Solar oven

Activity

In this activity you will use the energy from the sun to make a solar oven using an old pizza box. You will then use the oven to cook some delicious food! For a full guide on how to make the oven, see the accompanying video.

You will need

- Cardboard pizza box or a cardboard box of a similar size
- Black duct tape and/or black card
- Aluminium Foil
- Sellotape or glue
- Scissors
- Wooden skewers or another long, thin object.
- Food to melt – for example ‘s’mores’, which are melted chocolate and marshmallows on biscuits. Yum!
- Direct sunlight (or if there is no direct sunlight, one or more bright desk-lamp(s)).

Instructions

1. Open the pizza box. Cover the bottom of the box with the black tape or black card. If you’re only using black card, use some tape or glue to fix the card to the bottom of the box.
2. Glue or tape aluminium foil to the inside of the pizza box lid, making sure it is as smooth as possible!
3. Glue or tape more aluminium foil to any other bits of exposed cardboard on the inside of the box.
4. Put the food that you want to melt (for example the marshmallows and chocolate on biscuits) into the oven.
5. With the help on another person, tape the clingfilm across the bottom opening of the box. Try to make it as taut as possible, and as airtight as possible!
6. Use a couple of skewers to prop open the lid of the box at an angle that allows as much sun into the box as possible.
7. If there are any holes that you can spot around the box, use some more tape to try and make the inside of the box as airtight as possible, so it gets as hot as possible!
8. Place your oven outside in direct sunlight. This will work best on a sunny day from around 11 to 3 pm, and when it’s not too cold outside! On a sunny summer day it could take as little as 30 minutes to melt the marshmallows and chocolate. If it’s not sunny, you can also use one (or more) desk lamps and aim the light into the box – this will take a lot longer to melt your food!
9. Eat your delicious, melted treat!

Things to think about

- Why are we using black card of tape, not some other colour?
- What's the role of the aluminium foil?
- Could you use more than one layer of clingfilm to cover the box? What would using more clingfilm layers do?

Could you think of scientific experiments you could do to measure the heating effect of each of the bullet points above (colour of tape, aluminium foil, number of clingfilm layers)?

The Science

Energy from sunlight comes to earth in the form of radiation. We can use this radiation for different forms of renewable energy, by converting it into electricity, heat or fuels. In this experiment, we are using the sun's energy to create renewable energy in the form of heat.

When the sunlight hits the black material at the bottom of the pizza box, this radiation is absorbed and heats up the material. Black materials heat up the fastest because they absorb most of the radiation. The clingfilm then stops the created heat from escaping out of the box through convection, and as more and more radiation is absorbed the inside of the box starts to heat up. The aluminium foil on the lid and inside edge of the box helps to reflect more radiation onto the black material on the bottom of box, and makes it heat up faster.

The process by which the inside of the pizza box heats up is similar to the greenhouse effect that heats up the earth. In the earth's case, the radiation from the sun is absorbed by the surface of the planet (similar to the black card), and the resulting heat is trapped on the earth's surface by the earth's atmosphere (similar to the clingfilm).

This process is vital to making the earth warm enough for life to exist. Human activities, such as burning fossil fuels, are making the greenhouse effect stronger by releasing more and more gases such as carbon dioxide and methane into the atmosphere – this is like adding more and more layers of clingfilm on our solar oven to keep more and more of the heat in! This is causing the planet to heat up more than it should, which is called global warming!