



CLASSROOM ACTIVITY

Fabric Test

What kinds of fabric will keep someone visiting Antarctica warm in sub-zero temperatures? Find out by testing a variety of fabrics for their effectiveness as insulators. Use your knowledge to closely analyze the clothing gear issued to people living and working on Antarctica. As you and your team prepare and conduct your experiment, focus on the questions below. After you have completed the activity, respond to these questions directly in your journal.

- ▶ What are the needs of humans living and working in Antarctica?
- ▶ How can different fabrics be tested for their suitability in meeting some of those needs?
- ▶ What fabrics are most appropriate for use in clothing designed to protect humans from the extreme cold and wind of Antarctica?

Gather with your team and choose a captain and a note taker for today. The captain appoints group members to collect the required materials while the rest of the group reviews today's procedure. Before beginning, the captain makes sure that the group has all required materials, and that everyone knows the day's procedure.

The note taker takes notes on the group's findings for your team. Remember to record your observations and explanations in your journal for your own research notes. Include drawings to illustrate your findings.

MATERIALS

- ▶ research materials and/or research notes
- ▶ scraps of fabric, approximately 8 inches (20 cm) square
- ▶ 4 100-ml beakers
- ▶ 4 thermometers
- ▶ rubber bands
- ▶ graph paper
- ▶ colored pencils
- ▶ Antarctic Support Associates Clothing List
- ▶ Fabrics: polypropylene or other hydrophobic fabrics; super-thin fabrics, e.g., Primaloft, Microloft, or Thinsulate; cotton; wool; pile or fleece fabrics; down; fiber-fill (Polarguard, Hollofil, or Quallofil); Radiant Barriers, such as "Space Blankets"



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PROCEDURE

1. Before beginning your investigation, discuss what you already know about the type of gear that might be used to protect humans in extreme conditions. With your team, use the worksheet to list the needs of humans living and working in Antarctica, and the clothing gear that might help them meet the challenges of such extreme conditions. Review **Letter from Stephanie: Antarctic Hazards** or any other resources your teacher suggests.
2. Examine the fabrics you will test and investigate; make predictions about their insulating capabilities on your worksheet before conducting your experiments.
3. Use as many fabrics as your teacher specifies. If possible, test fabrics that you think will have different levels of insulating capability.
4. Use as many beakers as you have fabric, plus an extra one as a control. Wrap your beakers with the selected fabric; secure fabric with rubber bands. Leave the control beaker unwrapped. Place a thermometer in each beaker.

Don't forget to leave one beaker "nude."
That way you can see how much each fabric insulates in comparison with no insulation at all!



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5. Fill each beaker with 75 ml of hot water at 80–100°F. Be careful—the water is hot (but not hot enough to burn you)! Make sure the water in all the beakers is at the same temperature, and that there is the same amount of water in each beaker—explain why on your worksheet. Record the starting temperature on your worksheet also.
6. For the next twenty minutes, at regular intervals of two minutes, record the temperature in each beaker, using the chart on your worksheet.
7. When you have finished, use the graph area on your worksheet to graph the results. Review with your teacher any specific requirements for your graphs before beginning.
8. Draw some conclusions, using the questions on your worksheet. After all the groups in your class present their information, add to your notes and conclusions in your own Antarctic journal.
9. Now that you have a sense of how all the fabrics work, your teacher may ask you repeat the experiment using some wet fabrics to see how well each continues to insulate, even after becoming wet. Repeat the steps above with wet fabrics, making predictions, wrapping the tubes, placing the thermometer, filling the tubes with an equal amount of water at 80–100 degrees Fahrenheit, taking an original reading and then a reading every two minutes for twenty minutes, making a graph of your results, and then drawing conclusions about the kind of clothing you'd want if you were setting off for a research expedition to Antarctica.



GROUP MEMBERS _____

CAPTAIN _____ **NOTE TAKER** _____

1. Before you begin your experiment, discuss with your group the kinds of fabrics you think would be the most effective in the extreme environment of Antarctica. Use the chart below to record your ideas.

TYPE OF FABRIC	REASON IT WOULD BE EFFECTIVE

2. Because it is so cold in Antarctica, fabrics need to be good insulators. Insulators hold in body heat and help to block out the cold air that surrounds the body. Examine the fabrics you will be using today and offer some hypotheses about their insulating capabilities. Rank them in order of insulating capability and explain your reasoning in the chart below.

TYPE OF FABRIC	RANK	REASON FOR YOUR HYPOTHESIS ABOUT THIS FABRIC



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**GROUP WORKSHEET 2
 ANTARCTIC TEAM**

3. Test your hypotheses. Follow the procedure for wrapping your test tubes, placing the thermometers and filling the beakers with hot water. Why is it important that the beakers have the exact same amount of water at the same temperature?

4. Use the chart below to record the starting temperature, and the temperature every two minutes for twenty minutes. At the top of each column, write the type of fabric with which you have wrapped the beaker.

TIME	#1: NO FABRIC	#2	#3	#4	#5
0 minutes					
2 minutes					
4 minutes					
6 minutes					
8 minutes					
10 minutes					
12 minutes					
14 minutes					
16 minutes					
18 minutes					
20 minutes					



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Fabric Test (STEP ONE)

**GROUP WORKSHEET 3
ANTARCTIC TEAM**

5. On a separate piece of graph paper, create a graph of your data.

How will you label your graph of this data?

Title for the graph_____

label for x-axis_____ intervals for x-axis_____

label for y-axis_____ intervals for y-axis_____

6. Draw some conclusions. Were your fabric hypotheses correct? Which fabric is the best insulator? The worst? Explain your reasoning using the data from your experiment.

GROUP DYNAMICS

Comment on how each group member participated in today's discussion.



Testing Wet Fabrics

1. Test your fabrics to see how well they insulate when wet. Why might this information be important for people living and working in Antarctica?

2. Offer some hypotheses about the capacity of the fabrics to insulate when wet. Rank them in order of insulating capability and explain your reasoning in the chart below.

TYPE OF FABRIC	RANK	REASON FOR YOUR HYPOTHESIS ABOUT THIS FABRIC



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Fabric Test (STEP TWO)

**GROUP WORKSHEET 5
ANTARCTIC TEAM**

3. Test your hypotheses. Follow the procedure for wrapping your test tubes, but first wet your fabrics using cold water. Place the thermometers in the beakers and fill them with hot water. Use the chart below to record the starting temperature and the temperature every two minutes for twenty minutes. At the top of each column, write the type of fabric with which you have wrapped the beaker.

TIME	#1: NO FABRIC	#2	#3	#4	#5
0 minutes					
2 minutes					
4 minutes					
6 minutes					
8 minutes					
10 minutes					
12 minutes					
14 minutes					
16 minutes					
18 minutes					
20 minutes					

4. Now you will make a graph of the wet fabric data. How will you label your graph?

Title for the graph_____

label for x-axis_____ intervals for x-axis_____

label for y-axis_____ intervals for y-axis_____



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**GROUP WORKSHEET 6
ANTARCTIC TEAM**

5. Draw some conclusions. Were your wet fabric hypotheses correct? Which fabric is the best insulator when wet? The worst? How does your data for wet fabrics compare to the data for dry fabrics? Explain your reasoning using the data from your experiment.

6. If you were going on a trip to Antarctica, which fabrics would you want to use for your clothing gear? Consider also how you will layer different fabrics.

GROUP DYNAMICS

Comment on how each group member participated in today's discussion.