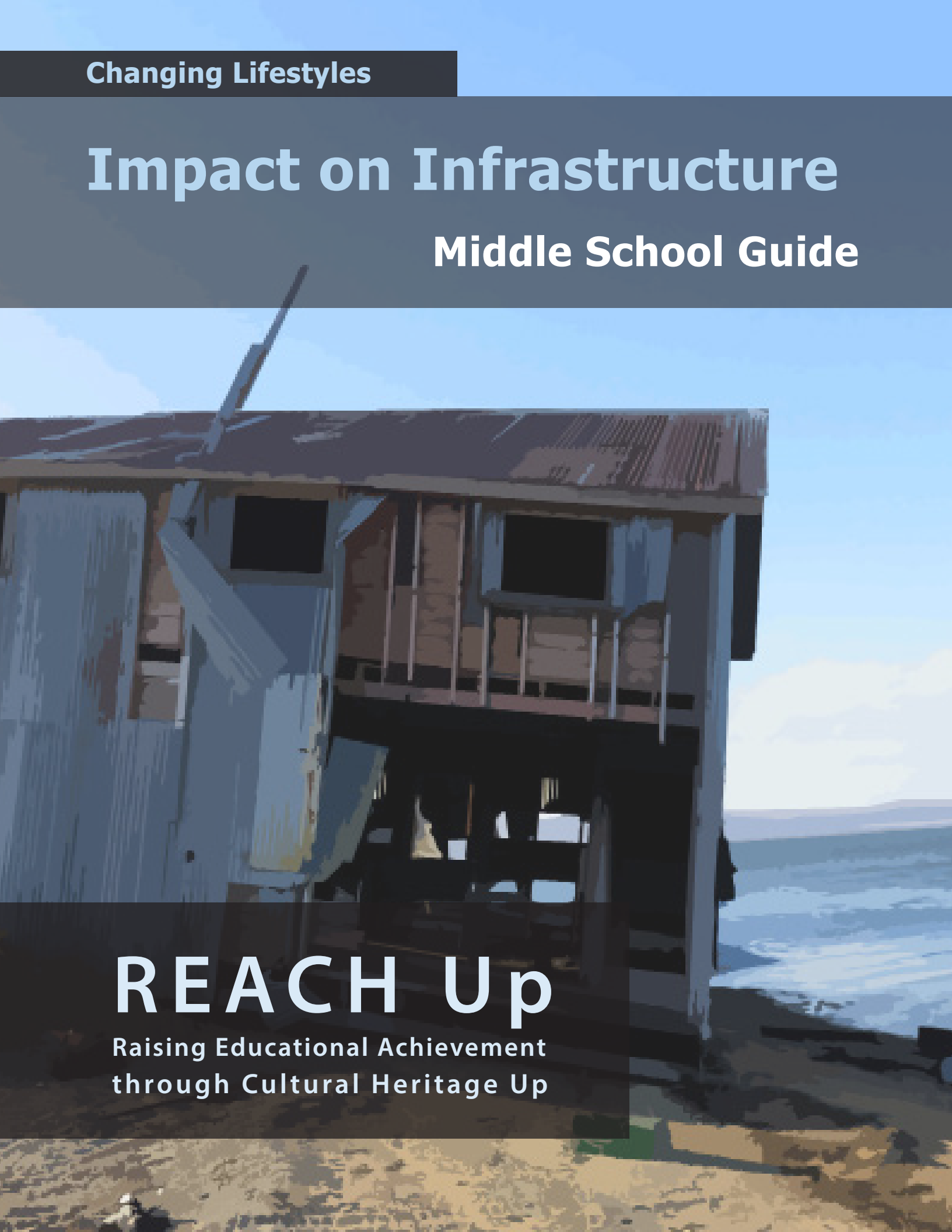
Changing Lifestyles

Impact on Infrastructure

Middle School Guide



REACH Up

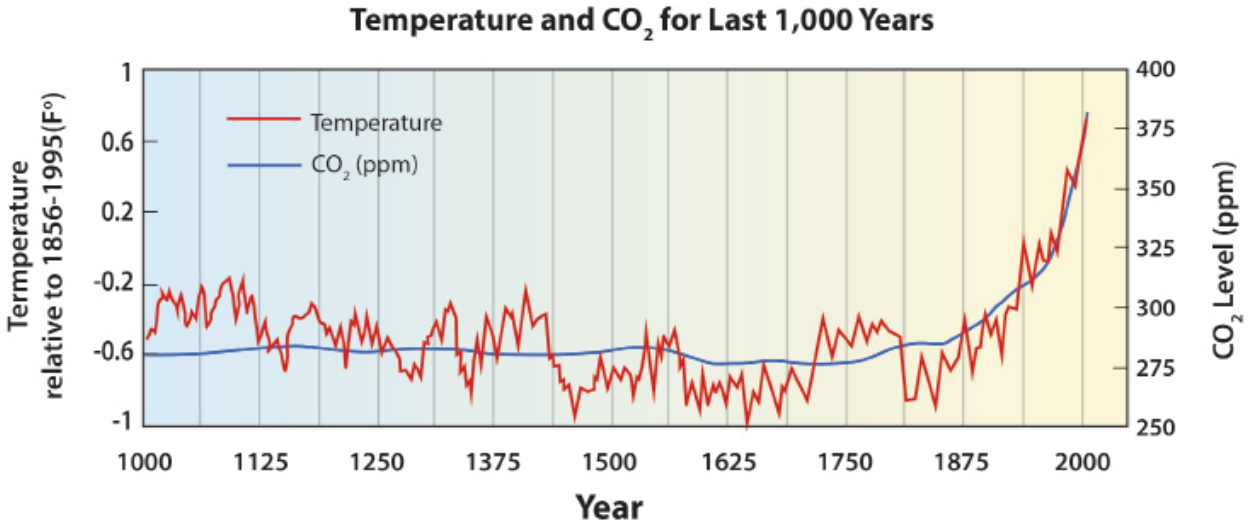
Raising Educational Achievement through Cultural Heritage Up

Changing Lifestyles

Climate Change and Carbon Dioxide

Carbon dioxide (CO_2), like water vapor and methane, is a greenhouse gas that contributes to the warming of our global climate. Carbon dioxide is a naturally occurring substance. For example, it is produced by volcanic eruptions and forest fires. It is a product of cellular respiration, meaning people and animals produce carbon dioxide when they breathe. Carbon dioxide is also produced by burning fossil fuels such as coal, fuel oil, and gasoline.

The graph below shows that carbon dioxide in the atmosphere increased significantly, starting in the 1800s. This coincides with the Industrial Revolution, when people began making things in factories. The factories burned coal and wood to run their machines, and contributed carbon dioxide to the atmosphere from their smokestacks.



Graph showing increasing temperatures and CO_2 levels, modified from an article by Bill Chameides, PhD., Duke University. Data sources for CO_2: Law Dome ice core and Mauna Loa air samples. Data source for temperature: NOAA. *Source: Environmental Defense Fund, 2007.*

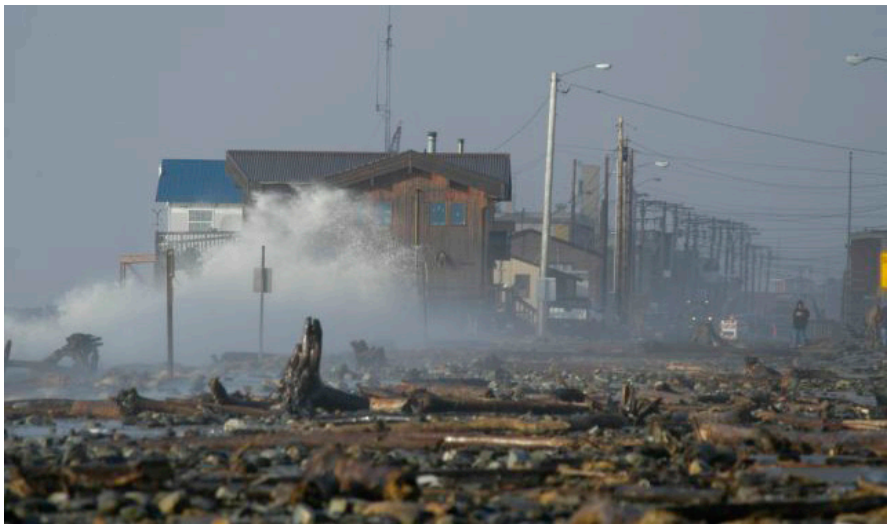
Today we contribute carbon dioxide in many ways. The factories that make the products we use, the airplanes that transport us and deliver our packages, the furnaces and woodstoves that heat our homes, and the vehicles we drive all produce carbon dioxide.

Changing Lifestyles

The landscapes in the northern part of the world are changing as a result of the warmer climate. People in the Bering Strait region are adapting their lifestyles to adjust to these changes. Some are also making lifestyle changes to reduce the amount of carbon dioxide and other pollution they create, so that they do not further contribute to the greenhouse effect and warming of the climate. How does the warming climate impact lifestyles in your community?

How is Climate Change Impacting Infrastructure in Western Alaska?

Climate change is affecting infrastructure in Alaska. Permafrost is thawing, leading to rapid erosion. Snow is melting earlier in the spring. Sea ice is disappearing, causing stronger onshore storms and increased flooding. These changes have caused houses and buildings to collapse. The changing climate also affects water pipes, sewers, and water treatment plants, making it difficult to secure safe drinking water and keep a healthy environment. Environmental changes are increasingly forcing communities to adapt more quickly than expected.



Twenty-foot waves from a 2004 Bering Sea storm pounded downtown Nome.

Erosion caused by the movements of the slough in Kotlik.

Photos: Department of Commerce, Community and Economic Development; Division of Community and Regional Affairs' Community Photo Library.

Ask an Expert

1. Watch the video *Impact on Infrastructure* available at www.k12reach.org/videos.php.
2. Interview elders, cultural knowledge bearers, or infrastructure experts in your community. Some questions you may want to ask:
    - What was infrastructure (such as roads and houses) like in the past compared to today?
    - How is climate change affecting infrastructure in our community (roads, houses and buildings, water resources, etc.)?
    - Have people in our community had to make any changes to our living environment (water supply, roads, buildings, etc.)? If so, how?
3. If the person you interview speaks an Alaska Native language, ask them what language and dialects they are familiar with. Ask them to please translate the following words:
    - climate
    - heat
    - house
    - insulation
    - vent
    - window

    Compare your words with the translations on the Infrastructure Vocabulary page of this student guide. Are any of the terms the same or similar?

Eva Ryan discusses changes she has seen in Unalakleet that have impacted the village's infrastructure over the years. *Photo: Qian Li, REACH Up.*

Infrastructure Vocabulary

Would you like to know Alaska Native language terms related to infrastructure?

Work with your classmates to practice infrastructure vocabulary words in English and the indigenous language of your community. Your teacher will give you vocabulary cards with the English word and an illustration on one side. Write the corresponding indigenous term on the blank line on the back of each card. Use the words that you learned from a local elder or cultural knowledge bearer, or choose the translation below that is closest to your community.

What Challenges Do Communities Face to Build a House?

Many communities in Alaska are experiencing housing shortages. There is a limited window during a year when the weather is suitable for building a house. Building safe, comfortable, and affordable housing in the Far North has challenges, as buildings need to withstand storms, extreme cold, and wind. Houses also need to be designed to allow moisture to escape to prevent mold, yet retain heat to keep heating costs affordable. Developing housing that is energy efficient and can adapt to the changing environment is crucial to create a healthy living environment, reduce fuel costs, and reduce further contribution to the greenhouse effect.

Robbin Garber-Slaght leads students on a tour of a house being built in their village of Brevig Mission. Garber-Slaght is a Product Testing Lab Engineer at the Cold Climate Housing Research Center in Fairbanks. *Photo: Sally Kieper, REACH Up.*

Building an Energy Efficient House

Part 1: Roof and Walls

Predict!

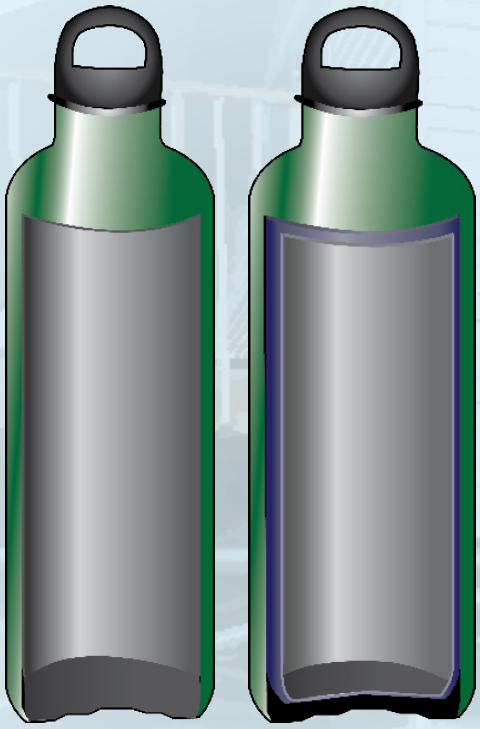
Which type of house keeps more heat inside, a house with a thin roof and thin walls or a house with added materials? Why?

Experiment

We will use different types of water bottles, which represent different types of houses, to determine what keeps heat inside a house.

Materials

- Uninsulated water bottle with an uninsulated lid
- Insulated water bottle with an insulated lid (the same size as the uninsulated water bottle)
- Thermometer (or temperature sensor)
- Measuring cup (500ml)
- Cold water



Procedure

1. Pour 500 ml cold water into each water bottle.
2. Feel the water bottles with your hands and record how cold each feels.
3. Use a thermometer and record the water temperature for each bottle.
4. Place lids on the water bottles and leave them in the room for 15 minutes.
5. Observe the outside of the water bottles and record any changes you find.
6. Measure the temperatures of the water again and record your results.

Discuss

- Share your results with your classmates.
- Which type of water bottle kept the water temperature closer to its original temperature? Why?
- How is energy transfer related to how different house designs affect the inside temperature of the house?
- Did you find any changes on the outside of the water bottles? If so, explain what you observed.

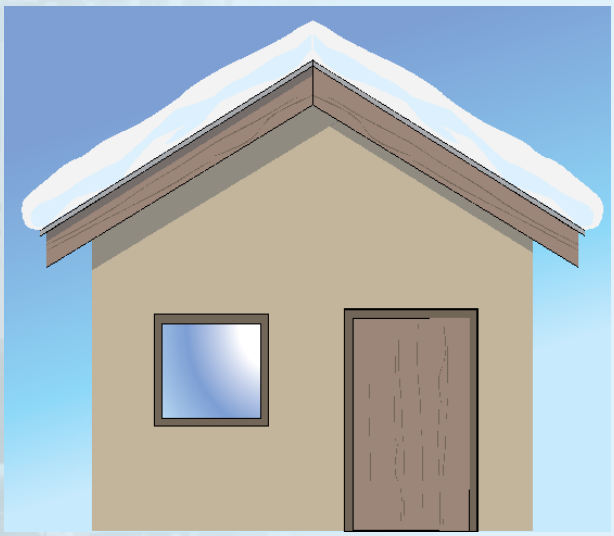
Part 2: Windows

Predict!

Which type of house keeps more heat inside, a house with big windows or small windows? Does a window work as a good insulator for the house? Why?

Experiment

In this experiment, a water bottle represents a house and a plastic wrap cover represents a window.



A house with few, small windows.

A house with numerous, large windows.

Materials

- Insulated water bottle with an insulated lid
- Insulated water bottle without a lid (the same size as the other water bottle)
- Plastic wrap
- Rubber band
- Thermometer (or temperature sensor)
- Measuring cup (500ml)
- Hot water

Procedure

1. Pour 500 ml hot water into each water bottle.
2. Measure the water temperature, using a thermometer.
3. Place a lid on one of the water bottles. Place plastic wrap on the other water bottle and secure it with a rubber band. Leave the water bottles in the room for 20 minutes.
4. Measure the temperature of the water again and record it.

Discuss

- Share your results with your classmates.
- Did the water bottle with the "window" maintain the original temperature of the water? Why or why not?
- How is energy transfer related to how windows affect the inside temperature of a house?

Keeping the Inside of a House Healthy

Photo: https://www.flickr.com/photos/satemkemet/4370813521

Photo: Joanna Bu.

The photos above show black mold, one of the toxic types of mold, inside a house.

Mold can cause health problems. What other problems do you think mold can cause in your home? What kind of environment is optimal for mold to grow? (Hint: Factors to consider include temperature, moisture, building materials, and location.)

We observed condensation on the uninsulated water bottle in the Building an Energy Efficient House - Part 1 experiment. That is because warm water vapor in the room cooled as it came in contact with the cold surface of the uninsulated water bottle. The water vapor transferred heat to the surface of the uninsulated water bottle and condensed into liquid water.

Have you noticed condensation on the windows in your homes in winter? It is the same principle. There is a lot of moisture produced in a house from our daily activities such as breathing, cooking, and showering/bathing. Indoor moisture also comes from plants and soil in crawlspaces.

While we need some moisture to keep skin and sinuses from becoming too dry, too much moisture inside of a house can provide a breeding ground for mold. Humidity levels above 40% in winter in our climate can lead to condensation in buildings, a potential source for mold growth. Some mold can be very toxic and we want to avoid it. Humidity above 60% any time of the year provides conditions for bacteria, viruses, and fungi to grow, leading to health concerns.

Keeping a healthy environment inside of a house is very important. What can we do to get rid of excess amounts of moisture in the house?

Moisture Inside of a House

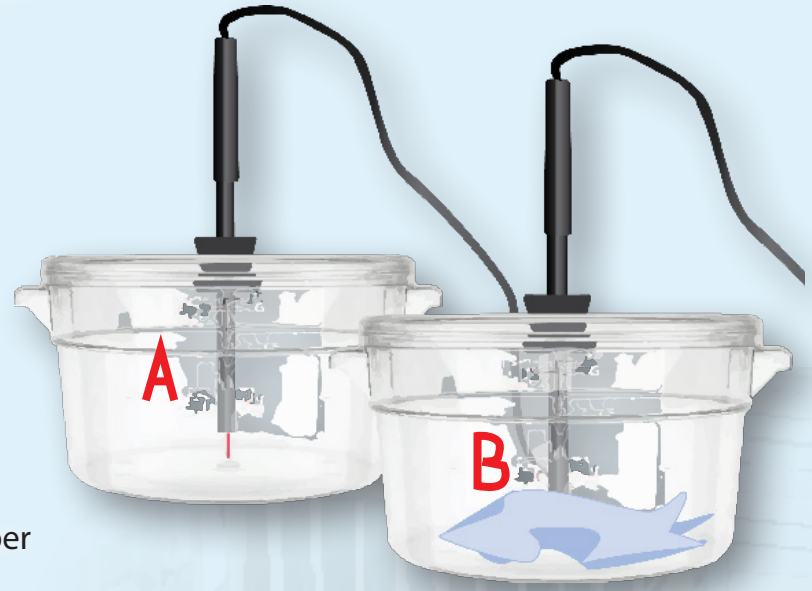
Experiment

In this experiment, a chamber represents a house.

Part 1: How can we measure the amount of moisture?

Materials

- Tape
- Labeling marker
- Chambers & rubber stoppers
- Relative humidity sensor
- Temperature sensor
- Piece of cloth
- Very warm water (hot to the touch)



Procedure

1. Label one chamber "A" and the other "B," using the tape and labeling maker.
2. Close the openings of the chamber lids with rubber stoppers.
3. Place the lid on top of Chamber A and close it tightly.
4. Soak the piece of cloth in very warm water. Place it inside Chamber B and close the lid tightly. Leave it for 10 minutes.
5. Observe the inside walls of the chambers and record your observations.
6. Measure the humidity and temperature inside the chambers, using the relative humidity sensor and temperature sensor. Record the humidity levels and temperatures. IMPORTANT: the sensors shoult NOT touch the cloth. Record the results.

Discuss

- Share your results with your classmates.
- Did you find any change in the humidity level after the damp cloth was placed? Why or why not?
- Did you find any changes in the temperature?
- Did you see any difference in the inside walls of the chambers? Why or why not?

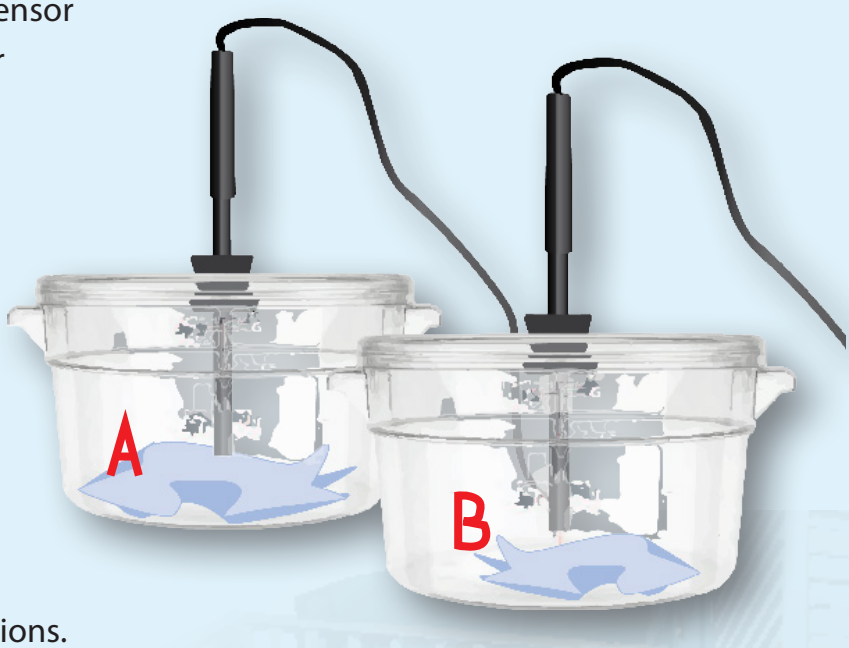
A new home being constructed in Brevig Mission. Note the layer of Tyvek® (house wrap) beneath the outside paneling. House wrap helps with proper moisture and air management for wall systems. A vapor barrier (plastic sheeting) hung on the inside of a house between the insulation and indoor wall paneling is another important step for moisture control. *Photo: Sally Kieper, REACH Up.*

Moisture Inside of a House

Part 2: Can we move some moisture out of the house?

Materials

- Tape
- Labeling marker
- Chambers & rubber stoppers
- Relative humidity sensor
- Temperature sensor
- Pieces of cloth
- Very warm water (hot to the touch)

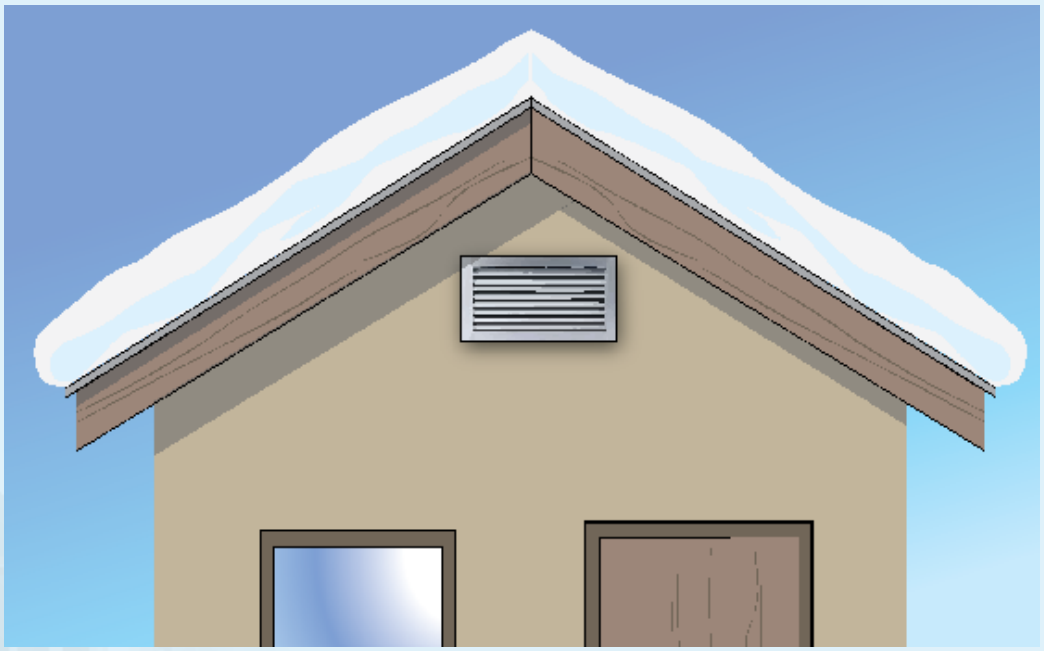


Procedure

1. Label one chamber "A" and the other "B," using the tape and labeling maker.
2. Observe the inside walls of the Chambers A and B and record your observations.
3. Close the openings of Chamber A lid with rubber stoppers. Do not close the openings of the other chamber (Chamber B).
4. Measure the humidity and temperature inside the chambers, using the relative humidity sensor and temperature sensor. Record the results.
5. Soak the pieces of cloth in very warm water (hot to the touch) and place a piece inside each of the chambers. Close the lids and leave them for 10 minutes.
6. Observe the inside walls of the chambers. Measure the humidity level and temperature inside the chambers again, using the relative humidity and temperature sensor, respecitvely. IMPORTANT: the sensors should NOT touch the cloth. Record the results.

Discuss

- Share your results with your classmates.
- Did you observe a difference between Chamber A and Chamber B after the damp cloths were added? Explain.
- Did you find any changes in the temperature?
- Did you measure a different percentage of relative humidity between Chamber A and Chamber B after the damp cloths were added? Explain.



Installing a ventillation system and vent in your home helps to prevent the accumulation of moisture and molds.

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