

Learning Objectives	Before the lesson
<ul style="list-style-type: none"> To understand static electricity I can describe what static electricity is and how it moves objects through attraction or repulsion I can generate static electricity independently <p>I can use static electricity to make objects move in the way I want them to</p> <ul style="list-style-type: none"> 	
Attention grabber	
<p>Watch video on link: 'Funscedemos- Exploring static electricity' on Videolink. Set up the straw and bottle experiment using a bottle, straw and a duster.</p> <p>Demonstrate the experiment to the class. Ask the children if they can explain how you made the straw move (static electricity).</p> <p>Use this as an opportunity to explain static electricity:</p> <ul style="list-style-type: none"> All objects contain charges (positive and negative). Charges can pass between objects when you rub them together. After rubbing, there will be a charge imbalance. <p>When charged objects encounter each other, they will move because:</p> <ul style="list-style-type: none"> Two negative or two positive objects put near each other will repel. Opposite charges (one positive and one negative) put near each other will attract. <p>This movement is called static electricity.</p> <p>Show pupils the video on link: 'The Royal Institution- Static Magic' on Videolink from 2:49 to 4.00.</p> <p>The video explains how static electricity is made through generation and transference of positive and negative electrons. The video also touches on the fact that things other than balloons can be charged to move pre-charged objects. You might want your pupils working at greater depth to experiment with this (see 'Differentiation').</p> <p>You can also show pupils this online simulation on link: 'Phet- Balloons and static electricity demonstration'. The simulation shows what happens in terms of positive and negative charges when a balloon rubs against a jumper.</p>	
Main event	

The children take part in a carousel of activities/experiments as demonstrated on link: 'Funsciencedemos- Exploring static electricity' on Videolink:

- Drinks can race at 1.15
- Water and balloon experiment at 2.17
- Balloon picking up glitter at 3.18

This experiment on link: 'heartcraftythings- Butterfly experiment' takes much longer and should be completed as a whole class at the end of the lesson.

Drinks Can Race

(The children will need: empty drinks cans, cloths/dusters, balloons.)

The aim of this experiment is for pupils to generate their own static electricity by charging balloons to race fizzy drinks cans.

Begin by demonstrating how the children should charge their balloons and then use the static charge to move the can along a table/the floor.

Put pupils into pairs. Give each pair a duster, balloon and empty drinks can. The children have ten minutes to play around with creating the charge, during which time they should experiment with what can they do to make their can move faster in preparation for the race.

The children should discover that they can make the can move faster by rubbing the balloon more vigorously, which creates a charge.

Water and Balloon Experiment

(They will need: cup with a hole in the base, container of water balloons.)

Children are given the above objects and a bowl of water. The children charge their balloons so that they are ready for the experiment.

The children then scoop up some water into their cup, letting it come out of the hole in the bottom in a stream, then they move the charged balloon close to the stream and observe the effect.

Balloon Picking Up Glitter

(They will need: balloons, cloths/dusters, glitter/confetti/cut up paper.)

Children charge a balloon and pour a small amount of glitter/confetti onto a sheet of card or paper. They then use the charged balloon to attract the glitter, lifting it off the page.

Electrostatic Butterflies

(They will need: balloons, cloths/dusters, tissue paper, card/cardboard.)

Show pupils the link: 'heartcraftythings- Butterfly experiment'. The children will be making a version of these. They could also make dragons, bats, dragonfly, birds, etc. One piece of A4 card/cardboard will make the base of the model. The children:

1. Draw and cut the body of the butterfly out of coloured or tissue paper.
2. Draw and cut the wings from tissue paper, before glueing the wings to the underside of the body.
3. Glue the body to the base, making sure that the wings are free to move.

4. Use a charged balloon to lift the wings to make the butterfly 'fly'.

Key questions

- What makes the straw move? Static electricity
- What did I do to make the straw move? Charging the straw by rubbing it, then moving your hand towards it which attracts/repels using static electricity
- How can you charge an object? By rubbing it against certain materials
- Will two positively charged objects attract or repel? Repel
- Will a negative and a positive object attract or repel? Attract
- Describe how you can make the can move using a balloon. I can charge the balloon by rubbing it on a duster and bringing it towards the can which will be either attracted or repelled by the charged balloon.

Wrapping up

Ask the children to complete the *Activity: Static electricity – experiment review* (See Classroom Resources)

Once finished, bring the children together and consolidate their understanding of static electricity by repeating the key questions:

- How can you charge an object? Rubbing it against certain materials
- Will two positively charged objects attract or repel? Repel
- Will a negative and a positive object attract or repel? Attract

Take the time to resolve any misconceptions the children may have, and allow them to correct and mark their answers.

Vocabulary

- Attract
- Electricity
- Electrostatic
- Repel

Assessing pupils' progression and understanding

Differentiation

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<p>Pupils with secure understanding indicated by: Describing and creating static electricity to move objects in the direction they want.</p> <p>Pupils working at greater depth indicated by: Identifying if objects are being attracted or repelled as well as describing how static electricity works. They should create it independently to move objects in the way they want.</p>	<p>Pupils needing extra support: Might need a recap of how to generate static electricity or to work with more confident pupils.</p> <p>Pupils working at greater depth: Challenge these children to find other objects they can charge – such as plastic combs or rulers. See the link: 'Funscedemos- Exploring static electricity' on Videolink, for more ideas.</p>
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Learning Objectives	Before the lesson
<ul style="list-style-type: none"> To make and test game designs I can refer to my original design to make my static electricity game I can use a range of materials and equipment safely to make my game I know my game must meet my design criteria and be suitable for my target audience I can test the success of my product against my design criteria 	<p>Note This lesson contains a CAD (computer-aided design) aspect to provide children with practice and exposure to CAD. CAD is a key part of the curriculum statement to generate, develop, model and communicate the children's ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design. This lesson also uses Microsoft PowerPoint, alternative software is available here 'Microsoft Paint' or 'Sketchpad' (web-based).</p> <p>Watch</p> <ul style="list-style-type: none"> <i>Teacher video: Electrostatic game manufacture</i> <p>Have ready</p> <ul style="list-style-type: none"> Completed Activity: <i>Static electricity game design booklets</i> from Lesson 2 Activity: <i>CAD Panel electrostatic game</i> (pre-download the file required for the children to design on the computer, or drop it on the intranet to easily access from a child's login) (see Classroom resources) <i>Teacher's guide: PowerPoint draw</i> (see Classroom resources) <i>Child's guide: PowerPoint draw</i> (see Classroom resources) A range of materials to make the children's electrostatic games, such as: <ul style="list-style-type: none"> scissors tape glue stick/PVA hole punches paper clips straws string/thread lollipop sticks pipe cleaners tin foil paper cups/plates card

- coloured paper
- balloons
- dusters/cloths
- empty packaging (tissue and shoeboxes, plastic bottles, lids, yoghurt pots, etc)
- Laptops or tablets with access to Microsoft Office
- Link: '[Microsoft Paint](#)'
- Link: '[Sketchpad](#)'

Attention grabber

Hand back the pupils' *Activity: Static electricity game design booklets*. Ask the children to volunteer their design criteria to the class.

Ask children why the design criteria are important. It will be used both during and after they make their game (to refer to and to test how effective their games are).

Demonstrate how to use tools and equipment safely by selecting materials that the children will be able to cut. The children draw shapes before cutting the material using scissors. The children use glue or tape to securely attach different components to each other or a stable base.

Conclude with a discussion about what a well-made game might look like:

- Parts cut/trimmed neatly
- Assembled securely
- Parts moving as intended
- All components fit in a box
- High-quality finish

Main event

The children collect the materials and equipment that they will need to make the main components of their game. At this point, the children don't need to worry about decorative items. Some children may require assistance when cutting thicker materials as sharper scissors may be required.

The children refer to their *Activity: Static electricity game design booklets* throughout the lesson to ensure that it closely matches their original ideas.

As the children are working, circulate and assist any pupils who are struggling. Children may need help to simplify their designs so that they can manage the time they have available. If the children make changes then they should be recorded on their design sheets.

Computer-aided-design activity

Show the *Activity: CAD panel electrostatic game*. As children complete their game designs, rotate and provide them access to a computer. Locate the PowerPoint file for creating a CAD (Computer-Aided Design) panel for their box. Ensure that the children have first measured the back panel of their box before completing their CAD.

Demonstrate the height, width, draw and picture tools in PowerPoint. The children explore these by decorating their panels with digital paintbrushes or through finding and placing a suitable image in the 'draw' toolbar if unavailable in your edition of PowerPoint (see Resources for teacher's guide).

Alternatively, the children digitally draw their own designs rather than selecting a stock image (insert>pictures>stock images), then they could use '[Microsoft Paint](#)' if using a Windows computer, or '[Sketchpad](#)' (web-based).

Microsoft Paint images can be 'File>saved as...'. The image is 'dropped' into the PowerPoint template; or if using Sketchpad, exported or screenshot and pasted onto the PowerPoint template. When the children have completed their CAD designs, they can be printed and stuck to their games.

Key questions

- What is a design criteria and why are these important to designers? A list of things a product must do to be successful (eg: size, shape, texture, colour scheme, theme), which reminds them what to include
- What do we mean by the target audience? A group of people a product is designed for.

- How can we test if a game is successful? Play the game and ask people what think of it, and how static electricity is used.
- How is static electricity used in your design?

Wrapping up

When children complete their design, they should check it once more against their design criteria and make a note of any changes they made to and, if time allows, explain why.

Vocabulary

- Attract
- Electricity
- Electrostatic
- Innovative
- Motion
- Research
- Repel
- Stable
- Template

Assessing pupils' progression and understanding

Differentiation

Pupils with secure understanding indicated by:
Using a range of materials and equipment to make a game for their peers which uses static electricity.

Pupils working at greater depth indicated by:
Using a wide range of materials and equipment to make a game which uses static electricity in an imaginative way (possibly in multiple ways) which is suitable for their peers and fulfils the design criteria they identified at the beginning of the task.

Pupils needing extra support: May need help to simplify parts of their design in order to manage their time – completing the product or to suit their skill level.

Pupils working at greater depth: Should be extended by encouraging more complex aspects to the design/more challenging practical components.

Learning Objectives

- To evaluate my game
- I refer to my original game design to evaluate my static electricity game
- I can explain how my game meets the design criteria
- I can test the success of my product against my design criteria

Before the lesson

Have ready

- Children's electrostatic games from '[Lesson 3: Electrostatic game manufacture](#)'
- Children's *Activity: Electricity game design booklets* from '[Lesson 2: Electrostatic game design](#)'
- *Activity: Evaluation sheet* (see Classroom resources) – one per pupil

Attention grabber

Hand out pupils' *Activity: Electricity game design booklets*. Ask the children to volunteer their design criteria points:

- Parts cut/trimmed neatly
- Assembled securely
- Parts moving as intended
- All components fit in a box
- High-quality finish

Give the children the opportunity to look at their games. Ask the children to consider what might make a successful game (How easy is it to play? How fragile are the pieces?) Pupils should use this time to finish their games.

Discuss anything that the children would add to the criteria of a successful product. Encourage pupils to justify their opinions and clarify their points using examples.

Note down the best points on the board to refer to during the lesson.

Main event

Children set up their games on their tables and write instructions to ensure people know how to play it.

The children move around the classroom exploring different games. Remind the children that the games are fragile and to take care. Using post-it notes, the children write down particularly good examples of things from the success criteria, as well as anything else that they think contributes to the games' success (the post-it notes should be stuck down next to the games). Any other points they have should be noted separately to discuss later.

The children return to their tables and discuss anything that they felt was missing from the success criteria, based on what they found when exploring different games. Encourage the children to justify their opinion with examples.

Key questions

- What would a well-made game look like? See 'Attention Grabber'.
- How can we test if the games are successful?
- How is static electricity used in your design?
- What is constructive criticism?

Wrapping up

The children complete the evaluation sections of their booklets, detailing the positive points and areas for development. Alternatively, the children could take photos of their game and then label it with the evaluation points using image editing software.

Vocabulary

- Attract
- Electricity
- Electrostatic
- Innovative
- Motion
- Research
- Repel
- Stable
- Template

Assessing pupils' progression and understanding

Pupils with secure understanding indicated by: Reflecting on what makes a successful game and describing how successful a game is based on the agreed criteria.

Pupils working at greater depth indicated by: Reflecting on what makes a successful game, giving ideas of what should be included in the success criteria and justifying their opinion using examples.

Differentiation

Pupils needing extra support: May need support to finish their products.

Pupils working at greater depth: Should justify their opinions using examples of different games.