Year 3

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

A change of state between solid and liquid can be caused by adding or removing heat

What concepts do I want my students to understand?

- When heat is removed a liquid cools down to a solid.
- When heat is added a solid changes into a liquid.
- The addition or removal of heat can change the state of matter.

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

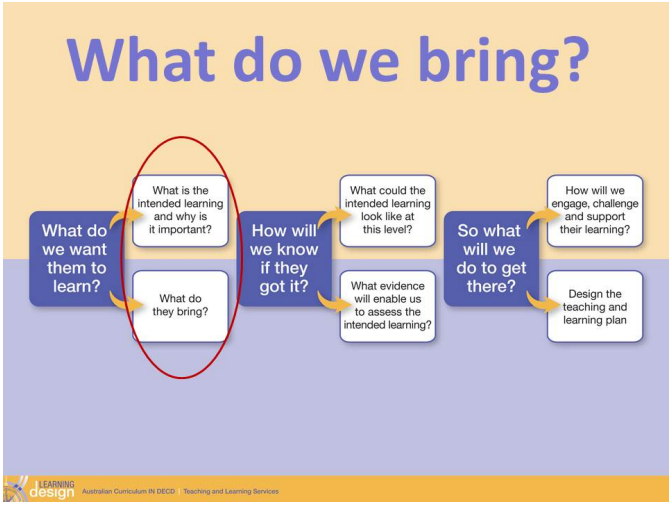
What might my students already know about this concept?

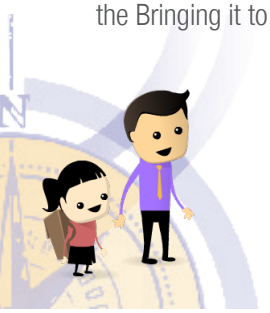
Students will know that their world is made up of different materials. These materials can be changed physically in lots of different ways. Different materials can be combined or mixed with other materials for a particular purpose.

What content could I use to explore this concept?

There are many examples that you could use to help students understand this concept, such as, by adding heat to candle wax which is a solid, you can see the solid melt into a liquid. By removing the heat, the liquid cools down back into a solid. You could explore the recycling of aluminium cans by changing from solid to liquid and liquid to solid.

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).





Year 3 example

For this example, I am going to investigate melting chocolate, ice and butter with my students.

What do you notice?

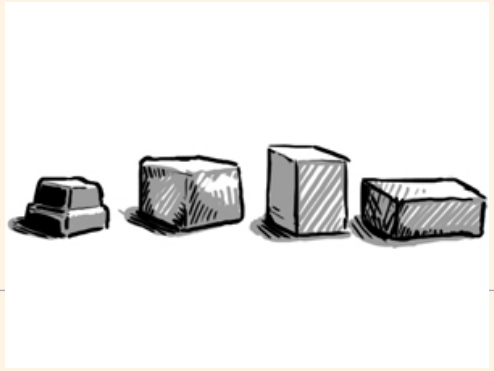
How can I help my students make observations?

Using the BitL questions, I could ask:

- *What do you notice?*

In Year 3, I want my students to make observations in order to group similar things together.

- *Which of these substances are solids?*
- *What do you see, feel, smell, taste when they are heated?*



What patterns and relationships can you see?

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 3, I want my students to be able to order their observations and group them. I could ask my students:

- *How is melting the same in each example? How is it different?*
- *How do they change?*
- *What questions do you have?*
- *How do you know when they are a solid or a liquid?*

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?*

In Year 3, with guidance, I want my students to predict what might happen based on prior knowledge with familiar contexts. Questions I might ask my students are:

- *What might happen if we freeze each substance?*
- *What would happen if we heat them and pour them into an ice cube container until the cube is full? Will they all freeze the same? Will they all make the same shape when they freeze?*
- *I may ask, "If we add heat to a cube of copha, how long does it take to turn into a liquid?"*
- *How long does this compare to a cube of eating chocolate and a cube of cooking chocolate?*

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?*

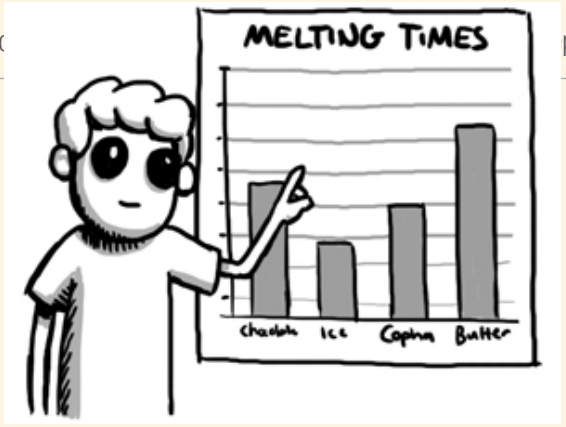
I would guide my students by asking:

- *What are we going to investigate?*
- *What ideas do you have?*
- *How can we investigate?*
- *How can we find out how long it takes an iced cube of copha to turn into liquid, compared to an ice cube of chocolate?*
- *How can you keep yourself and others safe when doing this investigation?*

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 c pts.



Using the BitL questions, I could ask:

- *How can you review and communicate?*

In Year 3, I want my students to start looking for trends in their observations by organising their results into a table or graph. Questions I could ask my students:

- *How can we share what we have found?*
- *Can you make a table or draw a graph to show other students what you have found?*
- *So what has this got to do with solids, liquids and heat?*

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?

I want my students to see this science in their everyday lives. When you add heat to some substances they change from solids to liquids, and by removing heat you can change them back to solids. I would ask my students:

- *Why is it important to know that some substances change when they are heated or cooled?*
- *Who else might be interested in knowing this?*
- *Where else do you see this?*

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 substances can be solids or liquids and they can change their state by adding or removing heat.

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.