Foundation

Conceptual narrative Science: Properties of matter

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

Big ideas

Objects in the world around us are made up of materials, which have properties.

What concepts do I want my students to understand?

- Objects in the world are made up of different materials.
- These materials have different properties.

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

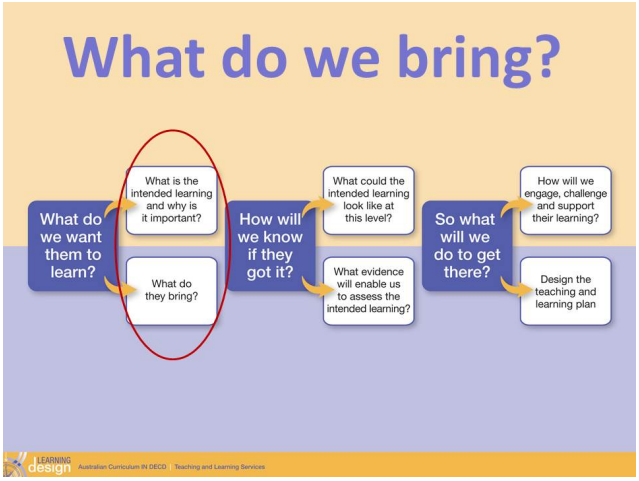
What might my students already know about this concept?

Students will have experienced different materials in familar objects.

What content could I use to explore this concept?

To explore this concept, we could sort and group different materials by their observable properties such as colour, texture, and flexibility.

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 Foundation, students learn that objects in the world around them are made up of materials.

Foundation example

There are many objects that you could use, but for this example I will ask my students to explore three different drinking cups on their tables.

What do you notice?

How can I help my students make observations?

Using the BitL questions, I could ask:

- *What do you notice?*

In Foundation, I want my students to make observations using their senses. Some questions I could ask the students:

- *Are the cups the same colour?*
- *What do they feel like?*
- *Do they feel smooth or rough?*

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?*

I want my students to use their observations to discover similarities and differences between the materials. To help students ask questions, I could prompt them by asking:

- *How are the cups the same?*
- *How are they different?*
- *Which one is the heaviest?*
- *What are the cups made of?*
- *What questions do you have?*

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 Foundation, 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 drop each cup on the floor?*
- *Would they make the same sound?*
- *Would they bounce or would they break?*
- *What would happen if we poured really cold water into each one?*
- *Which would stay coldest the longest?*

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?*

In Foundation, I want my students to start exploring their questions and predictions. For example, we could pour cold water into each cup and feel how cold they are. Then leave them for 10 minutes and feel them again. I could ask:

- *What is another way we can tell how cold they are?*
- *What did the water feel like?*
- *How would you find out about warm water?*
- *How will we find out if they make different sounds when you tap them with a pen?*
- *How could we find out which bounce and break?*
- *Why is it not a good idea to do this?*

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?*

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

- *Will they be the same after 10 minutes?*
- *Can you draw a picture of the three cups?*
- *How will you show which was coldest?*
- *What is this cup made of?*
- *Did other students choose the same cup as you?*

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?*

It is important to connect the concept to their everyday lives so they can see why it is important to know this. I could ask:

- *What materials would you use to keep things cold?*
- *Why?*

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 the world is made up of materials with different properties..

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 properties of matter concept

Foundation

If you think of the composition of matter through Foundation, the focus is that objects in the world are made up of materials, which have properties, for example, a plastic plate is strong compared to a paper plate which can tear easily.

Year 4

At Year 4, the focus is on grouping materials into either natural or processed materials, and explaining how the properties of these materials determine their use. For example, when choosing building materials, wood is a natural material which is strong and can be cut, whereas concrete is a processed material which is also strong but can be moulded.

Year 5

In Year 5, we want students to understand the characteristic properties of solids, liquids, and gases. For example, ice, water, and water vapour are the same substance but differ in whether they have a fixed shape and volume.

Year 7

Year 7 students work with mixtures, to reach the understanding that some substances are pure while others are made up of a number of substances. They mix substances together and then separate them using a range of techniques to get back the substances they started with. For example, salt dissolved in water can be recovered by evaporating the water.

Year 8

At Year 8 level, the properties and behaviour of the states of matter are explained through the motion and arrangement of particles. For example, there is no regular arrangement of particles in a gas, so the particles are well separated, creating free space between the particles, which means that gases can be compressed.

Year 9

During Year 9 we introduce abstract thinking about the concept of matter. We want students to know that all matter is made up of particles, which we call atoms, and understand that atoms are made up of smaller particles called protons, neutrons and electrons. Since we are unable to see these atoms physically with our eyes, it is more complex for students to understand the particle model of matter.

Year 10

Even deeper thinking is required at Year 10. We want the students to be able to understand that the Periodic Table is a way of organising elements based on their atomic structure and properties.

So, from Foundation to Year 10, students broaden and deepen their understanding. They start with the properties of matter in their immediate surroundings and build on those to consider properties of matter in the wider world, and then use abstract models and theories to describe, explain, predict and generalise.