Year 1

Conceptual narrative Science: Changes of matter

In the chemical sciences sub-strand, there are two main conceptual threads being developed from Foundation through to Year 10, properties of matter and changes of matter.

Big ideas

Objects are made up of different materials, which can be physically changed in many different ways.

What concepts do I want my students to understand?

- Physical changes to materials include cutting, crumpling and moulding.
- Changes can be caused by people, or the environment.

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, (properties of matter and changes of matter) together, because they complement each other.

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

Introduction

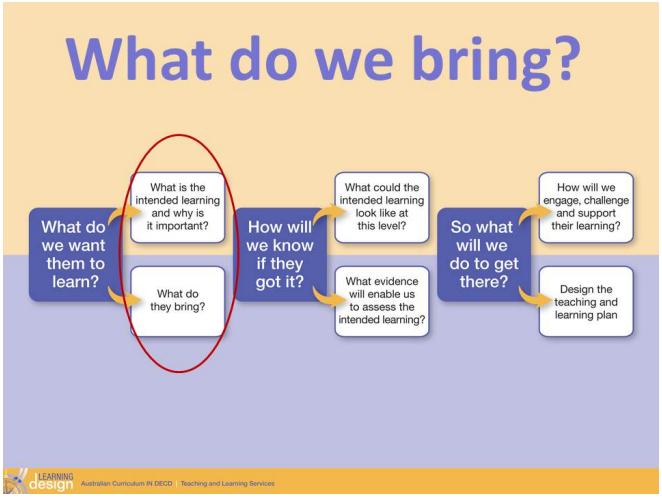
What might my students already know about this concept?

Students may know that their world is made of materials which have different properties.

What content could I use to explore this concept?

We could explore physical changes like moulding plasticine, cutting an apple into smaller pieces, screwing up a piece of paper, or squeezing an orange to make orange juice.

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 1, we want our students to understand that objects are made up of materials which can be changed physically in lots of different ways. We want our students to understand we still have the same material but it may look, feel or smell different.

Year 1 example

In this example, my students will play with and mould plasticine. It is worth noting that it is not until Year 3 that students look at how materials change by adding or removing heat.

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 1, I want my students to make observations about the plasticine using their senses. Some questions I could ask the students:

- *What does plasticine feel like?*
- *What do you see when you stretch the plasticine?*
- *What does plasticine look like when you flatten it?*
- *How can you use a plastic knife to change the plasticine?*

What do you think?

Students' 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 do you think?*

In Year 1, I want my students to, not only notice about how the plasticine changes, but to ask questions. I could prompt the students by asking:

- *What else is plasticine like?*
- *How does it change when you stretch it?*
- *How does it change when you cut it?*
- *How does it change when you roll it into a ball?*
- *What questions do you have about plasticine?*

What do you think if?

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

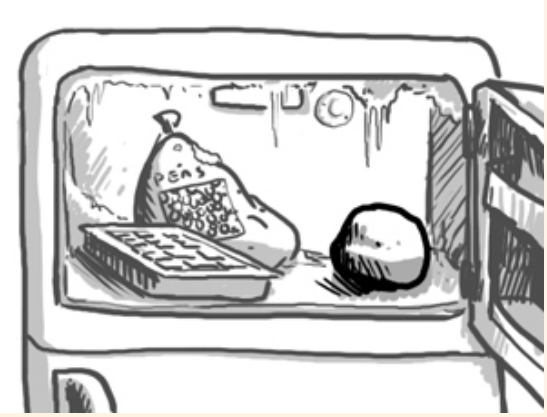
Students ask testable questions that help them to narrow the focus of the inquiry. These questions provide opportunities for students to make predictions.

Using the BitL questions, I could ask:

- *What do you think if...?*

Some students in Year 1, may start to make predictions about possible changes or answers to their questions. To develop the students ability to think scientifically, I could ask:

- *What do you think would happen if we put plasticine in the freezer?*
- *Or, someone told me that if you place plasticine in the freezer it won't stretch anymore. What do you think?*



How can you explore?

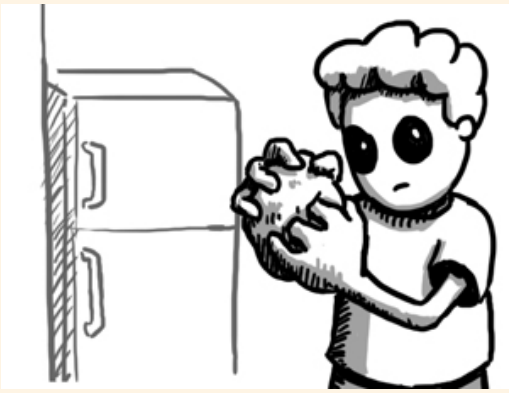
These questions support students to develop science inquiry skills and problem solve.

Using the BitL questions, I could ask:

- *How can you explore?*

I want my students to start exploring their questions and predictions. I could ask students:

- *How are you going to find out if plasticine will still stretch after being put in the freezer?*
- *How might you record what you find out?*



How can you share?

How can I help students share their observations and questions?

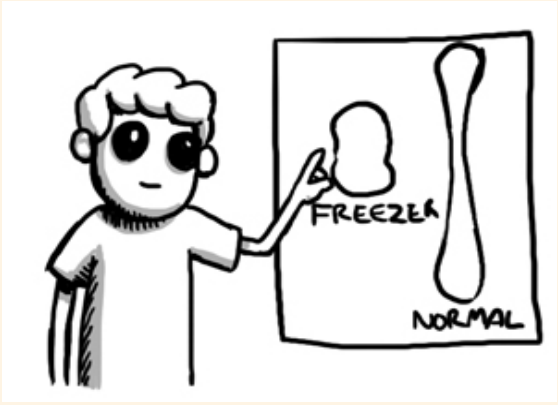
These questions stimulate students' reasoning and help them analyse, draw conclusions and make generalisations about the concepts.

Using the BitL questions, I could ask:

- *How can you share?*

In Year 1, I want my students to represent their observations and findings through discussions, drawings and role plays. I might ask my students:

- *Can you draw what happens to the plasticine before it was placed in the freezer, and after it was taken out of the freezer?*
- *Can you show if this was the same as your prediction?*
- *How could you show which was the freezer drawing?*



So what?

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

These questions support students' 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?*
- *Why is it important to know about changes in materials?*
- *When do you want to stop things being broken or squashed?*
- *How might we do this with the supermarket shopping?*
- *Where would you keep your plasticine if you want to use it over and over?*

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 think, work and process scientifically. Students can connect science to their world, and consider why they need to learn that materials can be changed.

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, (properties of matter and changes of matter) together, because they complement each other.

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

Chemical sciences

In the chemical sciences sub-strand, there are two main conceptual threads being developed from Foundation through to Year 10. They are the concepts, properties of matter and change of matter. Let's look at the concept, change of matter.

Let's look at the change of matter concept

Year 1

If you think of the change of matter in Year 1, the focus is that everyday materials can be physically changed in many ways, such as, by bending, stretching or heating. For example, plasticine can be stretched, and an ice cream melts when it is left in the sun.

Year 2

In Year 2, this concept is expanded to understand that materials can be changed when they are mixed with other materials for a new purpose. For example, jelly crystals are changed when they are mixed in water to make jelly.

Year 3

In Year 3, the focus is on changes of state associated with heating and cooling. For example, the change of state from solid chocolate to liquid chocolate when heat is added, or liquid water to solid ice, when heat is removed.

Year 6

When students are in Year 6, they investigate and classify a range of changes as physical or chemical. The first type of change is reversible, where you can get back what you started with. For example, when ice melts to become water, the change can be reversed, by freezing. The second type of change is irreversible. With this type of change, you cannot get back the materials you started with. An example of this is burning paper, where you cannot get paper back from the ash formed.

Year 8

At Year 8 level, we want students to successfully use the terms, elements and compounds. Students make compounds, which can have a number of pure substances or elements joined together through chemical reactions. They learn that new substances are formed, when a chemical reaction occurs. As when iron (an element) reacts with oxygen (another element) in the air, the new compound, iron oxide forms, known as rust and is a new substance, from which the original iron can't be easily recovered.

Year 9

In Year 9, we want students to understand changes in the nucleus of the atom, and how unstable atoms can release alpha and beta particles and gamma radiation. We also want students to understand that chemical reactions involve the rearrangement of atoms to form new substances, and that during a chemical reaction, matter is not created or destroyed. This is known as the Law of Conservation of Mass. For example, the role of oxygen in respiration compared to combustion of butane.

Year 10

Even deeper thinking is required at Year 10. We want the students to be able to understand that there are many different types of chemical reactions which can produce a range of products, and can happen at different rates, depending on the conditions. For example, iron and steel are both produced from iron ore.

So, from Foundation to Year 10, students broaden and deepen their understanding of changes of matter. They start with familiar materials and build on those to consider a wide range of changes and then classify them as physical or chemical. By Year 10, they are able to use particle and atomic theories to explain and classify these changes.