Pre-lesson preparation, materials and equipment

The LEARN ABOUT WOOL resources below will give you ample background information to carry out this lesson and answer a range of questions posed by students. This lesson focuses on the thermoregulatory properties of wool and its ability to insulate.

This activity will involve comparing the change in temperature over time of refrigerator-cold cans of drink when covered with a wool sock and a cotton sock.

Demonstrate this activity before allowing students to investigate for themselves. Before carrying out the demonstration clearly explain to students they must listen carefully to all instructions and take care when using laboratory thermometers.

A student data recording sheet *Temperature of the cans* has been provided for you to distribute to students for recording their predictions and their observations from this lesson.

Useful resources:

LEARN ABOUT WOOL factsheets

- *Properties of wool*
- *Different types of wool fabrics*

Videos

- *Sam the Lamb — Properties of wool*
- *Wool regulates body temperature*
- *The innovator*
- *Merino Activewear*
- *Merino wool in sports and activewear*

Materials and equipment

Per group of four students:

- LEARN ABOUT WOOL data recording sheet: *Temperature of the cans*
- Two refrigerator-cold cans of drink per group of four students
- Two laboratory thermometers
- One woollen sock
- One cotton sock
- Science journal to record student observations

Lesson objective:

- To allow students to investigate and compare the thermoregulatory (temperature regulation) capacity of wool compared with cotton and draw conclusions about the suitability of these textiles for a range of everyday uses.

Students will have the opportunity to:

- test the thermoregulatory capacities of wool compared with cotton
- consider the implications of wool's ability to influence the temperature of the user in a range of everyday uses.

Setting the context

In contrast to synthetics, wool is an active fibre that reacts to changes in body temperature. It helps you stay warm when the weather is cold, and cool when the weather is hot. Wool is the preferred fibre for many outdoor activities for its water-repellent qualities, as well as its ability wick sweat away from the skin and help regulate body temperature. Wool's insulation properties, trapping air in the natural crimp of the fibres, help keep you warm when it's cold.

In terms of thermal conductivity, wool is not really that different from other fabrics, such as cotton or polyester. The main reason why wool is better at controlling temperature is how it manages moisture. When it is hot, wool manages moisture to keep you cooler. Water is transported through the fabric and away from the skin into the drier air. When you exercise and start to sweat, the wool next to your skin automatically absorbs the vapour transporting it, and the heat associated with it, away from your skin, keeping you dry and comfortable. This movement of moisture away from your skin not only helps to keep you dry, it also helps keep you cool.

Lesson focus

The focus of this lesson is to encourage students to think about the link between the thermoregulatory properties of a fibre and the implications for its end use.

Introduction

Using their science journals, reflect with students what they now know about wool — where it comes from, how it feels and some of its hidden properties (fire and stain resistance).

Explain to students that during this lesson they are going to think about some of the ways wool can be used in domestic applications, such as insulation and bedding, and how these items assist with temperature regulation of the user. The LEARN ABOUT WOOL factsheets *Properties of wool* and *Different types of wool fabrics* can be used to stimulate discussion.

To assist with their understanding, students will carry out an activity designed to test the difference between two fabrics using the concept of a 'fair test'. This means all parts of the test will be kept the same, apart from the one variable they are testing; in this case, the sock material.

Body of lesson

1. Distribute the data recording sheet *Temperature of the cans* to students and explain that you will ask them to predict what will happen to the temperature of the can over time when you cover a cold can of drink with a wool sock or a cotton sock. They can record their predictions on their data recording sheets before they carry out the experiment.
2. In groups of four students, ask students to put each of the socks on two identical cold cans of drink. Carefully place a laboratory thermometer down the side of the can underneath the sock. Ensure the cans are placed in the same location.
3. Ask students to predict what will happen to the temperature of the can when the sock is placed on the cans and ask them to record their predictions on their recording sheets.
4. Record the starting temperature of the two cans and record the temperature of each can every two minutes for 10 minutes. Ask students to calculate the total change in temperature after 10 minutes and record this on their data sheets in the space provided at the end of the table. Ask students to complete the statement on their data recording sheet as to which sock kept the can the coolest.
5. Group by group, ask the students share their observations of what happened to the temperature over time and encourage them to explain their results.
6. Ask the students to use the data recorded in the table on their data recording sheets to construct a simple column graph (temperature vs time) showing the change in temperature of the two cans during the 10 minutes. Explain that they will need a separate column for each sock type at each two-minute increment (perhaps blue for cotton and yellow for wool, for example).
7. Play the animation Wool regulates body temperature. Ask students to reflect on the experiment and the animation as they describe what happened during the experiment in their science journals. Discuss whether what happened matched their predictions.
8. Play The innovator animation shown during Lesson 2 *Wool — taking a closer look* and ask each student group if they can now describe why the animations' hero is comfortable in wool both indoors and outdoors. Encourage students to think about how they would feel if they went hiking on a cold day wearing a woollen jumper. What would happen if they were wearing a cotton hoodie? Encourage students to think about other items of clothing e.g. woollen hats compared with cotton caps.

Conclusion

Ask students to develop a paragraph to describe the thermoregulatory (temperature regulation) properties of wool and record this in their science journals. Ask them questions such as:

- "What sort of clothing would help keep you cooler in summer and warmer in winter?"
- "How could wool be used to help keep our houses cooler in summer and warmer in winter?"

Explain that during the next lesson you will be considering how the properties you have been investigating influence the way we use wool in a range of everyday products and how we dispose of unwanted clothing.

Extension activity

Using the design of the class activity, modify and design a fair test to demonstrate how wool can help keep objects warmer for longer e.g. a hot drink.

Alternatively, investigate the domestic uses of wool, including roof and wall insulation, wool furnishings and carpet in the home. How does the use of wool help keep the user warmer in winter and cooler in summer in their home? Students could present their findings as a poster or infographic, using this question as the title.

Links to the Australian Curriculum:

- Natural and processed materials have a range of physical properties that can influence their use. (ACSSU074)
- Science involves making predictions and describing patterns and relationships (ACSHE061)
- With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge (ACSIS064)
- Represent and communicate observations, ideas and findings using formal and informal representations (ACSIS071)
- Compare results with predictions, suggesting possible reasons for findings (ACSIS216)
- Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately (ACSIS066)
- Reflect on investigations, including whether a test was fair or not (ACSIS069)
- Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends (ACSIS068)