

Electricity and Magnetism: Teaching Approaches 05

Contents

Activities to learn about power (a list of activities)	2
Electrical power	3
The electrical home	6
How things have changed!	8
Check questions.....	9

This is the 'Teaching Approaches', showing selected possible activities suitable for the classroom. To develop your expertise in the episode, work with the 'Physics Narrative' and the 'Teaching and Learning Issues'. Navigate to any part of the topic using the Topic Menu, or use the tabs below to stay within this episode.

Activities to learn about power

Electrical power	teacher demonstration	<ul style="list-style-type: none">• to introduce and discuss what is meant by electrical power• to relate the idea of electrical power to familiar household appliances• to make the link from ideas about current and voltage to ideas about electrical power
The electrical home	homework activity	<ul style="list-style-type: none">• to encourage pupils to think and talk about the range of electrical appliances in their own home and the relative power outputs of those appliances• to make the connection between high power output and heating appliances
How things have changed!	homework or class discussion activity	<ul style="list-style-type: none">• to encourage pupils to think and talk about the rapid expansion in the use of electrical appliances within the last 30-40 years
Check questions	three diagnostic questions	<ul style="list-style-type: none">• to check the pupils' understanding of ideas developed in this episode• to help identify where further teaching and learning effort may be needed

Electrical power

What the activity is for

The aim of this interactive demonstration is to introduce the idea of electrical power by examining a range of electrical appliances. In addition, for those pupils who are able to follow the line of argument, the link is made from basic ideas of current and voltage to that of power.

What to prepare:

- collection of electrical appliances
- joulemeter

Equipment Tip: Some joulemeters are designed to work at low voltages only (for example up to 16 volt), whilst others operate at the mains supply voltage (around 240 volt). You will need to select electrical appliances to demonstrate according to the type of joulemeter.

What happens during this activity: Everyday Appliances

The aim of this part of the activity is to get pupils talking about a range of familiar electrical appliances. These might include:

- a 40 watt bulb in a lamp
- a 100 watt bulb in a lamp
- a CD player
- hair tongs
- convector heater

Electrical power

Ask the pupils how the two lamps differ from one another and move the discussion on to considering how you would know which kind of bulb to buy in a supermarket:

OK so we have these two bulbs one dim, one bright. How would you know which kind to get in a supermarket?

Is it called the watts?
Like a 100 watt?

That's exactly right. In fact this here is a 100 watt bulb. What do you think the dim one is?
How many watts?



Move towards the idea that this value in watts is the electrical power of the device and that the power measures the amount of energy shifted per second (see narrative and teaching and learning issues).

Electrical power

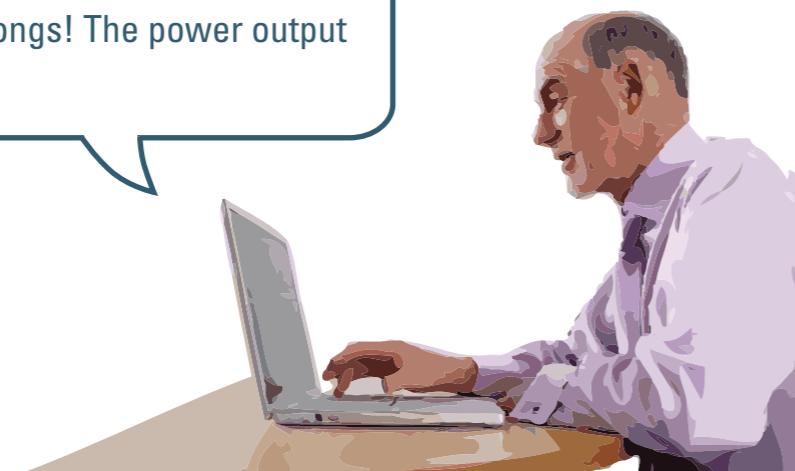
Different appliances: Using a joulemeter

Look at each of the appliances in turn and ask the pupils to predict their power output. If you have access to a joulemeter, it is interesting at this point to connect it up to the different appliances.

Joulemeters measure the amount of energy transferred by a device as time goes by. Most have some kind of flashing display, on which each flash indicates 100 joule of energy transferred. The faster the flashing, the greater the rate of energy transfer, the bigger the power output. With some meters the output can be connected up to an amplifier and speaker so that you can "hear" the rate of flashing.

It is helpful to make the link from the rate of flashing to the image of charges passing through the device and transferring energy as they go:

Wow! Just look at that. Can't you just see the charges zipping round transferring energy as they pass through the tongs! The power output is really HUGE here.



This kind of activity leads into the homework task.

A formal approach

Developing the idea of power output from current and voltage ideas

For those classes which are able to cope with the ideas involved you might now return to the base ideas of current (as charges passing per second) and voltage (as energy transferred per coulomb) and develop the idea of power (as energy transferred per second).

The electrical home

What the activity is for

This is a homework activity in which pupils make a survey of the different electrical appliances used in their own homes. The aim is for the pupils to collect information about the use and electrical power output of each appliance and then to list the appliances in terms of relative power. This will allow the pupils to make the link between high power outputs and appliances which have a heating function.

What to prepare:

- data
- homework sheet: The electrical home

What happens during this activity

The pupils follow the instructions on the homework sheet and collect information about the different electrical appliances that they have in their own homes. Having collected the information the pupils then make a table listing the appliances in order of their power output. The aim here is to demonstrate that the appliances which have a high power output (those which transfer energy quickly) all have some kind of heating function.

Direct the pupils to find power output figures by examining:

- information on the casing of the appliance
- information leaflets for the appliance
- information available on the internet



The electrical home

You might also draw on the figures listed below to help pupils who have drawn a blank with particular appliances.

	Electrical appliance	Typical power output / watt
Bulbs	Incandescent light bulbs	40/60/100
	Energy efficient light bulb	20
TV/Music/Personal	TV (25 inch colour)	250
	Video games (not inc. TV)	20
	Video recorder (VCR)	100
	CD/DVD player	50
	Hi-Fi stereo, surround sound system	500
	Portable stereo (average volume)	55
	Mobile phone (on standby)	20
	Hair tongs	200
	Computer system	1200
Heaters	Microwave oven	1200
	Electric fire	2000
	Kettle	2500
	Fan Heater	3000
	Immersion heater	3000
	Washing machine	3000

How things have changed!

What the activity is for

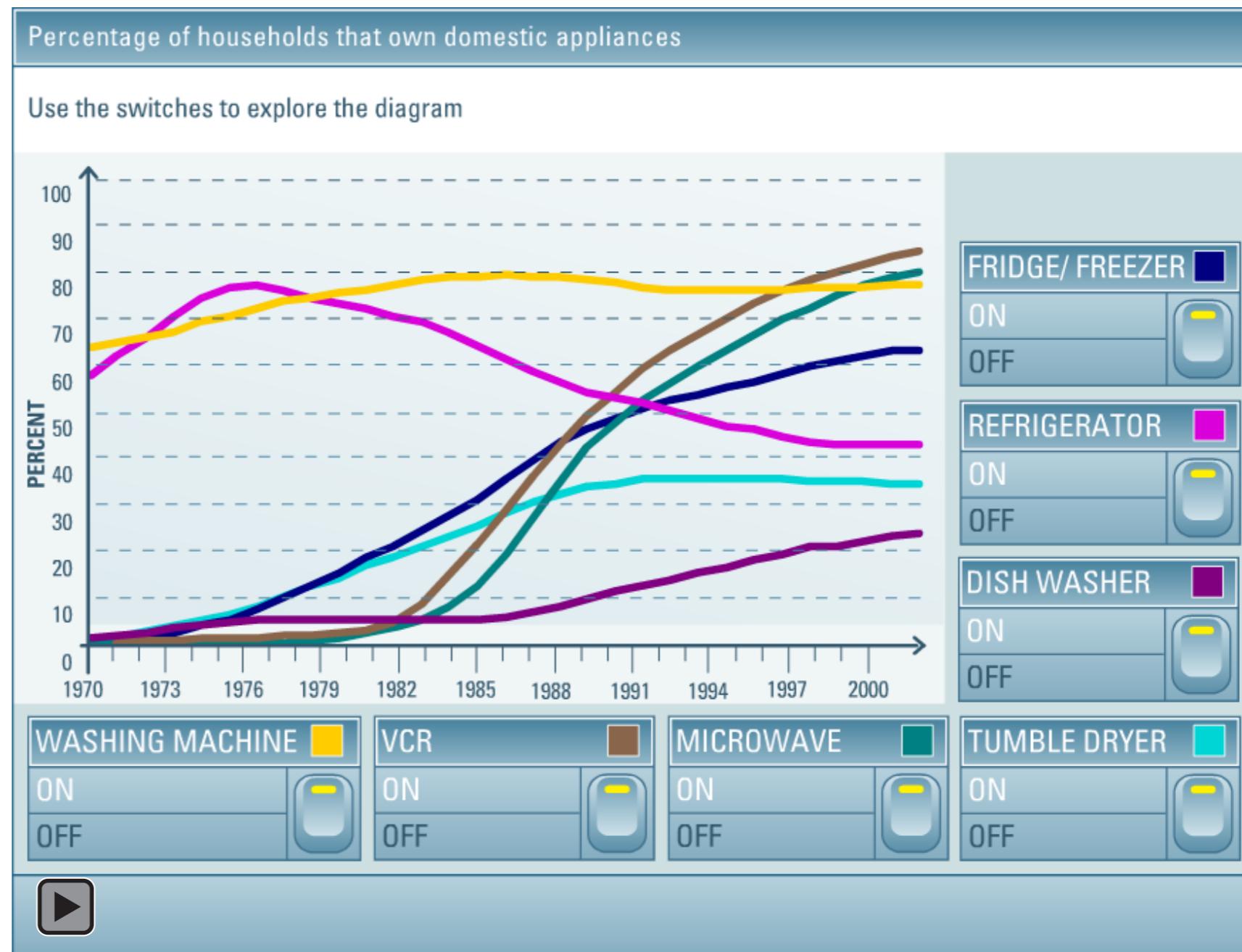
This is a discussion activity which focuses on the rapid expansion in the range of electrical devices in the home within the last 30-40 years.

What to prepare:

- a copy of this interactive object

What happens during this activity

The pupils might be asked, for homework, to collect some information about the electrical appliances that older neighbours or relatives had in their homes some 30-40 years ago. They can report back their findings in a class discussion which also draws upon the data show here.



Check questions

What the activity is for

The diagnostic questions can be used to check the pupils' understanding of key ideas introduced in this episode.

What to prepare:

- copies of the diagnostic questions

What happens during this activity

The questions might be used for homework or as the basis for discussion in class.

Best word

This question is designed to check pupils' ability to use the correct terms in relation to a simple electric circuit.

- (a) An electric current
- (b) Electric charge
- (c) Voltage
- (d) Energy
- (e) Power output

Make a match

This question probes understanding of 3 basic electrical units.

- (a) 1 ampere is the same as 1 coulomb per second (B)
- (b) 1 volt is the same as 1 joule per coulomb (D)
- (c) 1 watt is the same as 1 joule per second (A)

Who do you agree with?

This question probes pupils' understanding of a series circuit with two bulbs of different rating.

- (a) Tanya: AGREE
- (b) Ben: DISAGREE
- (c) Jane: AGREE