CURIOSITY AT HOME

BEAT THE HEAT

Many vaccines need to be kept at a cold temperature to keep their effectiveness. Unfortunately, many places that need vaccines don't have access to reliable power for refrigeration, so insulation packs are needed to keep vaccines cool. Insulators slow the transfer of heat energy from warm to cool areas.

Let's design some insulation packs and test which materials make the best insulators!

MATERIALS

- 3 small glass jars with lids (Ziploc bags will work as well)
- 3 ice cubes (as close to each other in size/shape as possible)
- Cardboard
- Aluminum foil
- Wool socks
- Science notebook or paper
- Something to write with

PROCEDURE

- Line the outside of each glass jar or Ziploc bag with one of each of the following materials: cardboard, aluminum foil, and wool. Make sure it is covered as completely as possible for the best insulation.
- Gently place one ice cube in each glass jar or bag and seal the lid.
- Place all three jars or bags in a similar location. Make sure they all get the same room temperature and amount of sunlight.
- In your science notebook, make a prediction about which material will be the best insulator. Rank them from best insulator (the ice cube will melt the slowest) to worst insulator (the ice cube will melt the fastest).
- Every five to ten minutes, open the jars or bags to see how much of the ice cube has melted. The time interval for best results may vary on how warm your experiment room is.
- Record your observations as you do each check, drawing how big each ice cube looks at each time checked. Which insulator did the best at keeping the ice cube from melting? Record how long it takes for each ice cube to melt.
- Redesign your insulation jar or bag by changing how much of the insulator is used. Try lining the inside of the jar or bag instead of the outside; is there a difference in how well it insulates?

Experiment continued on next page...

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EXPLORE MORE

- Instead of using a glass jar or a Ziploc bag, design an insulation pack that uses a different container. Do some containers work better than others? What material is that container made of?
- Choose insulation other than cardboard, aluminum foil, or wool. Get creative and record your results! What material makes the best insulator?
- Design an insulation pack that uses more than one material for insulation (for example, aluminum foil in one layer and cardboard in another). Record your observations!
- Do insulators work the other way around? Try putting warm water in your insulation packs and put them in the freezer. How long does each jar or bag of water take to freeze?

DID YOU KNOW?

The series of tools and procedures that takes a vaccine from being produced in a lab to delivered to a patient is known as the cold chain. Materials engineers design and test all kinds of materials to create the best insulators. A specialized vacuum flask is such a good insulator that it can keep a vaccine cold for up to a month without a refrigerator!

Experiment continued on next page...

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GRADE 6–8 EXPLORATION

Explore the following questions and write your observations in your science notebook.

- Which material was the best insulator? How drastic were the results? Did one material shine above the rest?
- Vaccines can be fragile. How could you redesign your insulation pack to keep anything inside of it from breaking? If you have the materials to make one, do so! If you do not, draw your redesign in your science notebook.
- Test out your redesign if you can by putting in an ice cube and shaking your insulation pack. Did your ice cube break?
- Moving air can have larger effects on temperature than still air. Repeat the insulator pack tests in front of a fan. Do any of your results change?
- For some vaccines, it's not enough to just keep it as cold as possible. Make it too cold, and that vaccine is ineffective. Therefore, it's important to monitor the temperature inside your insulation pack in real time to adjust it if necessary. Redesign your insulation pack so that you can use a thermometer to measure the temperature inside your insulation pack. This might mean designing a custom lid for your container that will allow you to measure the temperature while letting in as little heat as possible!