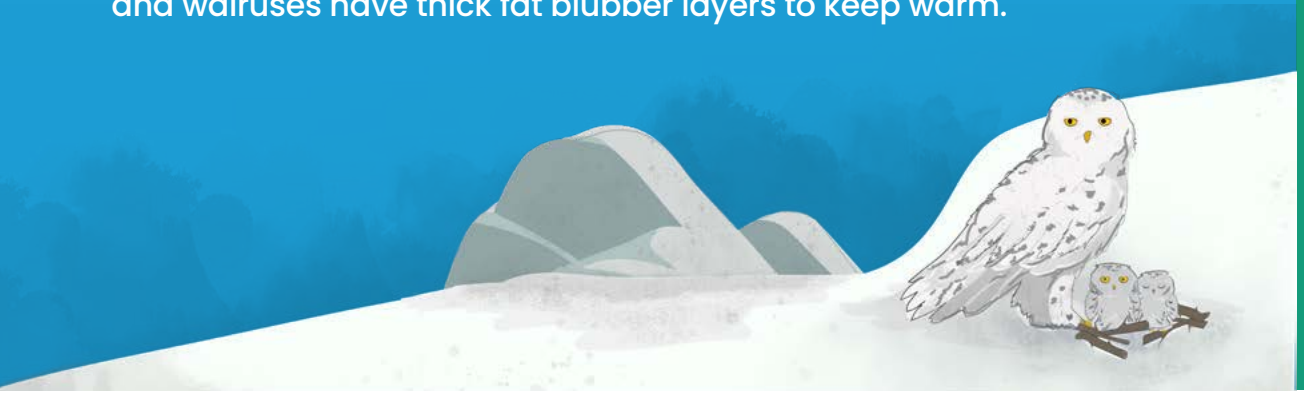
INTRODUCTION

Heat travels from warmer places to colder places. Insulation is a name for a material which acts as a barrier to heat and stops heat transferring from one place to another.

In colder climates, animals must insulate their bodies to prevent heat escaping and to keep themselves warm.

Materials such as wool, cotton, bubble wrap, sponges and cork all share one thing in common. Heat cannot travel through them very easily, making them good insulating materials. This is because they contain pockets of air. Air and other gasses are a very good form of insulation and prevent heat transferring from one place to another. In cold climates animals like caribou, snowy owls and penguins use air trapped in fur or feathers to keep their bodies warm.

Fat is also a good insulating material as heat does not travel through fat molecules very easily. This is why animals such as seals, whales and walruses have thick fat blubber layers to keep warm.

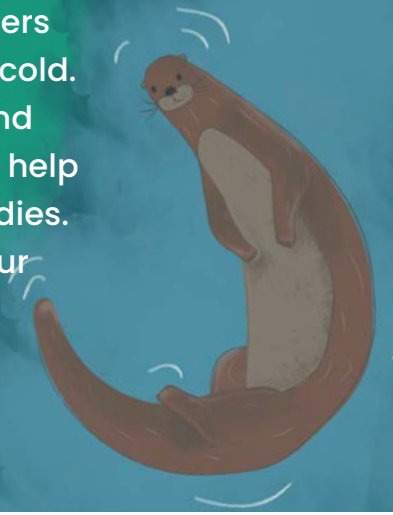


SAFETY

- Always ask an adult for help using ovens.
- Always allow hot items to cool before handling and only handle with an adult's permission.
- Always wash hands after handling.
- Do not consume any food from the experiment.

DID YOU KNOW?

In cold climates birds and animals can use dense fur or feathers to help keep warm. Birds, like snowy owls, fluff up their feathers in the winter to trap air in between the feathers to help insulate them from the cold. Animals such as the caribou and the polar bear have thick fur to help trap a layer of air near their bodies. The sea otter has the densest fur of any mammal, with around 100,000–400,000 hairs per square centimetre.



ACTIVITY

COSY PENGUINS – INVESTIGATE WHETHER TRAPPED AIR IS A GOOD INSULATOR FOR PREVENTING HEAT LOSS

INSTRUCTIONS

1. Place the 3 eggs in a saucepan of water and ask an adult to hard boil them.
2. Make 3 long strands of playdough and join the ends of each to make 3 small doughnut shapes. These will be the stands for your eggs.
3. Once the eggs are hard boiled, leave the eggs to cool in air. An adult should check the eggs are a suitable temperature to handle safely before allowing children to handle the eggs.
4. Work quickly to keep the eggs warm, quickly draw a penguin face on each egg with the pens.
5. Wrap one warm 'penguin' egg in bubble wrap and secure with sticky tape, then transfer to a playdough stand.
6. Place the second warm 'penguin' egg in two layers of plastic food bag. Secure with tape and transfer to a stand.
7. Leave the third 'penguin' egg uncovered and place in the third stand.
8. Set the timer for 20 minutes. After 20 minutes quickly unwrap the 'penguins' and touch each of the eggs. Which penguin feels the hottest and which feels the coolest?

CHALLENGE

Is there a way of putting ice cream in an oven without it melting, using insulation? Look up a recipe for 'Baked Alaska' and ask an adult to help you try baking it!

YOU WILL NEED

- 3 large eggs, as similar as possible in size
- A saucepan
- A timer/clock
- Access to a cooker

- Some playdough or plasticine
- A small sheet of bubble wrap
- Two small plastic food bags
- Sticky tape
- An orange and black pen

WHAT'S HAPPENING?

Bubble wrap is made from two layers of thin plastic with pockets of trapped air between them. Wrapping the second egg in two layers of plastic allows us to test whether trapped air keeps the penguin warmer than just plastic alone. The third uncovered egg allows us to test whether it is the plastic layer that is keeping the penguin warm. Completing the experiment this way makes it a fair test. The bubble wrapped penguin will feel warmest as the trapped air is a good insulator. The egg wrapped in plastic will still feel warm, but plastic is not as good an insulator as air, so it will be cooler than the bubble wrapped penguin. The uncovered egg will feel coolest because it has no insulation to prevent heat escaping.

Another innovative form of insulation is using recycled chicken feathers embedded in recycled plastic to produce a material that has very good insulating properties due to the many tiny pockets of air trapped in the microscopic barbs on each feather.

Reference:
Mrajji O, Wazna ME, Boussoualem Y, Bouari AE, Cherkaoui O. Feather waste as a thermal insulation solution: Treatment, elaboration and characterization. Journal of Industrial Textiles. 2021;50(10):1674-1697. doi:10.1177/1528083719869393

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