills and investigations - ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience
* Energy changes and transfers - Heating and thermal equilibrium: temperature difference between 2 objects leading to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference; use of insulators.

Mathematics - KS3 Laying out graphs | **Northern Ireland Curriculum**Technology & Design* KS3 Education for Sustainable Development

Science* Forces and energy - Forces and energy transfer
* Develop a range of practical skills, including the safe use of science equipment.
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| **Scotland: Curriculum for Excellence**Technologies* TCH 0-10a, TCH 0-9a

Science* SCN 2-01a, SCN 2-04a

Mathematics* MTH 2-21a
* MTH 3-21a
 | **Wales: National Curriculum** Design and Technology* KS3 Skills: Designing 8,9
* Making 2

Science* KS3 Range: 6, 7

Mathematics* KS3 Using data skills
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| **Assessment opportunities** |
| * Informal teacher assessment of practical skills through observation of learners.
* Formal teacher assessment of completed experiments and results.
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