

Marshmallow roaster

Overview: Do you like marshmallows cooked over a campfire? I sure do. What if you don't have a campfire? We'll solve that problem by building our own food roaster that you can use to roast hot dogs, marshmallows, or anything you want. And it's battery-free since this device is powered by the sun.

What to Learn: Again, you'll see how the sun can directly meet our energy needs!

Materials

- 7×10" page magnifier (Fresnel lens)
- Cardboard box, about a 10" cube
- Aluminum foil
- Hot glue, razor, scissors, tape
- Wooden skewers (BBQ-style)
- Chocolate, marshmallows, & graham cracker
- Thermometer

Lab Time

1. Take a razor and cut out a hole from the cardboard box slightly smaller than the Fresnel lens. Make sure the lens will fit.
2. Find the side of the lens that has grooves and place that side facing outwards. Secure the lens with hot glue. Use adult help if needed.
3. Cover each side of the inside of the box with aluminum foil. The lens will collect incoming light, but we don't want the box itself to catch on fire! This is what the foil is for. Don't worry about making the foil perfectly arranged. It just needs to cover every exposed part of the box.
4. Close the flaps of your box and seal it shut.
5. Cut a small window (maybe twice the size of the marshmallow) in the side of the box. Use your skewer to poke a hole through one door and out of the other. This is where the marshmallow goes.
6. Put a marshmallow in place on the skewer, and place your oven in the sun to get cooking! Record your observations and data on the worksheet. Use a thermometer to get your temperature readings in degrees Celsius.

Marshmallow Roaster Data Table

Time	Is it cooked?	Temperature (C)
2 hours		
3 hours		
3.5 hours		
4 hours		
4.5 hours		
5 hours		
5.5 hours		
6 hours		

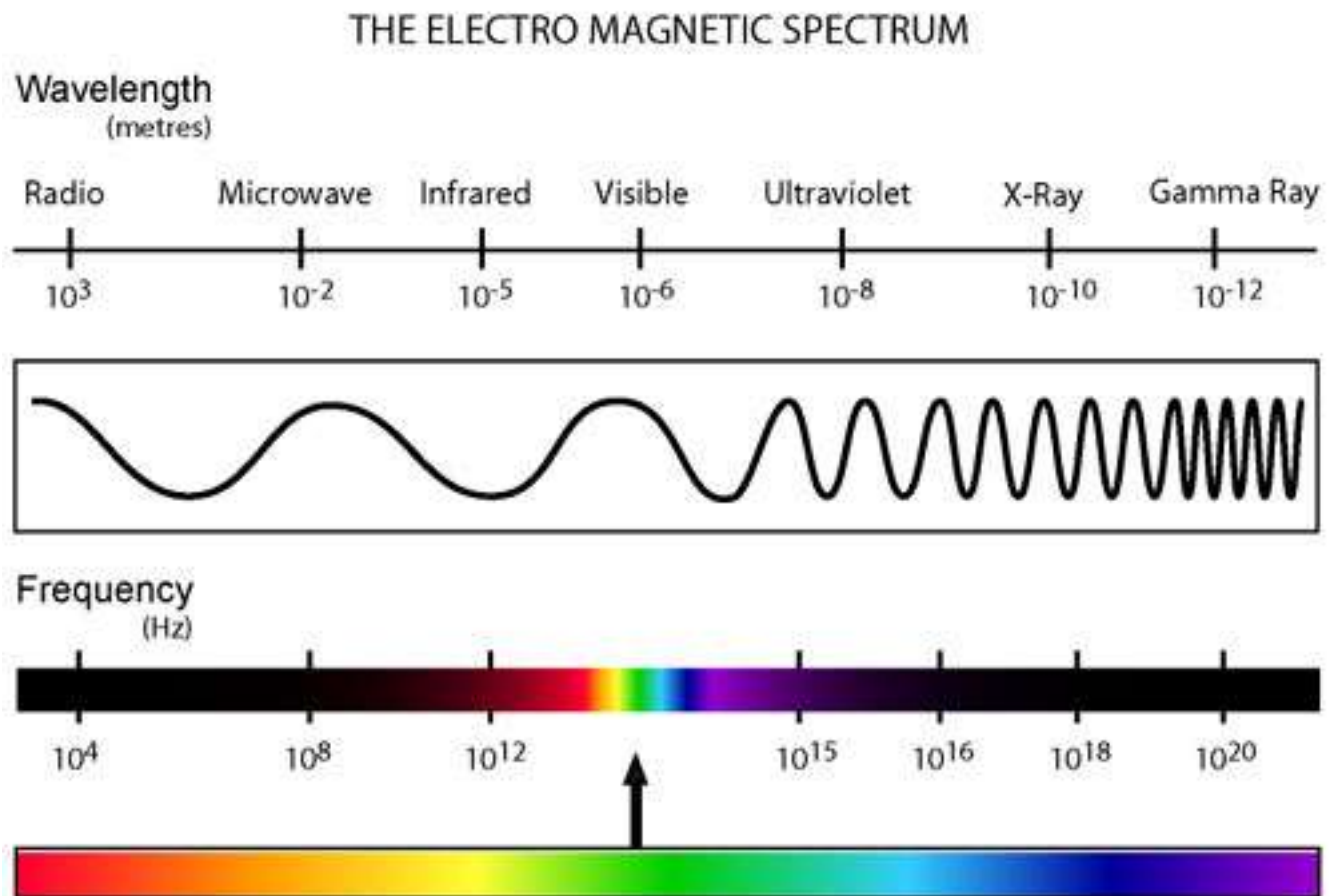
Reading

The Fresnel lens is a lot like a magnifying glass. A Fresnel lens (first used in the 1800s to focus the beam in a lighthouse) has lots of ridges you can feel with your fingers. It's basically a series of magnifying lenses stacked together in rings (like in a tree trunk) to magnify an image.

The best thing about Fresnel lenses is that they are lightweight, so they can be very large, which is why you'll find them in lighthouses. Fresnel lenses curve to keep the focus at the same point, no matter close your light source is.

The Fresnel lens in this project is focusing the incoming sunlight much more powerfully than a regular handheld magnifier. But focusing the light is only part of the story with your roaster. The other part is how your food cooks as the light hits it. If your food is light-colored, it's going to cook slower than darker (or charred) food. Notice how the burnt spots on your food heat up more quickly!

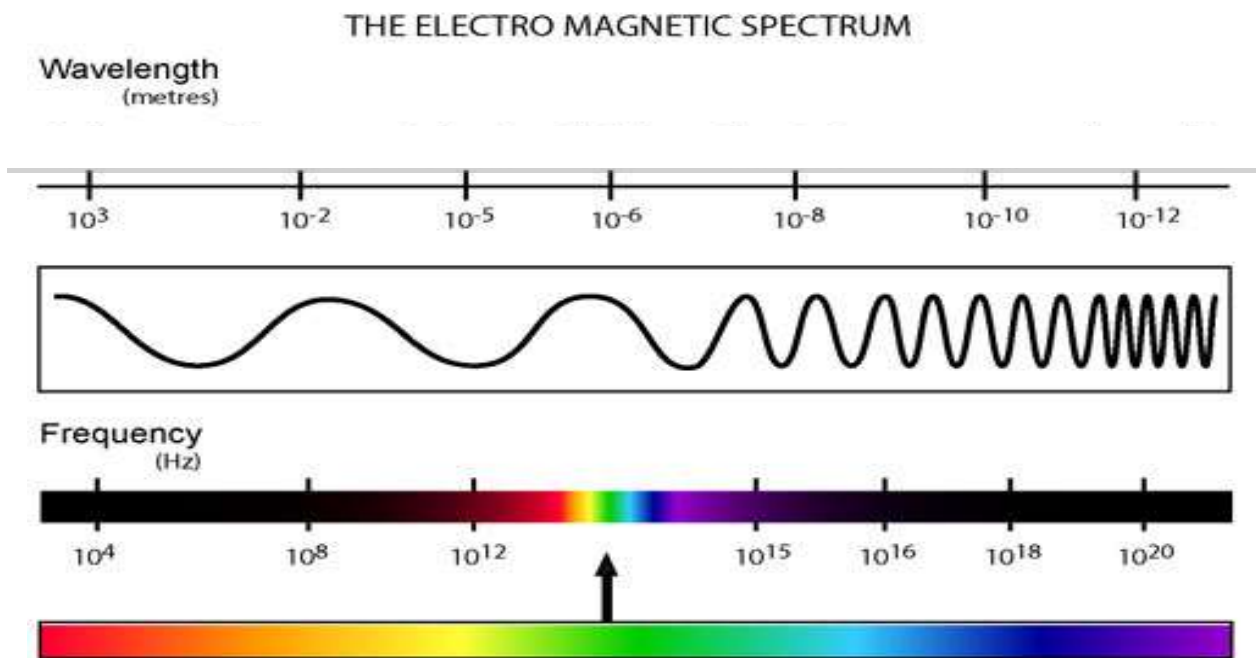
This lesson focuses on the different parts of the **electromagnetic spectrum**. You can use the diagram below to illustrate each of the important divisions we make. Do you notice how energetic light is, and how different the uses are for each type? Infra-red is the one most directly responsible for cooking our food, while the visible spectrum is what we see in the sky all around us.



Use a helpful mnemonic device to help you remember the spectrum and its parts: RMIVUXG, such as “Red Monkeys In Violet Underwear X-ray Good”... even though it's not proper English, it might do the trick to help remember the different parts of the spectrum.

Exercises Answer the questions below:

1. Label the parts of the electromagnetic spectrum below:



Answers to Exercises: Marshmallow Roaster

1. Label the electromagnetic spectrum. (Refer to diagram.)