Year 8

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

Different forms of energy can cause change in simple systems through transfer and transformation.

What concepts do I want my students to understand?

- Kinetic, potential, heat, sound, light, electrical, chemical are different forms of energy.

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

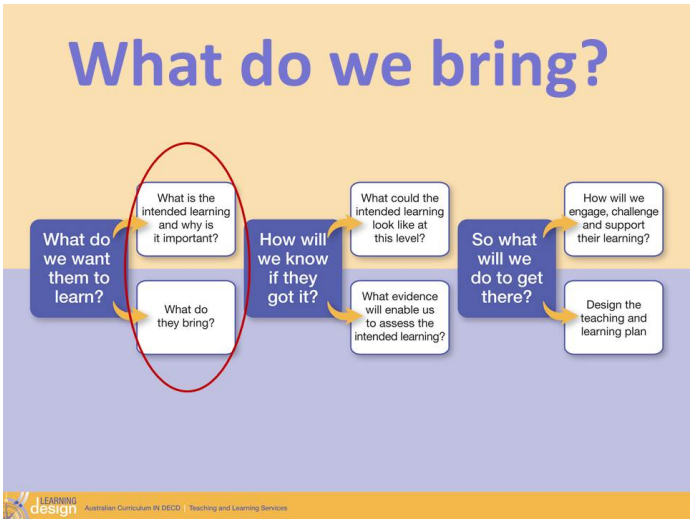
What might my students already know about this concept?

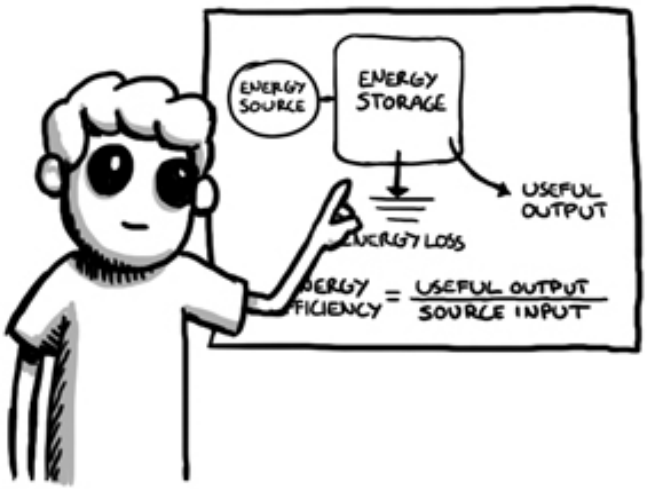
Students are likely to be aware that heat and light energy are produced by sources and their transfer is inhibited by some materials and promoted by others. We now want students to understand that electricity, like other energy, is produced by a range of sources and can be transferred from place to another.

What content could I use to explore this concept?

There are many ways to explore these concepts. We could explore with a Scootle learning object, use an energy calculator to explore energy transfer in using appliances and investigate steam or solar engines.

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).





The science understanding for students at Year 8 is that there are different forms of energy including movement (kinetic energy), heat and potential energy, and cases change within systems.

Year 8 example

Students will look at a variety of appliances they use in their day to day lives, for example, hair straightener, toaster, refrigerator, television.

What do you observe?

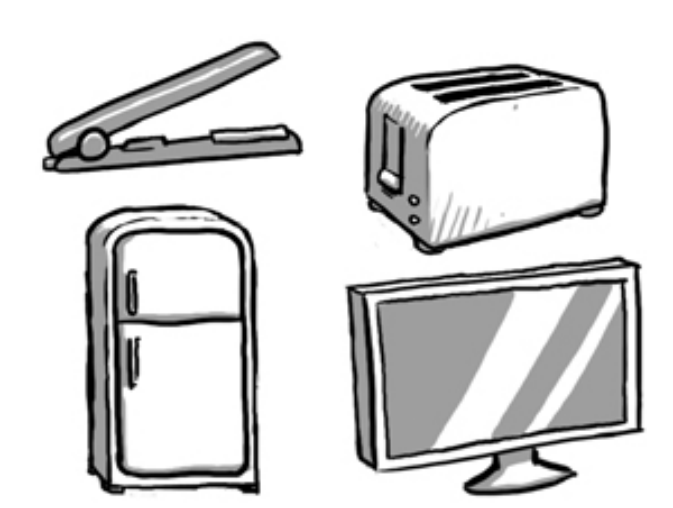
How can I help my students make observations?

Using the BitL questions, I could ask:

- *What do you observe?*

In Year 8, I want my students to make observations about the energy changes that occur when the appliance is being used, and how this energy transforms to different types of energy. I could ask my students:

- *What changes do you notice happening in each appliance?*
- *Which appliances use the most electricity?*



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?*
- *How do these patterns and relationships compare and change over time?*
- *What energy transformations were the same with the appliances? What were different?*
- *What contributed to the similarities?*
- *How did the purpose of the appliance change the energy transformations? How are these changes the same?*
- *How do they differ between different appliances?*
- *Where is electrical energy transferred?*
- *Where is it transformed?*
- *What's the difference?*
- *What do you notice about appliances which use the most electricity?*

What do you predict might happen?

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 will happen?*

In Year 8, I want my students to make predictions based on scientific knowledge.

- *If heat energy isn't transferred to the surface of the television, how might that affect how the television works?*
- *How might the flow of energy help you think about this?*
- *If the appliances isn't working, where might the problem be?*
- *How does energy transfer and transformation help to explain it?*

What investigations could you design?

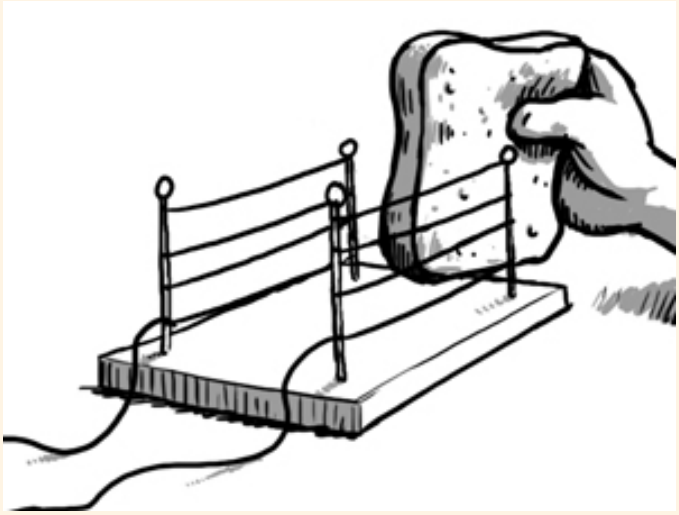
These questions support students to develop science inquiry skills and problem solve.

Using the BitL questions, I could ask:

- *What investigations could you design?*

I want my students to test their predictions. I might ask:

- *How might you test your predictions?*
- *What equipment do you need?*
- *What safety aspects do you need to consider?*
- *How could you use the batteries and small scale electrical components to make a model of an appliance?*
- *What would you investigate about energy transfer and transformation using your model?*
- *Why is it sometimes necessary in science to use models rather than the real thing?*



How can you review and communicate?

How can I help students share their observations and questions?

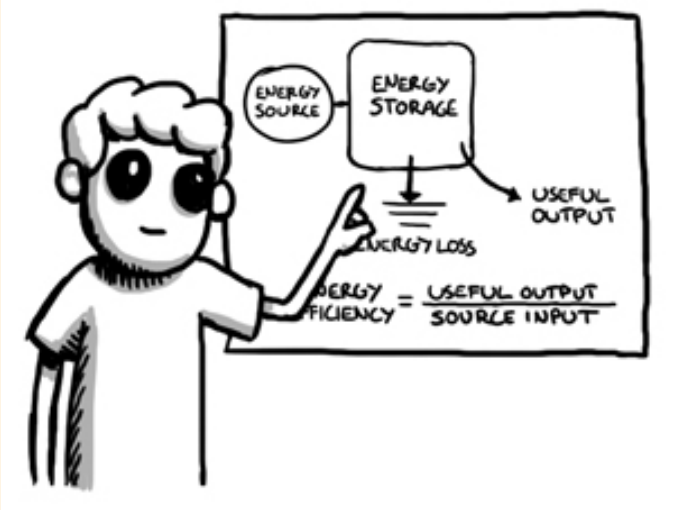
These questions stimulate student's reasoning and help them analyse, draw conclusions and make generalisations about the concepts.

Using the BitL questions, I could ask:

- *How can you review and communicate?*

At Year 8, I want my students to use scientific language when they communicate their findings. Questions I may ask:

- *How can we represent the data and your explanations in a way that enables sharing with others?*
- *How does the idea of energy transfer and transformation explain your data?*
- *How could you use the evidence gathered to explain that heat energy is often produced as a by-product of energy transfer?*



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 8, I want my students to start thinking about where this knowledge may be used in society.

- *Who might need to know about energy transfer and transformation in appliances?*
- *How might this information help in designing appliances that produce a lot of heat energy?*
- *How does understanding this affect my life?*

Concluding comments

What concepts might students develop through working with the BitL questions in this way?

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 energy appears in different forms and causes changes within systems.

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.