Year 6

Conceptual narrative Science: Energy

In the physical sciences sub-strand, there are two main conceptual threads being developed from Foundation through to Year 10, energy and forces and motion.

Big ideas

Electricity, like other energy is produced by a range of sources and can be transferred from one place to another.

What concepts do I want my students to understand?

- Electricity can be produced from light, movement, heat and chemical sources.
- Conductors transmit electricity well, insulator don't.
- A complete circuit of conductors is needed for electricity to flow.

Appendix 1 shows how the three interwoven strands, Science Understanding, Science as a Human Endeavour and Science Inquiry Skills, work together to build the sophistication and complexity of the science concepts from Foundation to Year 10.

This conceptual narrative illustrates one of the nine science concepts from the Australian Curriculum: Science Content structure. It tells the story of the concept in isolation of the eight others. However, there are situations when it is advisable to teach both concepts (energy and forces and motion) together, because they complement each other.

Note: Not all concepts are specifically addressed in each year level.

Introduction

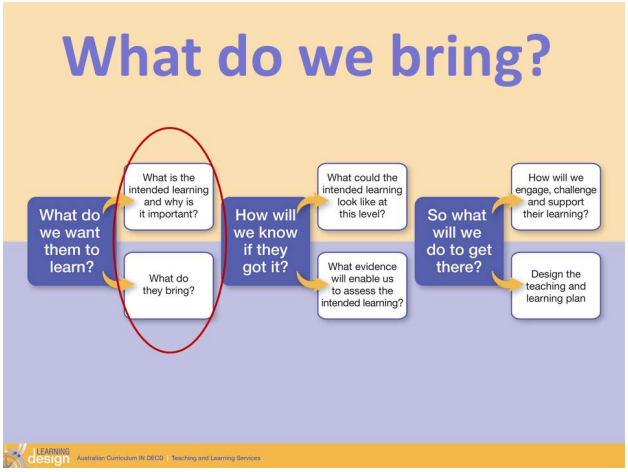
What might my students already know about this concept?

Students are likely to be aware that heat and light energy are produced by sources and their transfer is inhibited by some materials and prompted by others.

What content could I use to explore this concept?

We could learn these concepts in a number of ways. We could use electrical circuits, investigate power generation, make a torch, or investigate the working of simple household appliances.

Now to bring the essence of scientific understanding to life, let's think about this concept through the six questions from the Bringing it to Life tool (BitL).



In Year 6, we want our students to build on their understanding of the sources and transfer of energy by investigating the sources and transfer of electrical energy.

Year 6 example

In this example, my students will use batteries, globes and wires to construct a torch.

What do you notice?

How can I help my students make observations?

Using the BitL questions, I could ask:

- *What do you notice?*

In Year 6, I want my students to make observations using their senses and equipment. After the students have had a go at getting the globe to light I could ask:

- *What do you notice about the circuits where the globe is lit?*
- *How are they different from those where it is not alight?*
- *In how many different ways could you turn the globe off?*

What patterns and relationships can you see?

How can I help students to see patterns and relationships? What questions might my students ask?

Student's curiosity leads them to ask questions. These questions help students to order their findings into a pattern to be able to make comparisons or find relationships. These questions support students to be more precise and foster analysis and classification of the observations.

Using the BitL questions, I could ask:

- *What patterns and relationships can you see?*

In Year 6, I want my students to notice the relationship between the layout of the components in electrical circuits that work and those that don't. I could prompt the students by asking:

- *What are the similarities and differences in the circuits which work?*
- *Is there anything unusual?*
- *How could you change some of the non-working circuits so they work?*
- *What is the least number of changes you could make?*

What do you predict?

How can I help students to identify and formulate investigable questions?

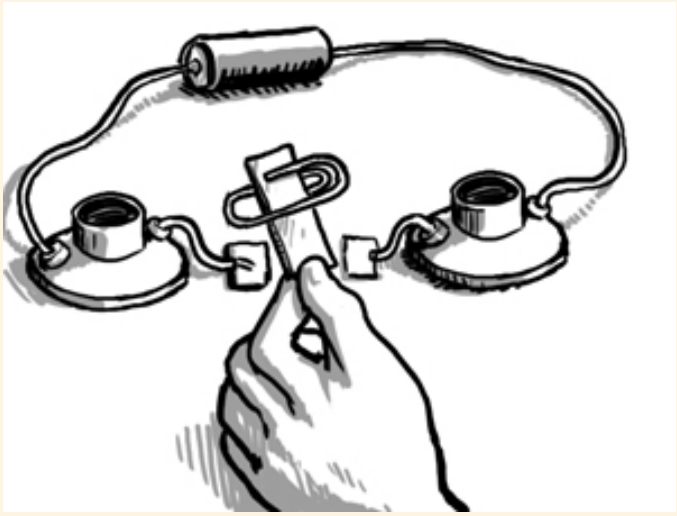
Students ask testable questions that help them to narrow the focus of the inquiry. These questions provide opportunities for students to make predictions.

Using the BitL questions, I could ask:

- *What do you predict?*

In Year 6, I want my students to make predictions on what the findings of the investigation might be. I could ask:

- *What other materials in the room could you include in your circuit for it to still work?*
- *What happens if you put two globes in the circuit?*
- *Does the arrangement of globes make a difference?*



How can you test it?

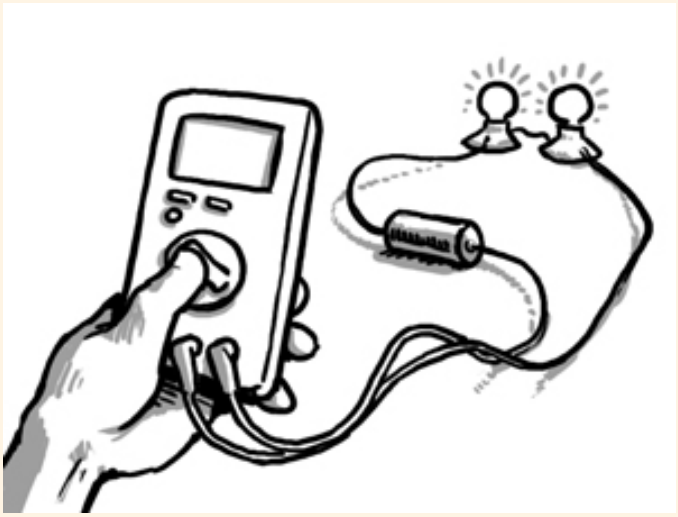
These questions support students to develop science inquiry skills and problem solve.

Using the BitL questions, I could ask:

- *How can you test it?*

I want my students to investigate their questions. In Year 6, I want my students to use digital technologies such as multimeters in their investigations. I could show students how a multimeter works and ask:

- *How could this help your investigation?*
- *How could it help you troubleshoot non-working circuits?*



How can you review and communicate?

How can I help students share their observations and questions?

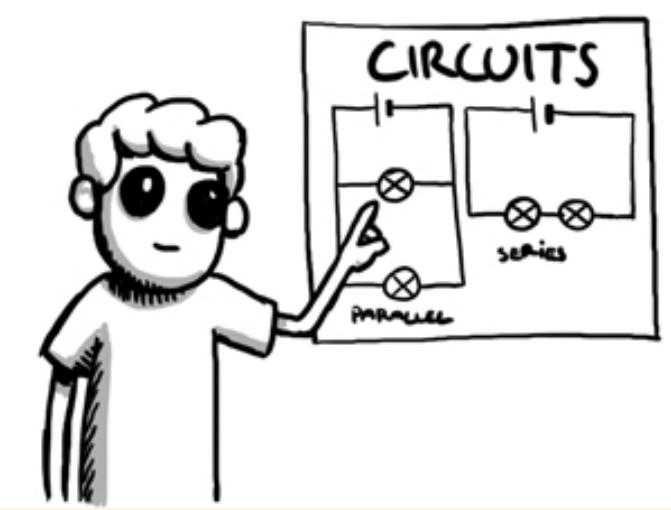
These questions stimulate student's reasoning and help them analyse, draw conclusions and make generalisations about the concepts.

Using the BitL questions, I could ask:

- *How can you review and communicate?*

In Year 6, we want our students to record and communicate their data and thinking about electricity transfer in lists, tables or graphs. I might ask the students:

- *What does a circuit diagram communicate?*
- *What does it not show?*
- *What are its advantages and disadvantages compared with the usual 3D diagram?*
- *How fair was your investigation?*
- *How could you improve your investigation?*



So what? What next?

How can I help students apply the concepts in a range of authentic contexts?

These questions support student's reasoning, to expand or change their ideas from their experience and evidence and generalise to new contexts.

Using the BitL questions, I could ask:

- *So what? What next?*

In Year 6, I want my students to see how scientific knowledge and understandings are used to solve problems that inform personal and community decisions. I want students to see that people from a range of cultures have made important contributions to the advancement of science. I could ask the students:

- *Why do you have to keep metal objects away from power points?*
- *What activities are not safe to do in a thunderstorm? Why?*
- *Who might be interested in how electricity is transferred? Why?*
- *How might this inform decisions about how we use electricity devices?*

Concluding comments

By exploring this science understanding through these questions, we can help our students to be able to think, work and process scientifically Students can connect science to their world and consider how electrical circuits provide a means of transforming electricity.

Appendix 1

Appendix 1 shows how the three interwoven strands, Science Understanding, Science as a Human Endeavour and Science Inquiry Skills, work together to build the sophistication and complexity of the science concepts from Foundation to Year 10.

This conceptual narrative illustrates one of the nine science concepts from the Australian Curriculum: Science Content structure. These concepts develop in depth and breadth of understanding from Foundation to Year 10. This conceptual narrative tells the story of the concept in isolation of the eight others. However, there are situations when it is advisable to teach both concepts, (energy and forces and motion) together, because they complement each other.

Note: Not all concepts are specifically addressed in each year level.

Physical sciences

In the physical sciences sub-strand, there are two main conceptual threads being developed from Foundation through to Year 10. They are the concepts energy and forces and motion. Let's look at the concept energy.

Year 1

This begins in Year 1, where students investigate familiar forms of energy, such as light and sound. Students learn that objects can only be seen when they are illuminated by light. Students sense light coming from the sun, and sound coming from a phone. Students explore how they can make sounds, such as clapping their hands.

Year 3

In Year 3, students learn about heat, another form of energy. They learn that things produce heat, and heat moves from one object to another. For example, if you are feeling cold, you can stand in front of a fire to warm up. The heat from the fire moves to your body.

Year 5

At Year 5, there is a deeper understanding of how light energy is transferred. The focus is on how light can be reflected, such as when a light beam reflects off a mirror, or refracted, such as when a light beam is bent as it moves from the air into water so a ruler looks bent in a glass of water, and absorbed, such as when the curtains get warmed up as the light shines on them. Students also learn how light from a source forms shadows

Year 6

In Year 6, the energy focus is on electricity and students learn that it can come from many different sources such as wind, solar cells or from burning fossil fuels. They also learn electrical circuits provide a means of transferring electrical energy through wires, and electrical energy can be transformed into light energy to light up a globe.

Year 8

In Year 8, students learn to classify the different forms of energy, such as kinetic, potential and heat energy which cause change to systems. Students learn that heat energy is often produced as a by-product of energy transfer, which can be illustrated in flow diagrams showing energy transformations that occur in every day appliances. For example, an iron transforms electrical energy into heat energy to iron your clothes.

Year 10

In Year 10, students generalise their thinking to use the law of conservation of energy, where they learn that energy cannot be created or destroyed. They account for energy transfer and transformation within systems and explain how no system is 100% efficient.

So from Year 1 to Year 10, students broaden and deepen their understanding of energy as they move from concrete to abstract thought. They use laws and models to describe predict and generalise.