One Planet Matters

Greenspaces & temperature:
making a thermometer

Summary:

Making a thermometer is a great way to get thinking about what the urban island effect is and what effects it can have on people and wildlife. By making multiple thermometers using this method, learners can track the difference in temperature between green and built environments, and come to understand the importance of green spaces in built environments. It is a great conversation starter for finding creative ways to mitigate the negative effects of climate change and urbanisation in a way that all age groups can understand and get involved with.

Key Stage / Age group: Upper KS2

Time needed: 1 hour for activity and discussion

Location: Outside in various locations - greenspace, shaded concrete, sunny concrete

Curriculum links:

Upper Key Stage 2 - Geography - Land use/Human Geography/Change over time

PRE-ACTIVITY:

Discussion & hypothesis

Take a look at the two images below, showing two different cities - one with lots of greenery, and one with very little greenery.


Answer these questions either individually or as a class:

❖ Which of these two cities do you think is the hottest? (Assuming they are in the same place). Why?

❖ What effect do you think greenery and green spaces have on how hot a city is?

❖ Do you think that cities are the same temperature throughout, or do you think that it can be hotter in one place and cooler in another?

❖ Based on your answers, make a hypothesis about whether your thermometers will show that temperature varies depending on whether you test greenspaces or built areas, or whether it is the same. What do you expect to find?

THE ACTIVITY:

Making a thermometer to test the temperature of greenspaces versus built spaces.
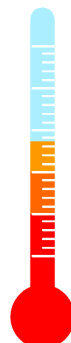
To do this experiment, you will need to make at least 2 thermometers - one to place in a paved or concrete environment, and one to place in a green environment. **Ideally, make 3 thermometers** so that you can also place one in a green environment under the cover of trees. The list below outlines what you need for one thermometer. Note that you will need more glass bottles, sticky tack, and clear straws to make more thermometers.

You will need:

- Glass bottle
- Rubbing alcohol - this is optional, but it will make your thermometer react to temperature changes more quickly
- Water
- Clear straw
- Measuring cup
- Pipette
- Sticky tack
- Food dye
- Cooking oil
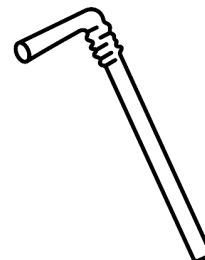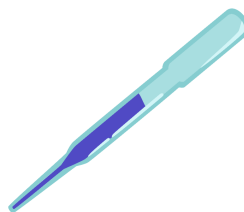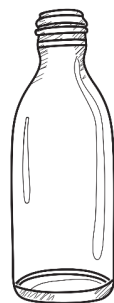
How does it work?

When the temperature of alcohol increases, it expands. This means that when we have alcohol in the straw, the liquid level will rise as temperatures rise and vice versa. This means that you will be able to see how much the temperature has risen or fallen from room temperature by the increase or decrease in water level in the straw. This is how thermometers work!

How to:

1. Fill your glass bottle with water, and then pour the water into the measuring jug to find out how much liquid can fit into the bottle.

2. Pour half of the water back into the bottle, and pour an equal amount of rubbing alcohol into the bottle, making sure that the liquid reaches right to the top of the bottle. Make sure you handle rubbing alcohol with adult supervision.

3. Add some food dye to your bottle - you can use any colour, but we recommend using a bright colour like red or blue. This is because brightly coloured food dye will help you to see the temperature change more clearly, through looking at the water rising and falling in the clear straw.

4. Put your clear straw into the bottle, making sure that you have a big enough straw that it can reach the bottom of the bottle as well as some of it poking out of the bottle at the top. Then use your modelling clay to create an airtight seal around the opening of the bottle. It is important that you don't leave any holes or gaps for air to enter, as this will affect your temperature reading.

5. Use a pipette to measure out a small amount of water into the measuring jug, and then add the same amount of rubbing alcohol to the jug - you will only need a few millilitres of each. Mix the water and rubbing alcohol with the pipette and then use your pipette to add some of this mixture to the straw - you want about 2 inches of liquid to be above the bottle in the straw. Now leave it for an hour or two and then check that the liquid hasn't dropped into the bottle. If it has, add a few more drops into the straw so that you have 2 inches of liquid in it again. Wait again to check the water doesn't drop into the bottle, and repeat this process if necessary.

6. Once you know that the liquid in the straw is staying in the straw, add a drop of cooking oil to the straw. This will rise to the surface and create a seal so that the liquid doesn't evaporate.

7. Now repeat this process to make two more thermometers in order to measure the temperature of different areas in your school grounds. On the straw of each thermometer, draw a line where the top of the liquid is.

8. Once you have three thermometers, place them in three different locations on a warm and sunny day:
   - **Thermometer 1: concrete or paved environment**, away from greenspace. Make sure it is in the sun.
   - **Thermometer 2: Greenspace**, such as in the middle of a playing field or lawn. Make sure it is in the sun.
   - **Thermometer 3: Covered greenspace**, such as on grass and under trees.

9. Check your thermometers every half an hour to see how much the liquid has risen above the line you drew. Use a ruler to measure the distance between the original line and the new highest point of the liquid. Do this until the liquid stops rising in all three thermometers.

10. Draw your results into a graph or chart to see the difference between the temperature in each location over time.

Post-activity: Results analysis & discussion

Once you have your results, here are some questions to discuss and answer:

- ❖ What did your results tell you about the temperature in green spaces versus built spaces?

- ❖ Did your results show what you predicted in your hypothesis, or were you surprised by what you found?

- ❖ What effects do you think high temperatures in cities have on people and wildlife?
    - Think about the last heatwave you experienced, or the last time it was very hot. How did you feel? What effect did it have on you and your family? Did you notice plants suffering? Can you think about how animals and birds might have been affected? Can you think about how elderly people or other vulnerable people might be affected?

- ❖ Looking back at the images in the pre-activity and based on your results, which city would you prefer to live in when it is very hot? Why?

- ❖ Based on your results and your answers to the above questions, do you think that having more green spaces and greenery in cities is important or unimportant for the wellbeing of people and wildlife (particularly in hot weather)?