

# Radiation and Microwave Ovens



## Starting Point

People have been cooking with ovens for a long, long time. Ovens are pretty basic: light a fire somewhere, use it to heat up a small space, and stick things in there to cook. Whatever is in the oven gets hot on the outside, and that heat travels through it until the whole thing is done.

In 1939, two British scientists called Boot and Randall were working on ways to improve the radar system that would help to defend the UK. (What happened in 1939?) They invented a device called a Magnetron Tube. This Magnetron Tube gave off **microwaves** - waves of energy, just like light, but invisible to our eyes.

Relatively recently, only in 1947, a different way of using these microwaves was developed. In the USA, a prototype for a new and different kind of oven was built. The Microwave Oven was born.

It really was not that long ago. In fact, it wasn't until 1978 that people in the UK could buy a Microwave Oven to take home. Microwave Ovens cook things in a totally different way. Whereas normal ovens cook things from the outside in, Microwave Ovens cook things from the inside out. The microwaves go into the food and are absorbed by water molecules in there. These water molecules take the energy from the microwaves and start jumping about. Eventually (very quickly compared to an old-fashioned oven!), and as long as the molecules in the food can't lose this energy, all the water is jumping about like this. The food is cooked!

### COMPARISON STUDY

Find out the cooking times in the Microwave Oven for different foods or drinks. Then find out how long they would take on the hob or in a normal oven. Start off with the three items given here, then do seven more of your own. A trip to your kitchen or a supermarket would do the job!

1. Tin of baked beans.
2. Tin of tomato soup.
3. Frozen peas.

... and 7 more from you! This might give you an idea of the difference in time between cooking with an oven or a hob and cooking with a Microwave Oven.

### How A Microwave Oven Works

Microwaves are absorbed by moisture, but reflected by metal. The walls of Microwave Ovens are made of metal, so that when the microwaves are sent in there, they bounce around until they are absorbed by the food. This makes the food absorb more and more of them, which heats the food up.

You need a metal box, otherwise the food would lose this microwave energy almost as soon as it gets it. By using a metal box, more and more microwaves are taken in by the food, which gets hotter and hotter.

The door of a Microwave Oven is reinforced glass with a metal mesh. This means that the microwaves can't get out to you and are reflected back to the food even off this surface.

### The Debate

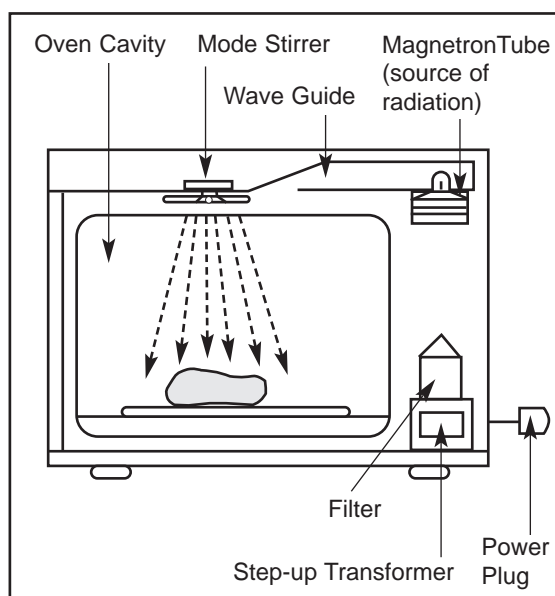
Suppose the Microwave Oven got a bit old and loads of those microwaves got out? Can Microwave Ovens be dangerous or affect our health in any way? As they are such a new technology, people are worried about possible dangers that Microwave Ovens might pose. Do you know how to use a Microwave Oven safely?

# Task 1

Use your own knowledge and ask around to find out some rules or guidelines for Microwave Ovens. Is there anything you shouldn't do? Can you find out why?

# Task 2

Do a simply survey to find out:  
a) how many people know how Microwave Ovens work,  
b) do they think there are any dangers from them?



# o p i n i o n

Below are 3 sources that tell you about the issues in this Report, or give you different opinions on those issues. They may help you in your own summary.

## Source 1

### 'How safe is the British Standard for Microwaves?'

The National Radiological Protection Board advises the Department of Trade and Industry on this subject.

The British Standards (BS EN 60 335-2-25 2002 for domestic models and BS 5175 for catering models), set the maximum limit of energy leakage during the life of a cooker at 5 milliwatts per square centimetre from a cooker door. In practice, levels are much lower.'

### From the Microwave Association website

<http://www.microwaveassociation.org.uk/factsheets/safe.htm>

## Source 2

### 'What are the health issues of Microwave exposure?'

Exposure to sufficiently high levels of microwaves will cause heating. In the case of human tissue, excessive heating could have serious health effects such as deep tissue burns and hyperthermia. Extensive research has provided no substantiated evidence that microwave exposure, at any level, either causes or promotes cancer.

### How safe are Microwave Ovens?

Microwaves generated in microwave ovens cease to exist once the electrical power to the magnetron is turned off (like visible light from light globes). They do not remain in the food when the power is turned off. Neither can they make the food or the oven radioactive. Therefore, food cooked in a microwave oven is not a radiation hazard.

All microwave ovens have at least two safety interlock switches which stop the generation of microwaves immediately the door is opened. '

### From the Portable Appliance Testing website.

<http://www.pat-testing.info/microwave-safety.htm>

## Source 3

'In reality, ovens are notoriously resistant to leaking microwaves. In the past 10 years, I have only heard of two instances of oven leakage exceeding the FDA/CDRH standard of 5 mW cm<sup>-2</sup> at 5 cm. The first oven had a physical puncture of the protective metal grid at the viewing window (caused by an exploding metal food container). The second oven had a defective door seal as a result of dropping the oven off the top of a refrigerator. In addition, I once found an oven that had been intentionally disassembled to remove the magnetron tube and power supply for use in a laboratory experiment (apparently research funds were short). In all of these cases, the oven had been severely damaged either through misuse or abuse.'

### From the Health Physics Society website, based in the USA.

<http://hps.org/hpspublications/articles/microwaveoven.html>

# Main Task

Write an essay on Radiation and Microwave Ovens. Split it into several parts:

- Do an **Introduction**. This should describe how Microwave Ovens work, and how the food in them gets hot.
- Next, do a section on the dangers of microwaves in general. Why are people worried about them at all?
- Then introduce different people's views, as well as the views of the experts and the manufacturers, to compare.
- Say what you have learned that you didn't know before starting this module, and how your new knowledge has affected your opinion.
- Lastly, finish off with a **Conclusion**. This should bring together the whole essay, and give a summary of the dangers - or not - posed by Microwave Ovens according to you. Remember to be clear but keep this bit to the point.

## More Sources of Information

Although there are lots of articles here, they won't be enough to tell you everybody's opinion. Have a look at some more places to find more information. Some places you could look:

### Google key phrases:

Microwaves, Radiation and Microwave Ovens, Microwave Oven Dangers, Microwave Oven Safety

### Useful web addresses:

<http://www.microwaveassociation.org.uk/factsheets/safe.htm>

[http://www.arpana.gov.au/is\\_mwave.htm](http://www.arpana.gov.au/is_mwave.htm)

[http://www.hc-sc.gc.ca/iyh-vsv/prod/micro\\_e.html](http://www.hc-sc.gc.ca/iyh-vsv/prod/micro_e.html)

<http://www.safekids.co.uk/MicrowaveSafetyChildren.html>

[http://www.ccohs.ca/oshanswers/phys\\_agents/microwave\\_ovens.html](http://www.ccohs.ca/oshanswers/phys_agents/microwave_ovens.html)

<b>COMPARISON STUDY</b>		
Fill in the table below		
<b>ITEM</b>	<b>MICROWAVE OVEN COOKING TIME (800W)</b>	<b>HOB OR NORMAL OVEN COOKING TIME</b>
1) Tin of baked beans		
2) Tin of tomato soup		
3) Frozen peas		
4)		
5)		
6)		
7)		
8)		
9)		
10)		

**TASK 1**  
 Right and wrong ways of using Microwave Ovens - including **Reasons** for these if you can find them

<b>TASK 2</b> Microwave Oven Survey		
<b>Person (to keep it anonymous!)</b>	<b>How Do Microwaves Work?</b>	<b>What dangers do you think they could have?</b>
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Continue your survey on a separate sheet of paper if you can - the more people are in it, the better information you have!