

HOW DOES A MICROWAVE OVEN WORK?

An experiment to help you to understand it better

YOU NEED:

- microwave oven
- big plate
- some grated cheese
- ruler



DEMONSTRATION:

- Take the turntable out of the microwave
- Put a plate upside down over the device that rotates the turntable
- Put the cheese on the plate
- Heat the cheese for about 20 - 40 seconds
- Take the plate out of the microwave

PREVIOUS KNOWLEDGE:

- Microwave radiation is electromagnetic radiation with a wavelength ranging from 0.1 cm to 100 cm
- It travels at the speed of light
- Microwaves are reflected by metals
- Two waves coming from opposite directions interfere and create a standing wave
- Each standing wave contains two kinds of characteristic points – nodes, where there are no vibrations, and antinodes, where the vibrations are the biggest
- The energy loss of a wave is proportional to the amplitude squared

OBSERVATIONS:



- The cheese melted only in a few separate places

CONCLUSION:

- The spots of melted cheese are the antinodes of the standing microwave

MEASUREMENTS:



- Measure the distance between the melted spots

CALCULATIONS:

- Multiply the distance between the spots on the cheese by two to get the wavelength
- Divide $300\,000\,000\text{ m/s}$ by the wavelength to get the frequency of the microwaves
- Compare the result with the frequency given at the back of the microwave oven

EXPLANATION OF HOW A MICROWAVE OVEN WORKS

- Inside a strong metal box, there is a microwave generator called a magnetron. When you start cooking, the magnetron takes electricity from the power outlet and converts it into high-powered, 12cm microwaves.
- The magnetron blasts these waves into the food compartment through a channel called a wave guide.
- The food sits on a turntable, spinning slowly round so the microwaves cook it evenly.
- The microwaves bounce back and forth off the reflective metal walls of the food compartment. When the microwaves reach the food itself, they penetrate inside it and make its molecules vibrate more quickly.
- Vibrating molecules have energy, so the faster the molecules vibrate, the hotter the food becomes. Thus the microwaves pass their energy onto the molecules in the food, rapidly heating it up.