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Skills Development

- Careers and the World of Work
- Curriculum Cymreig
- Developing Communication
- Developing Number
- Developing Thinking
- Personal Social Education
Conductor or Insulator?

What you need:
• Battery and battery holder
• Bulb and holder
• Wires to make a circuit
• A selection of materials or materials found around the classroom.

What you do:
• Connect the bulb to one end of the battery.
• Attach wires to the non-connected battery and the bulb.
• The free metal ends of the wires can be used to test materials to see if they are conductors or insulators.
• The conductor/insulator test is carried out by touching the free ends of the two wires to the test material. If the bulb lights up the material will be a conductor.
• Be careful not to let the ends of the wires touch as this will complete the circuit.

What about the science?
Some materials let electricity pass through them easily. These materials are known as electrical conductors. Many metals, such as copper, iron and steel, are good electrical conductors. That is why the parts of electrical objects that need to let electricity pass through are always made of metal.

Metal is used in plugs to allow electricity to transfer from the wall socket, through the plug, and into a device such as a radio or TV. The brightness of the bulb can be an indicator as to how good the material is as a conductor. The brighter the bulb, the better the conductor. Remember that the brightness of the bulb can also be affected by the amount of charge left in the battery.

Some materials do not allow electricity to pass through them. These materials are known as electrical insulators. Plastic, wood, glass and rubber are good electrical insulators. These are used to cover materials that carry electricity. The plastic covering that surrounds wires is an electrical insulator. It stops you from getting an electrical shock.
Gareth and Gwen were making an electric circuit in the workshop. After the workshop Gareth said, “I really love watching films about the police catching criminals. It’s really exciting! I wonder if we could make a gadget to help the police catch them.” Gwen thought about it for a while and asked, “What would we make it from? How could we use a circuit as part of it?”

- Explore Gwen’s question.
- Design a gadget to help the police catch criminals.
- Explore how an electric circuit would be a part of it.
- Test the circuit.
Gather/Organise
This is the starting point for the activity. Pupils assimilate all their knowledge about the topic into their working memory. At this stage it is possible to identify what pupils already know and any gaps in their knowledge. It is also possible to begin differentiating between pupils.
Questions to ask pupils at this stage include:
- What do you know about this?
- Where have you met this before?
- What information do you have?
- How much do you understand?
- What questions do you need to ask?

Identify
Pupils explore their understanding of the task to make sure they know what is required of them. Pupils can also set the success criteria for the activity at this stage.
Questions to ask pupils at this stage include:
- What is the task?
- What are your goals?
- What are your obstacles?
- What do you need to know?
- What do you need to do this?

Generate
This is a creative and open-ended stage. Pupils may engage in brainstorming. Here all ideas about how to approach the task are valid.
Questions to ask pupils at this stage include:
- How many ideas can you find?
- Who can help you?
- Where can you find out more?
- What do other people think?
- Is there another way?

Decide
This is a logical, rational, left-brained process, in contrast to the previous stage. Pupils consider time constraints, available resources, health and safety, as well as whether the idea fulfils the brief, when making decisions.
Questions to ask pupils at this stage include:
- Which ideas are important?
- Which is the best idea?
- What will happen if...?
- What is your plan?
- What else do you need to do?

Implement
Pupils test their idea in an attempt to fulfil the criteria for the task. Teamwork is key to their success at this stage. Pupils may work to a structured plan. The focus for this stage is ‘maximum thinking, minimum recording’. This stage is all about developing thinking.
Questions to ask pupils at this stage include:
- How do you do it?
- How do you check your progress?
- Are you doing it correctly?
- Is your plan working?
- What do you do next?

Evaluate
Pupils should be realistic about their achievements and identify the next steps for improvement. Self and peer evaluation are key elements of this process.
Questions to ask pupils at this stage include:
- What have you done?
- How well did you do?
- How could you do better?
- Did you solve the problem?
- Did you work well in your group?
Communicate

Pupils present their findings to an audience; this could be within the class, the school or beyond. This stage can increase the pupils’ motivation and engagement.

Questions to ask pupils at this stage include:
- Who will you tell?
- How will you tell or present?
- What will you say?
- How will you explain?
- How will you interest others?

Learn from Experience

This final stage focuses on metacognition; this is ‘thinking about thinking’. In this stage pupils reflect on and discuss their learning. This stage can significantly enhance the impact of the learning experiences.

Questions to ask pupils at this stage include:
- What have you learned?
- How have you changed?
- What do you think and feel now?
- How can you use what you have learnt?
- How would you use this again?
**Concept Photos**

These ‘concept photos’ have been developed to promote discussion and to stimulate scientific thinking. They show different people discussing an everyday situation and presenting alternative explanations for what can be observed. Because of this, they are a good tool for demonstrating real life applications of science. Each concept photo shows one of Techniquest’s exhibits or an everyday situation linked to the science-based topic. Open questions can be used to stimulate thinking and discussion. All pupils’ ideas and points of view should be treated equally.

**Photo 1**

The following questions can be used:

- Do you agree with any of the people in the picture? Who? Why?
- Do you disagree with any of the people in the picture? Who? Why?
- Can you think of any other explanations that are not included here?
- How can we find out which point of view is the most suitable?
- Is it possible that more than one point of view is suitable here?
- Why do you think different pupils have different points of view?

**Photo 2**

For this activity, only one of the speech bubbles has been filled in. The following open questions can be used:

- Do you agree or disagree with this statement? Why?
- Can you think of any other explanations that are not included here? These should be filled in on the image.
- Now we have some explanations, which do you agree or disagree with? Why?
- Is it possible that more than one point of view is suitable here?

**Developing your own images**

To do this:

- Use everyday contexts that pupils are familiar with.
- Provide three or four alternative statements for discussion.
- Use positive rather than negative statements.
- Refer to research on common pupil misconceptions for guidance on statements.
- Include the scientifically acceptable viewpoint.
The switch turns the lamp on and off.

I think the switch needs to be on the other side of the lamp to turn it off.

I think the switch can be anywhere in the circuit.
I think it will be brighter if we use a bigger lamp.
**Curriculum Links:**

**Range**

**How Things Work**
Pupils are given opportunities to study:
- The uses of electricity and its control in simple circuits.

**The Sustainable Earth**
Pupils are also given some opportunities to study:
- A comparison of the features and properties of some natural and made materials.
- The properties of materials relating to their uses.

**Skills**

**Communication**
Pupils are given opportunities to:
- Communicate clearly by speech, writing, drawings, diagrams, charts, tables, bar charts, line graphs, videos, and ICT packages, using relevant scientific vocabulary.

**Enquiry**

**Planning**
Pupils decide upon and give some justification for each of the following:
- The choice of success criteria.
- Predictions using some previous knowledge and understanding.
- The equipment and techniques required for the enquiry.

**Developing**
Pupils are given opportunities to:
- Use apparatus and equipment correctly and safely.
- Use some prior knowledge to explain links between cause and effect when concluding.
- Form considered opinions and make informed decisions.

**Reflecting**
Pupils think about what they have done in order to consolidate learning and transfer skills by:
- Beginning to evaluate outcomes against success criteria.
- Deciding whether the approach/method was successful.
- Describing any amendments made to the planned approach/method.
- Suggesting how the approach/method could have been improved.
- Linking the learning to similar situations, within and outside school.
### Developing Thinking

**Plan**
- Asking questions.
- Activating prior skills, knowledge and understanding.
- Gathering information.
- Determining the process/method and strategy.
- Determining success criteria.

**Develop**
- Generating and developing ideas.
- Valuing errors and unexpected outcomes.
- Entrepreneurial thinking.
- Thinking about cause and effect and making inferences.
- Thinking logically and seeking patterns.
- Considering evidence, information and ideas.
- Forming opinions and making decisions.
- Monitoring progress.

**Reflect**
- Reviewing outcomes and success criteria.
- Reviewing the process/method.
- Evaluate own learning and thinking.
- Linking and lateral thinking.

### Developing Communication

**Oracy**
- Developing information and ideas.
- Presenting information and ideas.

**Reading**
- Locating, selecting and using information.
- Using reading strategies.
- Responding to what has been read.

**Writing**
- Organising ideas and information.
- Writing accurately.

**Wider Communication Skills**
- Communicating ideas and emotions.
- Communicating information.

### Developing Number

**Use Mathematical Information**
- Using numbers.
- Measuring.
- Gathering information.

**Calculate**
- Using the number system.
- Using a variety of methods.

**Interpret and Present Findings**
- Talking about and explaining work.
- Comparing data.
- Recording and interpreting data and presenting findings.

### Developing ICT

**ICT Skills Framework**
- Finding and developing information and ideas.
- Creating and presenting information and ideas.

### Key
- Main focus
- No intended focus
- Incidental focus