

STEM Program



Melting Microwaves

Electromagnetic Waves

Experiment with melting different foods inside your microwave to find out how a microwave really works.

Suited to Section



Joey Scouts



Cub Scouts



Scouts



Venturer Scouts



Rover Scouts

Challenge Area



COMMUNITY



PERSONAL GROWTH



OUTDOORS



CREATIVE

Key SPICES Growth



SOCIAL



PHYSICAL



INTELLECTUAL



CHARACTER



EMOTIONAL



SPIRITUAL

Likely Scout Method Elements



COMMUNITY INVOLVEMENT



LEARNING BY DOING



NATURE AND THE OUTDOORS



PATROL SYSTEM



PERSONAL PROGRESSION



PROMISE AND LAW



SYMBOLIC FRAMEWORK



YOUTH LEADING, ADULTS SUPPORTING

STEM Program

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Plan

1. Do you know how a microwave is able to heat your food? It literally sends microwaves, a form of electromagnetic radiation into your food. Do some research to find out more about what electromagnetic radiation is and how a microwave works.
2. Design an experiment to determine the wavelength of the EMR produced by your microwave. You could try melting food in the microwave and measuring the distance between two hot spots to find half a wavelength. A few things to consider in your experimental design:
3. Remove the rotating dish from the microwave so that your food remains in the same place the whole time.
4. You will need a suitable surface to melt the food on. It should be flat and thick enough that it provides some thermal insulation from the base of the microwave. Cardboard usually works well.
5. There are different foods you can try to melt but whatever you choose you will need enough to cover a large enough area (at least 20cm by 20cm).
 - i. Cheese slices usually work well
 - ii. Marshmallows work best if you get the mini ones because the big ones swell up too much
 - iii. If using chocolate avoid baking chocolate or brands with a high melting point
 - iv. Butter will work but it melts very quickly so keep a close eye on progress
6. Collect all your required materials and consider how you are going to record your results. Make sure you have read the safety advice and have adult supervision and then you are ready to start your experiment.

Do

1. Complete your experiment and record your results. Completing more than one trial will give you more confidence in the reliability of your results.

Review

1. How can you tell if your results are accurate? Check the frequency of your microwave, this will probably be a number given in gighertz (GHz). If you take the number 30 and divide it by the frequency in GHz you will find the wavelength in centimetres (cm).
2. What have you learnt about microwaves and electromagnetic radiation from this experiment?
3. How could you improve this experiment or do further experimentation into microwaves?

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Variations

- Do you want a bigger mathematical challenge? Try using the data collected from your experiment along with the known frequency of your microwave to calculate the speed of an electromagnetic wave.
<http://www.planet-science.com/categories/over-11s/physics-is-fun!/2012/01/measure-the-speed-of-light-using-chocolate.aspx#:~:text=When%20you%20measure%20the%20distance,to%20get%20a%20whole%20wavelength>

Safety Tips

- Make sure you only put microwave safe materials into the microwave while completing this experiment. Metal objects should never be placed into the microwave because the build-up of charge can cause sparks and fires. If you are using cardboard, you should avoid waxed cardboard.
- Remember the items you remove from the microwave will be hot so wear suitable protective equipment.

Why Does This Happen?

Microwave ovens literally send out microwaves to heat up the food inside. When the microwaves reach your food, they cause all the food particles in your meal to vibrate, producing heat. The energy from the microwaves is absorbed by the food, and is converted into another form of energy, heat. Microwaves, as you might imagine, travel as waves. As the microwaves hit your food they cause 'hot spots' where the food is especially melted/heated. The distance between these two points represents half a wavelength. How might you work out the full wavelength? Look up a picture of microwaves in a microwave oven to help visualise how hot spots form and how these can be used to calculate half a wavelength.

SciScouts Physics of Waves

The SciScouts Physics of Waves is a National Science Week project, undertaken in collaboration with Fizzics Education. These instructions were prepared by Scouts for Scouts. This National Science Week project is supported by the Australian Government.

Scouting has always been strong on STEM skills. Maths to calculate catering quantities and navigate, the science of water purification, the physics of abseiling, and the engineering of pioneering structures – they all have their place. In the current program for our youth members, STEM and Innovation forms one of six Special Interest Areas that enable Scouts to set goals and pursue their own ideas.

