

# Questacon at HOME

## Energy Activity Sheet

# Heat Octopus

### BACKGROUND

Have you ever thought about how the Planet Earth gets its energy from the Sun? Almost all living things on Earth, including us, get energy from cycles that are powered by the Sun's energy. The Sun's light and heat travels approximately 100 million kilometres to reach us, and then initiates a number of life sustaining processes and systems, such as photosynthesis and the water cycle. In this experiment we will look at the basics of solar power and convection. These are responsible for causing wind and waves that we can also use to source our energy.

### MATERIALS

- Black and white paper/materials
- A stick/ruler/spatula - anything hold-able
- Scissors and sticky tape
- Hot and cold water
- Cheap plastic twine (pic)



### SAFETY

Scissors are sharp objects and should only be used by an adult. Be aware of dangerous heat sources and avoid using materials which might become too hot in the sun. Hot or boiling water should be only handled by an adult.

**Supervision is recommended for young experimenters.**

### PROCEDURE

**Heat Octopus:** Cut a 10cm piece of plastic twine and tease apart one end of it with your fingers or scissors into long fibrous lengths. Use sticky tape to attach the un-torn end to one end of a stick. This will be your Heat Octopus. The thinner and lighter the twine strands/octopus arms, the more effective this will be.

Try holding the Heat Octopus over hot surfaces so the arms dangle just above and see what happens. Try and hold it as still as possible or rest it on something stable. You should see the arms start to move around.

Hold your Heat Octopus over cold and hot water – do you see a difference?



### SAFETY

Don't use your Heat Octopus over open fires or other extremely hot surfaces



Place a white sheet of paper and a black sheet of paper in a sunny place and leave for 5 minutes. Which one feels warmer? What happens to the Heat Octopus when you hold it over the paper?

## TIPS AND TRICKS

- Air currents will interfere with your Heat Octopus, it works best indoors with air conditioners and heaters turned off
- Try different black and white materials to paper
- Hold your Heat Octopus to the side of a heat source and see if the effect is as strong as above
- Wrap one thermometer in white paper and one in black paper and put them in the sun

## WHAT'S THE SCIENCE?

You will find that your Heat Octopus works best when held directly over a heat source. This is because hot air rises in a process called *convection*. Convection occurs when air particles that are heated become lighter than colder air particles which are relatively heavy (dense) and will rise. In our experiment, the hot air pulls the thin strands of twine - your Heat Octopus along with it as it rises allowing you to see convection occurring! In the natural world, the sun is continually heating up air particles, which rise up and spread out resulting in areas where there are not as many air particles in a given space. This is described as an area of lower **air pressure**. The surrounding cooler air will rush in to fill the gaps; this is how wind is created. Convection is what causes winds to blow around our planet, and is responsible for the most powerful storms, especially those that form over warm ocean waters like cyclones and hurricanes.

We can use the energy in the wind for our own energy purposes. The wind is a renewable energy source which can spin giant wind turbines to convert the wind into electricity. Wind turbines are commonly located on hilltops or near the ocean; however they are not always dependable, as the wind does not continuously blow in the same place. To improve the reliability of wind turbines, researchers have developed ways to store the generated energy in the form of batteries, and also pair wind farms with solar farms. In 2019, there were 101 wind farms in Australia, accounting for 8.5% of Australia's electricity supply. (<http://www.cleanenergycouncil.org.au>).

Convection can also be seen if you place a black coloured object in the sun. Black coloured objects *absorb* more radiation (light and heat) than white coloured objects, and that absorbed radiation is then converted almost entirely into heat. The heat from the object then heats up the air around it. This also explains why you will feel especially warm wearing black clothes in the summer.

## WHAT QUESTIONS COULD I ASK?

Is your house in a place windy enough for a wind turbine?  
How would you feel about a wind turbine near your house?  
What colour is your roof? Is it good at reflecting summer heat?

## WHAT'S NEXT?

Could you improve your Heat Octopus to make it more sensitive?

Convection also causes water currents to flow, as hot water generally rises above cold water, just like hot air over cold air. Put some red dye in hot water and some blue dye in cold water then use a syringe for each to carefully inject them into a bowl of cold water. Make a prediction about what you think will happen, and then test!

*When experimenting, saying "I don't know" is ok - solving problems is about curiosity and finding things out. If we always knew the answer we would never learn anything new!*

