

**Activity Time:**

30 minutes plus ongoing observation for one day

**Setting:**

Indoor on a sunny windowsill

**Materials:**

- One thermometer for each coat

Not included:

- Pictures of the arctic in winter including weather, animals and people.
- Pictures of a tropical beach or resort area during its warm and cool (rainy) seasons.
- A variety of coats made from different types of materials: wool, polar fleece, down, polyester batting, cotton, etc. and in a range of colours.

**Grade Level:**

Grade 2-6

**Subject Areas:**

Biology, Chemistry, Ecology, Geography, Science, Language Arts, Math

**Group Size:**

Any

**Keywords:**

Atmosphere, climate change, greenhouse effect, temperature



# Too Hot, Too Cold, Just Right

The naturally occurring greenhouse effect keeps our planet at a temperature that is just right for life on earth. How is climate change affecting that temperature?

**Summary**

Students perform a simple experiment to relate different types of coats or blankets to what the greenhouse effect does for the earth's temperature.

**Objectives****Students will:**

- Infer the probable outcome of an event based on observations
- Ask questions that foster investigations relevant to the content
- Measure events
- Make predictions, supported by reasons and relevant to the content
- Use data from investigations to recognize patterns and reach conclusions
- Identify variables that can be changed in an experiment
- Describe the steps in designing an experiment
- Manipulate and control a number of variables in an experiment
- Analyze the impacts of weather on living and non-living things
- Determine how personal choices and actions have environmental consequences

**Making Connections**

The naturally occurring greenhouse effect is like a coat around the earth that keeps it nice and warm. Without the greenhouse effect, the earth's average temperature would be about  $-18^{\circ}\text{C}$  instead of the comfortable  $15^{\circ}\text{C}$  it is now. However, increasing global temperatures caused by global climate change are causing the earth to warm up, just as if the earth had put on a coat that is too warm for the weather. In this activity students examine a variety of fabrics and colours to understand that differences in the structure of a coat determines its ability to keep you warm, just as differences in the structure of the earth's atmosphere determines how warm the earth will be.

**Background**

The Climate Change Primer provides a detailed explanation of the natural and enhanced greenhouse effect.

**Procedure****Warm Up**

1. Ask students what life is like in the arctic during the winter season.



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Show the pictures of weather, animals and people in the arctic. What might it be like in terms of sunny days, rainy days, snowy days, hot days and cold days?

**2.** Ask students if every place is like that in the winter. Has anyone been to a warm place in the wintertime? What was it like? Show a picture of a warm resort place during its sunny season and its 'winter' season (generally the rainy season). What about our climate? How does it compare to those places in winter? What about summer, are we hot or moderate compared to those other places?

**3.** How does the earth get these different climates and how does the earth keep its warmth overall? Why isn't the whole earth like the arctic or the tropics? In part this is due to the shape and tilt of the earth. At different times of the year, different parts of the earth are closer to and further away from the sun. But the earth's atmosphere is what really shapes life on earth. The sun heats up the earth like a big heater. Luckily for us all the heat doesn't just bounce back into space again but instead the earth has a layer of air surrounding it, called the **atmosphere**, to trap some of the heat.

**4.** Without the atmosphere we would be very cold, or possibly

not here at all, because the earth's average temperature would be  $-18^{\circ}\text{C}$  instead of the  $15^{\circ}\text{C}$  it is now. This effect of the atmosphere keeping us warm is called the **natural greenhouse effect**. A greenhouse is a building made of clear glass or plastic that is used to grow plants. Why would this be a good place to do this (traps a layer of warm air around the plants helping them grow more quickly)?

**5.** We can also think of the atmosphere like a coat we would use to keep us warm. However, if someone gave you a new coat, you would not know how well it would keep you warm until you had tried it out because not every coat is made of the same materials.

Has anyone ever worn a coat that was always too hot? How about one that never keeps you warm? Have you ever noticed how some coats and blankets are just right? In this experiment we are going to determine which materials and colours will keep you too cold, too hot or just right.

## The Activity

**1.** As a group, compare the composition, thickness and colours of the coats. If possible, try to have at least two coats of a similar composition and thickness that

are different colours i.e. two polar fleeces, one black and one pink. Give each coat an identifying number or name.

**2.** Explain to the students that the coats will be placed on a sunny windowsill. Have students individually form and record a hypothesis for what will happen to the temperature inside each coat when the coats are placed in the sun. Also have students predict which coat will cool down most quickly and which coat will stay warm the longest.

**3.** Place the coats on the windowsill. Place a thermometer under the top layer of each coat. Check the temperatures every 15 minutes and record the results. When the temperatures have remained constant for three readings, remove the coats and place them out of the sun. Continue taking temperature readings every 15 minutes until the temperatures have stabilized.

**Note:** For younger grades, you may wish to omit the thermometers and have students check the temperatures just by touch.

**4.** Display the results for the heating and cooling of the coats. Have students compare the results with their hypothesis. As a class, discuss what happened and then have each student write a conclu-



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sion for the experiment.

**5.** Relate the different compositions of the coats to the composition of the gases in the earth's atmosphere. It is that composition that provides us with the 'warmth' we know as the **greenhouse effect**. Changes in the composition of the gases will result in changes to the earth's temperature. The **enhanced greenhouse effect** is due to an increase of heat trapping compounds, such as carbon dioxide (CO<sub>2</sub>), as a result of human activities.

## Wrap Up

**1.** Animals (including people) have adapted to the warmth of the earth's 'coat' or atmosphere that keeps the earth at a good temperature for life. Even though the temperature changes with the seasons we have learned to adapt. Some animals even change their coats for summer and winter.

**2.** What would happen if the earth's coat was suddenly thicker and the temperature got warmer? How long would it take to adjust if you were an animal with a permanent coat of fur? Would you be able to change your fur coat easily? What might happen if you were hot all the time? What about plants, what would happen to

them? A plant cannot move into the shade if it gets too hot. What adaptations might a plant be able to use? Would other plants that like heat move in and take over? What about the animals that eat the plants? What would happen to them if the plants cannot adapt to changes in temperature.

**3.** The earth's atmosphere is changing in composition, resulting in a global increase in average temperature.. We are concerned about this because the changes may occur too quickly for animals and plants to adapt, including ourselves. One of the really big challenges is that not every place will heat up at the same rate. Some places might even cool down. Scientists think that some plants and animals will be able to adapt to the changes but others will not. Many plants and animals may even go extinct.

**4.** It is important to know what is causing **human induced climate change** so that we can take action to stop it. The composition of the earth's atmosphere is changing and one of the biggest contributors is carbon dioxide released when we use gas, oil or coal. What are some ways that we use this? Brainstorm and record a list with the class: Driving cars, heating homes, etc.

**5.** Decide as a class on one action you will pledge to do to limit human induced climate change. This could be as simple as deciding to turn out the lights on sunny days and whenever the classroom is not in use.

## Assessment

Students create a poster or brochure outlining the natural greenhouse effect, the enhanced greenhouse effect or one of the challenges climate change will pose for plants and/or animals and a positive action humans can take to help slow this process.