**The Microwave - Script**

Hi. Good afternoon everybody. Thank you for coming again. Today, I want to talk to you for five minutes about the microwave. I forgot my clock. So, I'm going to use the timer on my watch. Are you ready? Here we go. Three. Two. One. Go.

OK. The microwave oven. I'm sure nearly all of you have used a microwave oven at some point in your life, or at least seen one on TV. What do we use microwave ovens for? We use them for heating up our food. Now, how do they work? Well, inside the box that is your microwave you have something called a magnetron. The magnetron releases microwaves … radio waves. You know the shape of a wave. Like that. A microwave, each wave is about 12.2cm wide and the waves travel at 2.45GHz. One hertz is one wave a second, basically. So, 2.45GHz, if I can calculate that right, means about 2.5 billion waves a second. 2.5 billion times a second. That's incredible.

So, how does it work? Well, inside your microwave you have a reflective metal case, and the magnetron releases microwaves that bounce around inside the microwave. What they do is, they go through the food or the drink, whatever it is you're trying to warm up. How do they warm it up? Well, a wave has a positive and a negative, and every molecule inside the food you're trying to heat up also has a positive and a negative, and, as you know from science, positives … likes attract. So, when the wave is positive, the molecule positive points up, and when the wave positive comes down here, the molecule switches over and the positive follows the wave. So, as your wave is doing this, your molecule does this, basically, keeps flipping over. And as the molecule rotates, as it vibrates, of course, it creates heat. And that heat is what warms up your food.

So, how come when you put an apple pie in, the crust stays cool and the inside is boiling hot, like lava? Or how come when you put a cup of coffee in there, the cup is really hot, but the coffee is not so hot? Why is that? Well, basically, water molecules heat up more easily than any other type of molecule. They are very free. They move very easily. So, if you put in an apple pie, for example, the water molecules in the center, in the filling, will heat up very, very quickly, but the outside is dry. It doesn't have so much water in it so, of course, it won't heat up. If you have a cup of coffee, it's going to heat up like a basic oven because it's all liquid. So, it's going to heat from the outside in. So, you’re going to have hot points and cold points and basically because the water heats faster. Ok?

Also, you'll notice that a lot of microwave meals have standing time as well. That's because microwaves cannot penetrate right the way through food. At most they go about two or three centimeters under the surface. So, when you cook your food, the two or three centimeters around the top get hot because of the microwave, but the middle portion is heated because of convection heating, basically. So, when you finish cooking your meal … microwaving your meal, you leave it for two or three minutes to allow the heat from the heated outside to enter into the center and heat the whole meal through.

OK. Microwaves, when were they invented? … Two minutes! … When were they invented? 1935, the cavity magnetron was invented. Without that we don't have microwaves. 1945, a a man called Percy Spencer was working on a radar installation. They were trying to see what radio waves they could use to detect planes and, as he walked past the machine, he noticed that a chocolate bar in his pocket got hot and melted. And he thought, “Oh! I wonder if those microwaves have heated my chocolate bar.” He did some research, found out, of course, that that was the reason, and he invented a microwave. He put it inside a metal box and he sold it. The first microwave was 1.8m high, same height as me. Was 370km, and cost about $5,000. Although, with any technology, once something starts, it gets smaller and cheaper. So, by 1967, when the first home version was released, it cost $495 and it was slightly bigger than ones we have today. OK?

If you look at this chart, which I'm going to put over here ... I’ll move to the side, so you can see it ... this lists microwave ovens in the U.S. and microwave ovens in India. As you can see, in the U.S., 1971 only one percent of the population have microwaves, but, as we go through time to about 1997, 90% of the population have microwaves. Of course, India is zero and zero but, by 1997, one percent have microwaves and then five percent. As you can see, it's starting to take off. So, countries like India, developing countries, are starting to get more modern applications more things like … appliances, sorry, not applications … appliances, more things like microwaves.

Now, the microwave is a wonderful invention of course. It's a labor-saving device. It helps us and saves us a lot of time. However, there is a strong link between the invention of the microwave and the growth of obesity in America. Most people … many people in America … many people in obese countries eat microwave dinners. Now, the problem with the microwave dinner is, of course, it cooks faster than a regular meal. It doesn't take as long to prepare, but they have to put more fat, more salt, more sugar in it to make it taste good. You don't have any fresh vegetables in there. You don't have to go shopping for it. You don't have to think about the ingredients. Basically, you don't ... oh, I’ve run out of time. … Basically, you don't know what you're cooking. So, because people are eating more and more microwave dinners, they're eating faster, they’re not thinking so much about what they're putting into the food, and they're eating more additives and more fats and more sugars and more salts and basically, they're becoming fatter. Also, of course, if you don't know what's going into your food, if you don't make it yourself, you don't have any appreciation for that food. It's merely a meal. You don't think about the person that made it. So, microwaves are very convenient, they are a wonderful labor-saving device, and I wouldn't be able to survive without my microwave. However, they must be treated with caution. You can see a link between microwaves and obesity in many countries.

I’m sorry. I went a little bit over my five minutes there. But, only by a little bit. Thank you for listening. If you have any questions or comments, please put them in the comment field down there somewhere. If you have any ideas, things you'd like me to talk about, please put them down there as well. If you liked this talk, click “like”. Down in the description box you can find the link to the script for this talk, questions, answers, the MP3. You can practice your English. You can hopefully learn something, and you can practice and get better at English. If you want to subscribe, “subscribe” that’s somewhere over here, and you can watch these talks whenever I make them. Thank you. I hope you learned something. Have a nice week. Goodbye.

**The Microwave – Questions**

1. What is a hertz?

A: 2.5 billion waves.

B: A giga-hertz

C: One wave in one second.

D: A magnetron.

2. What physical property heats your food?

A: Water is a liquid.

B: Gravity is strong.

C: Likes attract.

D: Opposites attract.

3. Why doesn’t the crust of a pizza heat up as quickly as the tomato sauce in the center?

A: Because it is drier.

B: Because it is a different color.

C: Because it has flour in it.

D: Because it doesn’t have as much flavor.

4. What is the purpose of the “standing time” on your microwave meal?

A: It gives the microwaves time to leave the meal.

B: It gives the meal a chance to mix.

C: It prevents your from burning your hands.

D: It allows the inside of the meal time to heat up.

5. What was Percy Spencer trying to do when he discovered the heating properties of microwaves?

A: He was building a chocolate shop.

B: He was trying to build a better radar.

C: He was designing a plane that was undetectable by radar.

D: He was planning on having a snack.

6. Why were later microwaves not as big and less expensive than the first?

A: Because Amazon was selling them.

B: Because there were more microwave meals available.

C: Because technology always gets smaller and cheaper.

D: Because they wouldn’t fit in a kitchen.

7. What was the approximate price difference between the first microwave and one released in 1967?

A: $500

B: $4000

C: $4500

D: $5000

8. Which of these facts is NOT correct.

A: In 1997, 90% of American homes had a microwave.

B: In 1971, one percent of American and Indian homes had a microwave.

C: Indian homes didn’t start getting microwaves until about 30 years after Americans.

D: The number of microwaves in Indian homes is increasing.

9. Which of these is NOT a reason why microwave meals could be linked to obesity?

A: They don’t take as long to cook as real meals.

B: You have to buy all of the ingredients yourself.

C: They have more sugar.

D: You don’t know what you’re cooking.

10. Steven says, “Also, of course, if you don't know what's going into your food, if you don't make it yourself, you don't have any **appreciation** for that food.” Which of these words is closest in meaning to “appreciation”?

A: depreciation

B: criticism

C: gratitude

D: neglect

11. Why do subsequent versions of a technology get smaller and cheaper?

12. Why is the number of microwaves increasing in developing countries?

13. Describe another labor-saving device that might have hidden health risks. What are they?

14. Obesity poses a greater risk than smoking. Discuss.

15. We use and own so many things these days. Is it impossible to appreciate everything that we have?

**The Microwave – Answers**

1. C 2. C 3. A 4. D 5. B 6. C 7. C 8. B 9. B 10. C

11. Why do subsequent versions of a technology get smaller and cheaper?

 Basically, because of money. When something is first invented, it is literally a prototype. It is the first. It has problems. There are things that will not work. There are things that could be improved upon. A lot of research money will have gone into that prototype. Not many will sell, so the high cost has to be split over a low number of sales. The people that buy the prototype are fans, or followers of new technology. They don’t mind paying a lot to be the first. And these are the people the industry relies upon. That money is then reinvested in the product to fix the problems that have been discovered, improve the bits that don’t work and to generally make it better. Then, the improved, usually faster and smaller model, is rereleased. It is better and therefore more people buy it. More people buying it means the cost of development can be spread across more buyers, meaning a lower price. The money is reinvested … and this continues until a different invented arrives and replaces the original one.

12. Why is the number of microwaves increasing in developing countries?

 The number has increased for exactly the same reason the number of microwaves increased in America as people became wealthier. For exactly the same reason that they increase in other countries. Many developing countries do still have extremely high levels of poverty, but they now have a middle class that they didn’t previously have. Globalization has brought levels of wealth to poor countries and the people that now have that wealth want to live easier lives. They desire microwaves partly for their image of western success, but also, and probably more likely, they desire them because they are labor-saving devices and they make life easier. There is an excellent TED talk by Hans Rosling about how developing countries are closing the gap with developed countries. Well worth a watch.

13. Describe another labor-saving device that might have hidden health risks. What are they?

 The only labor-saving device that might have hidden health risks that I can think of is a TV remote control. I’m not sure if it even qualifies as a labor-saving device. It doesn’t so much save labor as save you having to stand up and walk six paces to change the TV channel, before walking six paces back to your nest of Cheetos. The health risk would be that it encourages us to watch more TV, thereby spending more time sitting down on our sofas. I have seen no research, but I would suggest that the simple act of standing up to change a TV channel causes a very slight boost in metabolism and heart rate, thus being slightly healthy. Also, once someone is standing, it would be easier to then switch the TV off and go and do something else. Not having to stand to change the channels would encourage people to sit there for far longer, aimlessly clicking the remote.

14. Obesity poses a greater risk than smoking. Discuss.

 I would agree with this statement for four reasons. The risks of obesity are not as well documented as smoking, society frowns on name-calling, far more people are obese than smoke, and obesity is far harder to stop.

 The risks of obesity are not as well documented as smoking. By this, I do not mean scientifically, but publicly. Scientists have long researched the risks of obesity and you can find countless reports on it. However, not as many of these reports are made known to the public as smoking related reports. I think every person in America can quote the statistics concerning smoking related illnesses, yet they could not do the same with obesity related illnesses.

 Society frowns on name-calling and calling someone obese has become akin to bullying. If someone is smoking near you, there are no societal qualms about saying, “don’t you know what you are doing to your body? Don’t you realize how unhealthy that is?” Yet, if someone obese is eating a fifth cheeseburger, you could not go up and say the same things. Society feels there is a need to protect obese people’s feelings, but not those of smokers.

 The number of smokers has dropped in recent years. In America, about 16.8% of people smoke. Warnings on cigarette packets, rising prices and many other factors are bringing the number down. The same thing isn’t happening with obesity. Almost 70% of Americans are overweight. It has become the norm rather than the exception. This shows that efforts to halt the trend, what few there are, are not working. Smoking is being brought under control, while obesity is not.

 It is a relatively simple task to stop people smoking. You raise the prices, you educate smokers on the risk and you reduce the number of places they can smoke. You will never eliminate it completely, but you can reduce the numbers to a level where the health treatments don’t destroy the national budget. You cannot do that with obesity. You cannot raise the price of fat and sugar. Education is extremely difficult to do and you cannot cut the number of restaurants.

 Obesity is a problem that is going to get much worse before it gets better. Smoking has already peaked.

15. We use and own so many things these days. Is it impossible to appreciate everything that we have?

 No, it isn’t, But, that doesn’t mean we shouldn’t. There are three things we can do. Firstly, when we remember, we can try to think of all the work that went into whatever we are using. For example, my keyboard. It was invented, refined, developed. In a factory somewhere (probably in China) this keyboard was assembled by a worker. It was packed and shipped. Someone drove it. Someone flew it. Someone delivered it to me. If I can think like that whenever I remember, I will make a habit of being more appreciative. The second thing we can do is try to list three things we are grateful for at the end of each day. Even in the worst of worst days, you will be able to think of three things. This is good practice to make us more appreciative and positive people. And the third thing we can do is to try to go without things sometimes. Don’t use your phone for three days. Don’t use the Internet for a week. Don’t use any of the running water in your house for two days. You will soon learn to appreciate what you have when you don’t have it.