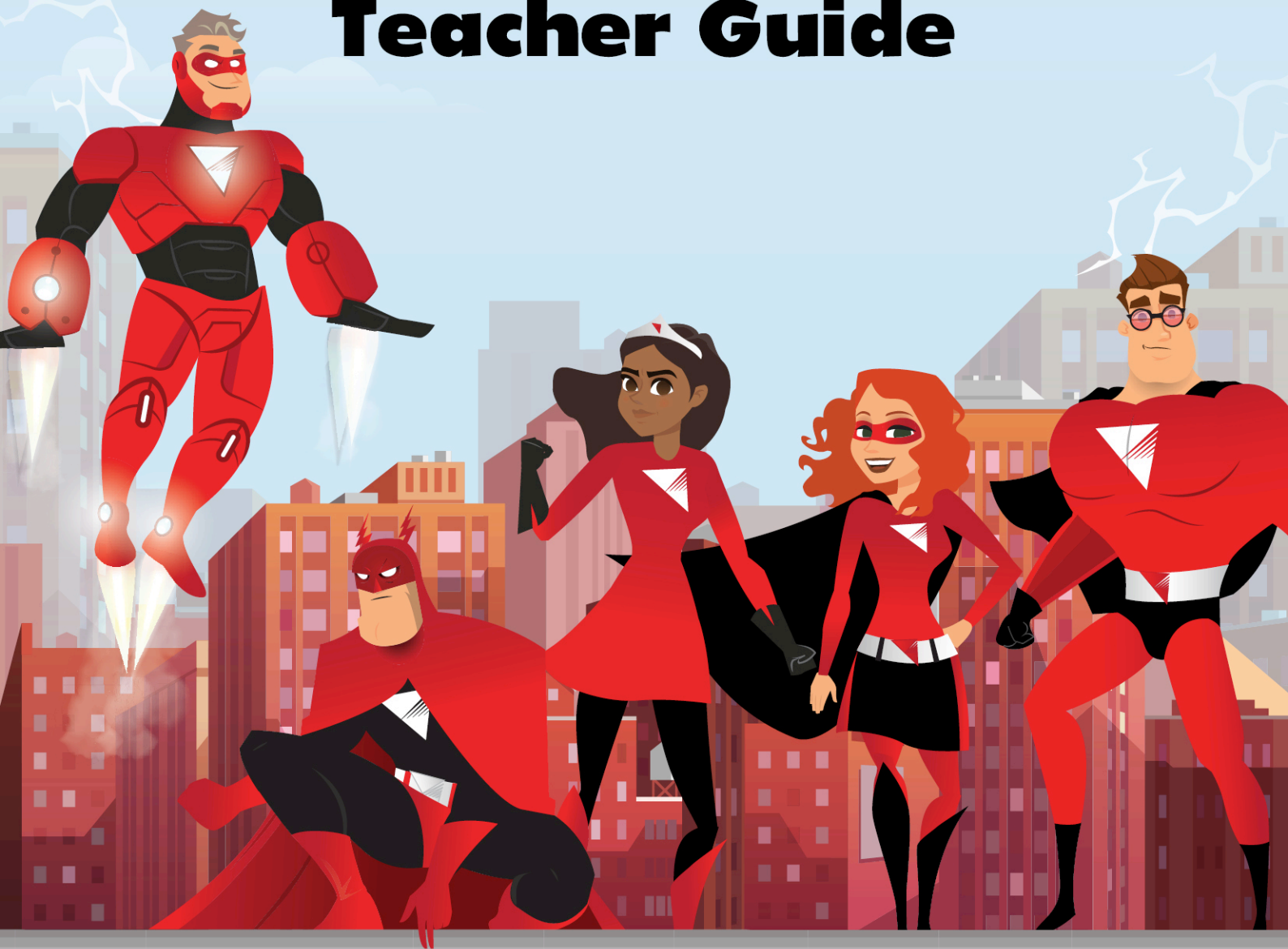


Electricity Day

Teacher Guide



Who are Northern Powergrid?

We deliver a safe and reliable electricity supply to 8 million customers across the North East, Yorkshire, and northern Lincolnshire.

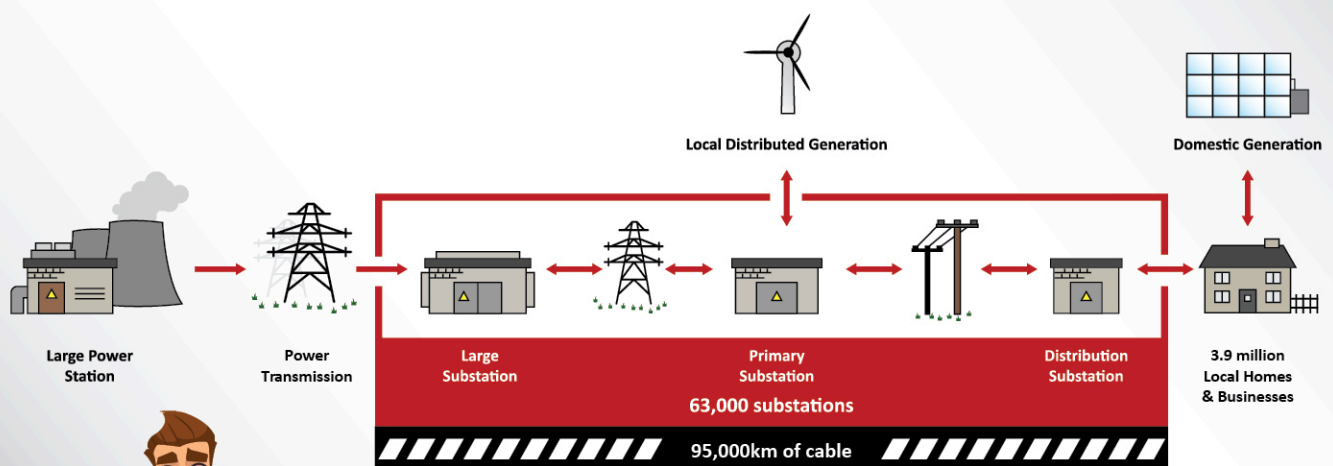
We take electricity from National Grid's transmission network (which connects the larger power stations) and from smaller generators (such as windfarms) that are directly connected to our network.

We distribute electricity to 3.9 million homes and businesses across the region. Our network is made up of more than 63,000 substations and 60,000 miles of overhead power lines and underground cables, spanning 9,650 square miles.

Northern Powergrid are committed to promoting safety around electricity and keeping young people informed about energy.



Where we fit in the electricity industry



An Introduction to this Pack

This pack has been put together for teachers to use in the classroom. It contains a teacher guide complete with lesson plans, a PowerPoint presentation, and a pupil workbook containing key facts and worksheets.

This resource has been put together and reviewed by teachers to provide pupils in Year 5 and Year 6 with an introduction to electricity.

The booklet will enable you to deliver a days' worth of lessons. Please use the PowerPoint presentation provided to help you work through and deliver the lesson plans with ease.

A summary of the day:

1. An introduction to Northern Powergrid and electricity
2. Lesson 1: Warning Signs and Keeping Safe
3. Lesson 2: Keeping Current! (a history of electricity consumption)
4. Lesson 3: My Circuit (exploring energy costs)

A summary of suggested resources:

- PowerPoint presentation
- Internet connection and AV for videos
- Printed and cut scenario cards (appendix A) – 1 set per group
- Printed Safe/ Unsafe warning signs table (appendix A) – 1 per group
- Keeping Safe – Home Safe and Sound Grid (Pupil workbook pg. 5)
- Pupil workbook – 1 per student
- Recording device – 1 per group
- Torch - 1
- Bulbs – 1 set for each group
- Wire with crocodile clips – 1 set for each group
- A range of batteries with 3 different voltages – 1 set for each group
- Switches – 1 set for each group
- Empty kitchen roll – 1 per group
- Sheets of white paper: 5 – 10 per group

Curriculum Links:

English

- Asking questions to improve their understanding
- Explaining and discuss their understanding of what they have read (including from formal presentations and debates), maintain a focus on the topic and using notes where necessary.

Mathematics

- Problems involving addition, subtraction, multiplication and division.

Science

- Planning different types of scientific enquiry to answer questions, including recognising and controlling variables where necessary
- Taking measurements; using a range of scientific equipment, with increasing accuracy and precision; and taking repeated readings when appropriate
- Associating the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit
- Comparing and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches
- Using recognised symbols when presenting a simple circuit in a diagram.

Section 1: Introduction



Suggested length | 15 mins

Suggested time	Activity	Slide Guide and Suggested Resources
10 mins	<p>Introduce pupils to the overall objectives for the day:</p> <ul style="list-style-type: none">• Know who Northern Powergrid is and what it does.• Learn how to stay safe within the home and the local community in situations involving electricity.• Understand the cost of electricity for an individual household and how it has changed in recent years.• Identify some of the Issues that face future generations when considering electricity consumption.• Explore electricity through scientific enquiry. <p>Discussion prompt: Have students heard of Northern Powergrid? Ask students to guess what they do if they haven't already heard of the company.</p>	Slide 1 and 2
5 mins	<p>Introduction to Northern Powergrid: Prompt discussion with students about whether they have heard of Northern Powergrid and ask students to guess what it does if they haven't heard of the company.</p> <p>Key points about Northern Powergrid: Northern Powergrid is an Electricity Distribution Network Operator (DNO) and is responsible for distributing electricity reliably and safely across its network.</p> <ul style="list-style-type: none">• Put simply, Northern Powergrid keep the lights on, the kettles boiling and the phones charged for 8 million people.• Northern Powergrid work across the Northeast, Yorkshire and northern Lincolnshire.	



Lesson 1: Warning Signs



Suggested length | 50 - 60 mins

Resources:

- PowerPoint Presentation
- Printed and cut scenario cards (appendix A) – 1 set per group
- Printed Safe/ Unsafe warning signs table (appendix A) – 1 per group
- Keeping Safe – Home Safe and Sound Grid – pupil workbook page 5

Curriculum Links:

English

- Asking questions to improve their understanding
- Explaining and discussing their understanding of what they have read, including from formal presentations and debates; maintain a focus on the topic and using notes where necessary

Suggested time	Activity	Slide Guide and Suggested Resources
5 minutes	<p>Introduce students to the first lesson of the day:</p> <p>The aim of this activity is to highlight key facts and features of electricity generation, distribution, infrastructure and promote Keeping Safe messages.</p> <p>Electricity is an important feature of our lives today - from switching on lights to powering our phones and public transport. It's difficult to think about life without electricity. Electricity can be dangerous.</p> <p>Watch this video on the dangers of electricity (this video is just under 1.5 minutes). The dangers of approaching a powerful source of electricity are demonstrated.</p> <p>www.bbc.co.uk/education/clips/z32w2hv</p>	Slide 7 and an internet connection
10 minutes	<p>Group activity</p> <p>Let's see how 'electricity smart' you are.</p> <p>Give each group a set of situational cards.</p> <p>Each card describes one of a range of scenarios relating to electricity and electrical safety.</p> <p>Each group needs to sort them under the correct headings of Safe/Unsafe.</p> <p>A suitable table for this activity is provided in appendix A, along with scenario cards that can be printed and cut out.</p> <p>Alternatively, there is a similar table on p. 3 of the Pupil workbook that you can use if you'd like students to make a note of the scenarios themselves.</p>	<p>Scenario cards (see: appendix A, p. 15)</p> <p>Safe/Unsafe table, preferably printed A3 (see: appendix A, p. 16)</p> <p>Guiding PowerPoint: slides 9 - 18</p>



Lesson 1: Warning Signs

Answers

Safe/Unsafe	Scenario	Answer
Scenario 1	Charging a phone in bed at night.	When charging, phones can overheat and cause fire.
Scenario 2	Making toast and the toast gets jammed, your friend suggests using a knife to get it out.	Metal objects and appliances can conduct electricity. Never poke at an electrical appliance as it can cause electrocution.
Scenario 3	You are playing football and the ball gets kicked into a substation – you decide not to go in after it.	Finding somewhere safe to play is a great idea! Entering a substation is deadly. Keep Out!
Scenario 4	You are playing with your kite in the park and forget to look out for overhead cables.	Find an open space free from overhead obstructions.
Scenario 5	Turn on/off a light switch with wet hands.	Water is a conductor of electricity. This action could lead to electrocution.
Scenario 6	After charging your phone/tablet you pull on the wire to disconnect.	Always turn off at the wall and take the plug out of the socket as electricity can jump.
Scenario 7	You notice that an electrical wire has become bare and you stop using the appliance and inform an adult.	Electrical leads are covered with a plastic coating for your safety and to avoid unnecessary accidents.
Scenario 8	A child wants to use steel pylons as a climbing frame.	No one should ever use pylons as a climbing frame. A playground is a much safer place for such an activity.
Scenario 9	You are out playing and you come across a train track so you decide to play somewhere else.	Train tracks are a major hazard. There are safer and more interesting places to play.
Scenario 10	There is an electrical box on your street. You are tired so you sit on it for a rest.	This box contains electrical cables. It is unsafe to sit on or touch. You should adhere to the warning signs.



Lesson 1: Warning Signs

Suggested time	Activity	Slide Guide and Suggested Resources
5 mins	Once pupils have sorted the cards, encourage pupils to discuss their ideas as a class and explore why each scenario is safe or unsafe. Advice to students: If you find yourself in a situation that you are unsure of, tell a responsible adult who will help you make a sensible decision. This could be anything from choosing to play elsewhere to contacting Northern Powergrid, the local council, or the emergency services depending on the severity of the situation.	Guiding PowerPoint: slides 19 - 28
10 mins	How does electricity get to your home? Slide 29: Have your students look at this diagram and the key. See if they can match the items in the key with the boxes on the diagram. Slide 30: Take students through the correct answer as shown on this slide. Outline the following definitions in relation to how electricity reaches the home: Power Station Electricity is generated at power stations. After passing through transformers, it leaves the power stations at high voltages (either 400,000 or 250,000 volts) and is carried along cables. Substation There are many different types of substations. The equipment inside them include transformers which are used to change the voltage and distribute electricity around the network of overhead and underground cables. Underground cables In some areas, usually towns and cities or new developments, electricity is usually carried along underground cables. The cables are covered with an insulating material. Transformers Transformers are found both in substations and on wooden poles. They are used to either increase or decrease the voltage of the electricity being transported on the journey from the power station to your home. Wood poles Electricity at lower voltages is sometimes distributed along cables attached to wooden poles. These cables can be mistaken for telephone wires. Pylons Pylons are metal structures (sometimes called 'towers') which support cables carrying high voltage electricity. Students can find these definitions in their own pupil workbooks.	Guiding PowerPoint: slides 29 – 30 Pupil workbook (p. 4)



Lesson 1: Warning Signs

Suggested time	Activity	Slide Guide and Suggested Resources
15 mins	Keeping safe: Home Safe and Sound This activity is all about improving your students' problem-solving skills. Pupils will use their new-found knowledge to plan a safe route across a grid to avoid all hazards and risks. This grid can be found on page 5 of the Pupil workbook. Pupils must identify, name and provide a definition of the risks and hazards that they encounter on the grid.	Home Safe and Sound Grid – Pupil workbook pg. 5 Optional: Bee-bot or similar programmable floor robot
5 - 10 mins	Plenary Choose a pupil to plan a route for a Bee-bot, to see if they have been successfully able to avoid all hazards and risks.	Optional: Bee-bot or similar programmable floor robot



Lesson 2: Keeping Current!



Suggested length | 60 mins

Resources:

- PowerPoint presentation
- Notes pages: pages 7 – 8 in the pupil workbook
- Pencils
- Recording device – 1 per group
- Optional: extra paper and pens/ pencils for mind mapping

Curriculum Links:

Mathematics

- Problems involving addition, subtraction, multiplication and division

English

- Noting and developing initial ideas, drawing on reading and research where necessary
- Using further organisational and presentational devices to structure text and to guide the reader (for example, headings, bullet points, underlining)
- Presenting their own compositions using appropriate intonation, volume and movement so that the meaning is clear

Suggested time	Activity	Slide Guide and Suggested Resources
5 minutes	<p>Introduce students to the second lesson of the day</p> <p>In this lesson we are going to:</p> <ul style="list-style-type: none">• Compare how electricity consumption has changed over the past 40 year period• Explore energy costs• Discuss what issues future decision makers face <p>From the information that we discover during this lesson you will be asked to work as a group to compose a script for a news article for a local TV station. Throughout this session we will making notes using pages 7 - 8 of your pupil workbook.</p> <p>Teachers should show students what this page looks like and will need to model using the templates to make notes throughout the lesson.</p>	Notes pages: pages 7 – 8 in the Pupil workbook
10 mins	<p>Maths challenge</p> <p>You leave a light bulb switched on for 24 hours, it will cost £0.20. How much would it cost if you left it on for: A week? $£0.20 \times 7 = £1.40$ A month? $£1.40 \times 4 = £5.60$ A year? $£1.40 \times 52 = £72.80$</p> <p>Now, what if you had six rooms in your house? $£72.80 \times 6 = £436.80$ per household in one year!</p> <p>How much money could a household save if lights were turned off when they weren't needed? What could you buy with the money saved?</p> <p>Imagine how much money could be saved if all electrical appliances were switched off when they weren't being used!</p> <p>Extension activity:</p> <p>Ask students to count the number of lightbulbs in their home. How much would it cost if they were all left on for a day, a week, a month and finally – a year.</p>	<p>Guiding PowerPoint: slide 33</p> <p>Note:</p> <p>The PowerPoint is animated. Take students through the Maths Challenge step-by-step using our guiding PowerPoint as a visual aid.</p>

Lesson 2: Keeping Current!

Suggested time	Activity	Slide Guide and Suggested Resources
10 mins	<p>1980s vs Today</p> <p>Slide 34:</p> <p>Students to discuss what electrical items and appliances they would expect to see in a house from the 1980s vs. one from today.</p> <p>There is space on p. 7 of the Pupil workbook for students to note down their ideas.</p> <p>Get students to share their ideas and encourage everyone to fill in p. 7 of their workbooks with any extra ideas that come out during discussion.</p> <p>Prompts:</p> <p>1980s: lights, TV, alarm clock, radio, record player, cassette player, VHS player/ recorder, hairdryer, curling tongs, iron, oven, microwave, computer, games console, phone, arcade machine, kettle, fridge, freezer.</p> <p>Today: TV, computer, laptop, smartphone, microwave, oven, lights, hairdryer, kettle, apple watch, tablet, games console, handheld console, DVD player, slow cooker, hairdryer, hair straighteners, curling tongs, Virtual Reality headset, fridge, freezer.</p> <p>Slide 35:</p> <p>Students to discuss what differences they would expect to see on an electricity bill from the 1980s vs. one from today.</p> <p>There is space on p. 7 of the Pupil workbook for students to note down their ideas.</p> <p>Students to feedback their ideas and teacher to lead discussion around the fact that energy costs are rising. Students to be encouraged to make a note of any extra information they did not include in their own answer.</p> <p>Slide 36:</p> <p>The image on this slide contains a link to the following video about household energy consumption: www.bbc.co.uk/newsround/18591410</p> <p>Extension activity:</p> <p>Energy costs are rising – why do you think that might be?</p> <p>Prompts:</p> <p>The invention of more household electrical goods has increased the demand and consumption of electricity, the lack of energy conservation in the home, the scarcity of certain types of fuel (coal etc.) and the increase in the cost of electricity bills.</p>	<p>Guiding PowerPoint: slides 34 - 36</p> <p>Pupil workbook: page 7</p>



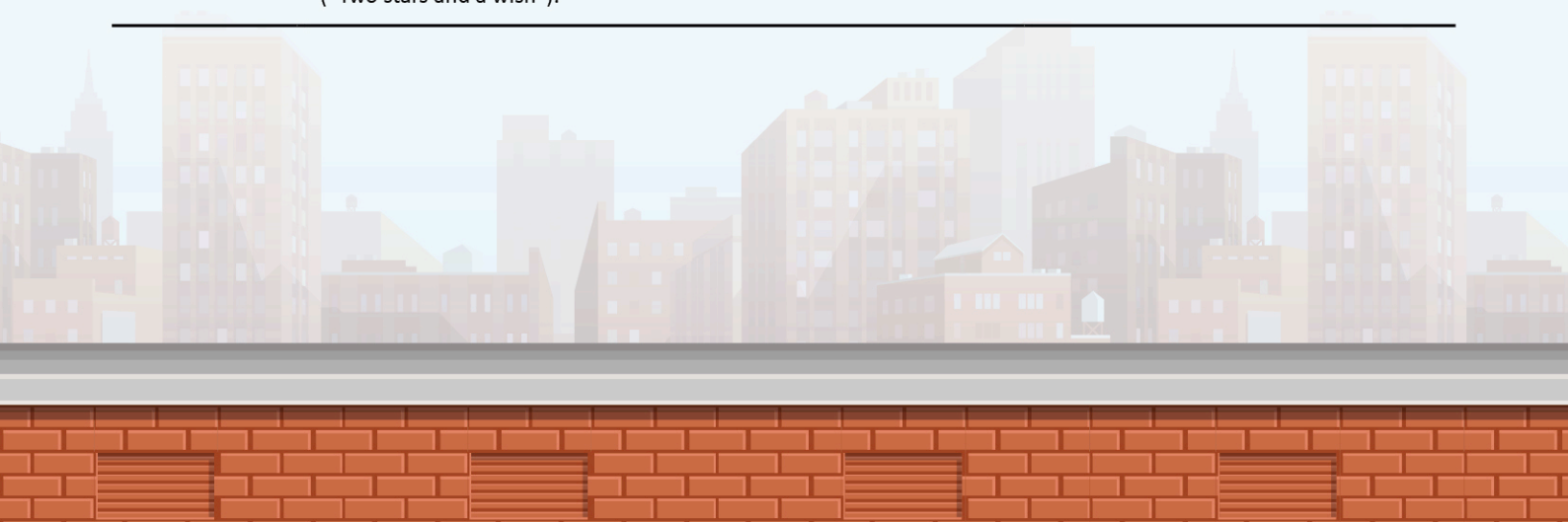
Lesson 2: Keeping Current!

Suggested time	Activity	Slide Guide and Suggested Resources
10 mins	<p>Thinking about change</p> <p>Slide 37: Ask students to think about how energy consumption has changed over the years. Help them explore themes to build understanding of this issue and reinforce some of the issues discussed previously.</p> <p>Prompts: Lack of energy conservation, more gadgets and household electrical goods available have influenced how we consume electricity. Some electrical items are getting cheaper and therefore people can afford to have more appliances and gadgets that rely on electricity; we are using electricity much more at work/in school to do our jobs and to learn (computers, tablets, programmable robots, smart boards etc. are examples of items students may have encountered).</p> <p>Slide 38: “What issues might face future decision makers?”</p> <p>Ask students to consider the kinds of decisions businesses and politicians might have to make in response to the changes in how we now consume electricity.</p> <p>There is space on p. 8 of their workbooks for students to make notes.</p> <p>Prompts: More substations and pylons may need to be built, household energy costs may rise and people encouraged to save energy.</p>	<p>Guiding PowerPoint: slides 37 – 38</p> <p>Pupil workbook: page 8</p>



Lesson 2: Keeping Current!

Suggested time	Activity	Slide Guide and Suggested Resources
10 mins	<p>Newsflash! – Setting brief and planning</p> <p>In groups, students script and record a short “newsflash” from the future.</p> <p>Students’ newsflashes must inform the public about a new decision that has been made about the distribution and/ or consumption of energy.</p> <p>Give the groups time to mind map and finish making notes from their previous discussions. Students should use p. 8 of their workbooks (these notes might inform their ideas).</p> <p>Students then need to select 1 key point to focus on.</p> <p>Students should create a script that communicates the following information:</p> <ul style="list-style-type: none">• What decision has been made?• Why has this decision been made?• How will it impact the public? <p>Example script:</p> <p>“NEWSFLASH!</p> <p>Northern Powergrid has announced that it will be building 50 new substations this year.</p> <p>This decision has been made because there is much more demand for electricity now. Northern Powergrid needs to build enough substations to meet demand and ensure that electricity is distributed reliably and safely to customers as and when they need it. The supply of electricity will be more reliable. This means you can all keep using your gadgets and appliances as much as you want!”</p> <p>The example script shows an approach to planning for the future that is driven by convenience and comfort (rather than concerns for the environment) – if this is an approach some of your students take when discussing future decision making/priorities, this may prompt further discussion.</p>	<p>Pupil workbooks: p. 8</p> <p>Optional: Extra paper and pens for mind mapping</p>
10 mins	<p>Newsflash! – recording</p> <p>Provide students with the opportunity to record their newsflash.</p>	<p>Recording equipment</p>
5 mins	<p>Plenary</p> <p>At the end of the session, teacher to select clip(s)/ recording(s) to be played for the class to peer assess.</p> <p>Pupils to feedback two positives and an idea for development. (“Two stars and a wish”).</p>	



Lesson 3: My Circuit



Suggested length | 60 mins

Resources:

- PowerPoint Presentation
- Torch - 1
- Bulbs – 1 set for each group
- Wire with crocodile clips – 1 set for each group
- A range of batteries with 3 different voltages – 1 set for each group
- Switches – 1 set for each group
- Empty kitchen roll – 1 per group
- Sheets of white paper: 5 – 10 per group
- Pages 9 - 12 of the pupil workbook

Curriculum Links:

Science

- Planning different types of scientific enquiry to answer questions, including recognising and controlling variables where necessary
- Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeated readings when appropriate
- Associating the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit
- Comparing and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches
- Use recognised symbols when representing a simple circuit in a diagram.

Suggested time	Activity	Slide Guide and Suggested Resources
5 minutes	<p>Introduce students to the last lesson of the day.</p> <p>In this lesson, students will:</p> <ul style="list-style-type: none">• Explore Current Electricity• Learn more about how a torch works• Learn about how a change in voltage can impact a circuit <p>Electricity can do lots of amazing things. Electricity is the flow of electrical power or charge through a conductor. There are two types of electricity: Static Electricity and Current Electricity. Today we are going to explore Current Electricity.</p>	Notes pages: pages 9 – 10 in the Pupil workbook
5 mins	<p>Introducing current</p> <p>Use a torch to introduce the lesson.</p> <p>Prompt students with the following questions:</p> <p>Do you know how a torch works? What is inside the torch that makes it work? What happens if you leave a torch on? What is the purpose of a torch? Does the torch light need to be dim or bright for the torch to fulfil its purpose?</p> <p>Students will attempt to complete a circuit so that a current flows through a light bulb.</p>	Torch



Lesson 3: My Circuit

Suggested time	Activity	Slide Guide and Suggested Resources
30 mins	<p>My Circuit</p> <p>Allocate groups, discuss safety issues and distribute materials.</p> <p>Model constructing the circuit using the battery with the lowest voltage. Place a kitchen roll over the top of the bulb. You should be able to see the light shining. Place a piece of paper over the top of the toilet roll. Can you still see the light?</p> <p>Keep adding individual sheets of paper until the light from the bulb is blocked out.</p> <p>Record the voltage of the battery used and how many pieces of paper it took to block out the light from the bulb.</p> <p>Pupils complete the experiment.</p>	<p>PowerPoint presentation</p> <p>Torch</p> <p>Circuit materials:</p> <ul style="list-style-type: none">• Bulbs• Wire with crocodile clips• A range of batteries with 3 different voltages.• Switches• Empty kitchen roll per group• Sheets of white paper <p>Page 9 of Pupil workbook</p>
10 mins	<p>Encourage students to discuss which circuit they found most suitable to use when designing a torch and why.</p> <p>Was the test fair?</p> <p>Extension activity:</p> <p>Pupils to design their own torch (p. 10).</p>	<p>Pupil workbook (p. 10)</p>
10 mins	<p>Wrap up activity:</p> <p>Remind students of the learning outcomes from today (slide 42).</p> <p>Students can use this time to complete the word search and crossword activities in their workbooks (p. 11 – 12).</p> <p>Alternatively, students can take their workbooks away with them and complete the puzzles at home.</p>	<p>Guiding PowerPoint: Slide 42</p> <p>Pupil workbook (p. 11 – 12)</p>



Warning Signs

Group work scenario - One set per group.

Scenario 1

Charging a phone
in bed at night

Scenario 2

You are making toast and the toast gets
jammed - your friend suggests
using a knife to get it out.

Scenario 3

You are playing football and the ball
gets kicked into a substation
– you decide not to go in after it.

Scenario 4

You are playing with your kite in the park
and forget to look out for overhead cables.

Scenario 5

Turning on/off a light switch
with wet hands.

Scenario 6

After charging your phone/tablet you
pull on the wire to disconnect.

Scenario 7

You notice that an electrical wire has
become bare and you stop using the
appliance and inform an adult.

Scenario 8

A younger sibling wants to use
steel pylons as a climbing frame.

Scenario 9

You are out playing and you come
across a train track so you decide to
play somewhere else.

Scenario 10

There is an electrical box on your street.
You are tired so you sit on it for a rest.



Warning Signs

As a group read the electricity-based scenarios and sort them under the Safe and Unsafe headings.

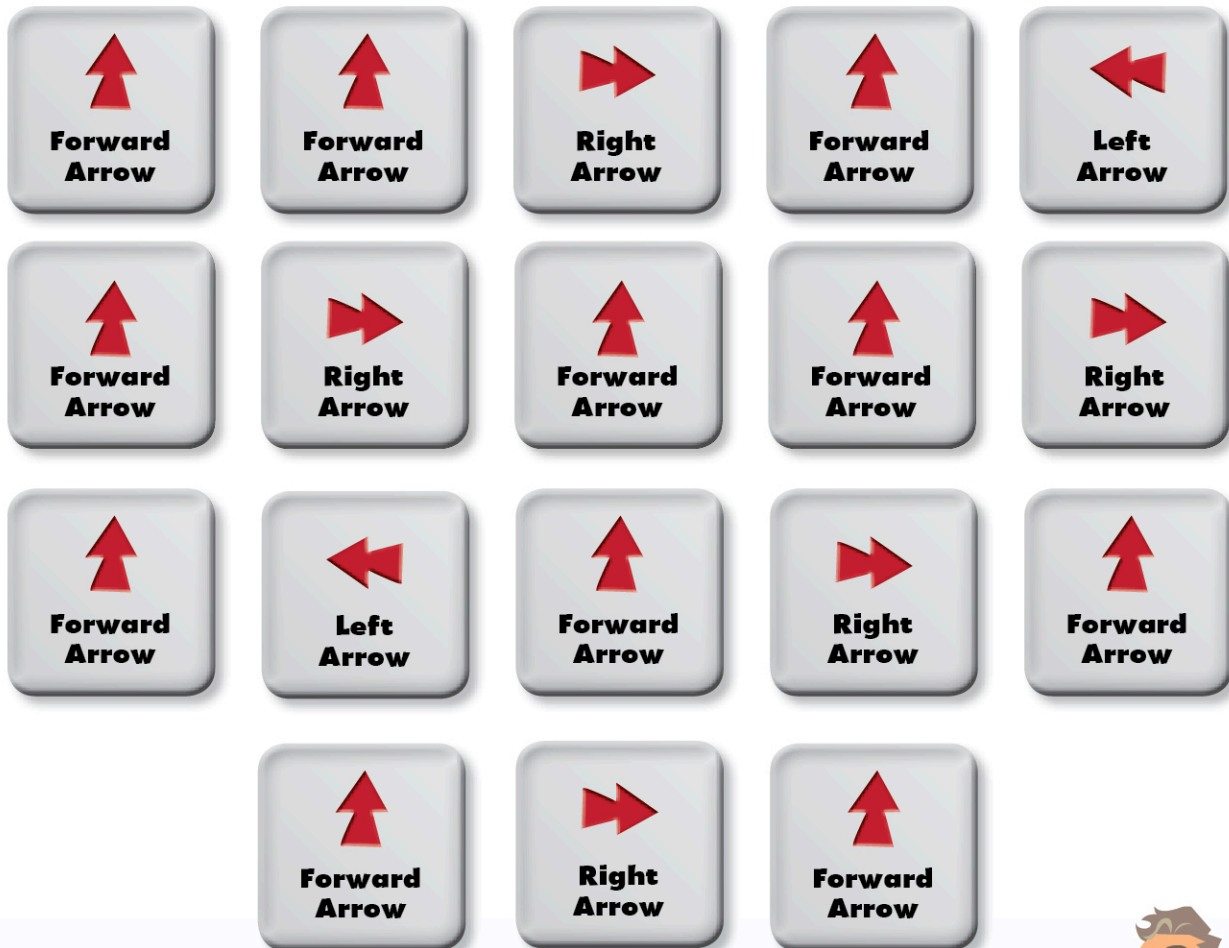
Safe

Unsafe

Keeping Safe

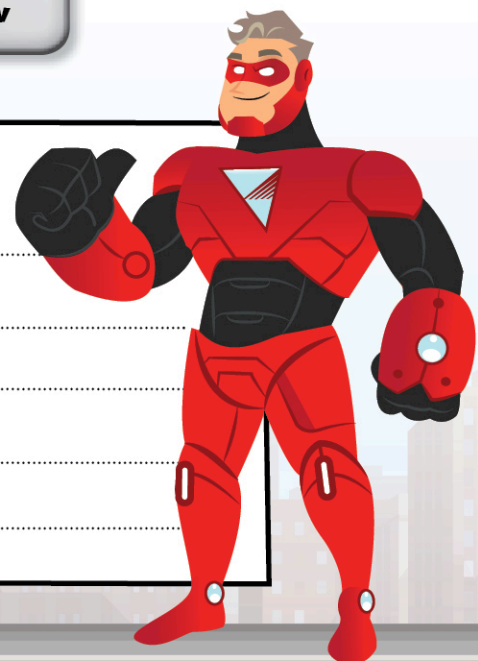
Home Safe and Sound - Answer sheet

Draw your directions to help the Beebot get from the school to home safely by avoiding all electrical risks and hazards.



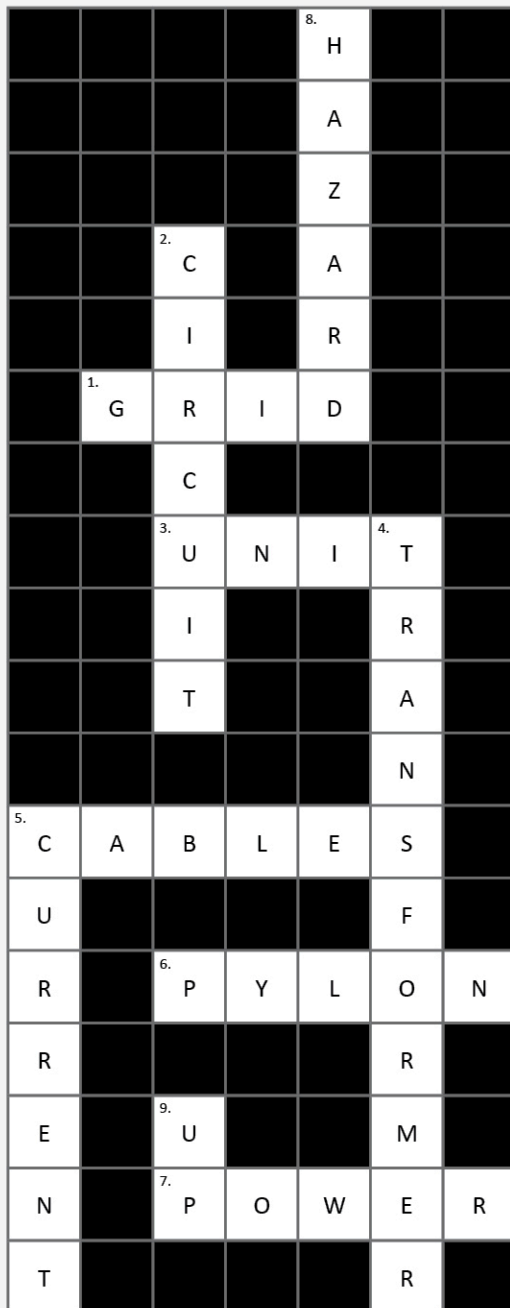
Record the potential electrical risks or hazards that you come across

1.
2.
3.
4.
5.



Crossword

Use the clues to complete the crossword puzzle.



Across

- What is the name of the company we have been learning about?
Northern Power_____
- A Kwh is a _____ used to measure electricity?
- In some areas, usually towns and cities or new developments, electricity is usually carried along by underground _____, which are insulated wires.
- Metal structures (sometimes called 'towers') which support cables carrying high voltage electricity.
- Electricity is generated at a _____ station.

DOWN

- The bulb will turn on when the _____ is complete.
- They are used to either increase or decrease the voltage of the electricity being transported on the journey from the power stations to your home.
- This type of electricity flows into your home.
- Another word for risk or danger.
- The price of electricity is going ____.



Wordsearch


T	D	E	B	N	G	H	A	Z	A	R	D
R	W	N	P	K	G	S	F	Y	B	N	S
A	U	Q	O	T	M	I	E	W	I	P	A
N	X	D	N	I	H	R	L	P	U	O	G
S	V	G	W	S	T	R	E	C	Y	W	I
F	O	T	K	V	M	A	C	I	Q	E	L
O	L	M	P	E	C	L	T	A	N	R	F
R	T	Y	D	F	Q	Z	R	S	E	I	J
M	A	B	U	A	R	J	I	O	B	H	R
E	G	L	O	S	H	K	C	R	J	U	I
R	E	T	I	N	U	G	I	B	K	W	S
S	C	U	R	R	E	N	T	S	A	T	K
J	D	Z	N	A	G	P	Y	L	O	N	U

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