Year 4

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

Materials can be grouped as natural or processed.

What concepts do I want my students to understand?

- Natural materials are used as they are found.
- Processed materials have been changed by humans.
- The properties of these materials determine how they are used.

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 are likely to know that their world is made up of different materials that have properties. 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.

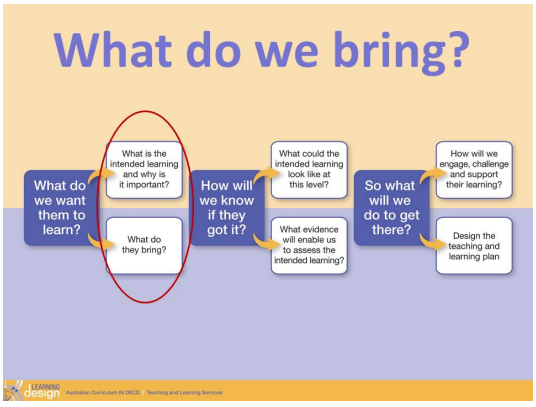
What content could I use to explore this concept?

There are many examples that you could use to help students understand this concept, such as, combining a range of found materials in an artwork, investigating building materials or investigating the use of wood and wood products.

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).

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

Let's think about this concept through the 6 questions bringing the essence to life.



The science understanding for students at Year 4 level is that materials can be grouped into either natural or processed materials.

Year 4 example

For this example, I am going to place samples of materials on a table.

What do you notice?

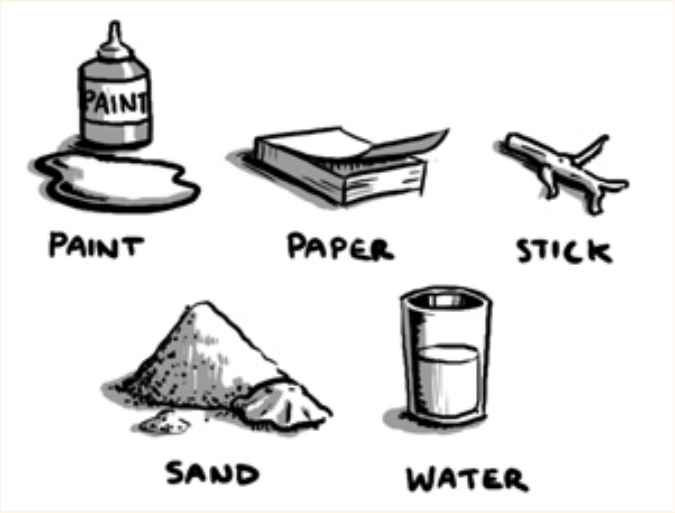
How can I help my students make observations?

Using the BitL questions, I could ask:

- *What do you notice?*

I want my students to make observations in order to group similar things together.

- *What similarities and differences are there between the materials?*
- *How could you group the materials?*



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?*

I could ask my students:

- *Are there other ways to group the materials?*
- *What questions do you have about the materials?*

What do you think if?

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

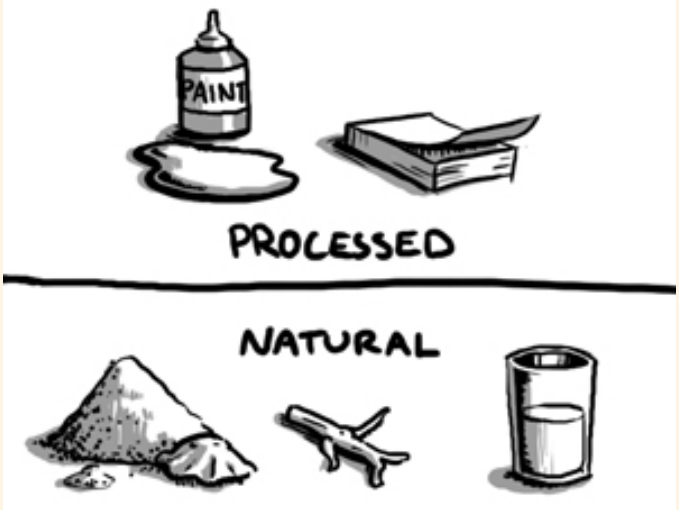
Students ask testable questions that help them to narrow the focus of the inquiry. These questions provide opportunities for students to make predictions.

Using the BitL questions, I could ask:

- *What do you think if?*

In Year 4, with guidance, I want my students to predict what might happen based on prior knowledge within familiar contexts. Questions I might ask my students are:

- *What do you think might happen if you were asked to group the materials into natural and processed materials?*
- *Would you have to change your groups?*
- *How would you know which group to put materials in?*
- *Which group would have more examples?*
- *Would this change if you looked at materials from other places?*



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 the properties of a paper bag and a plastic bag?*
- *How will you investigate which bag will keep your bread fresher?*
- *How will you decide which is fresher?*
- *How long will you leave your bread?*

How can you review and communicate?

How can I help students share their observations and questions?

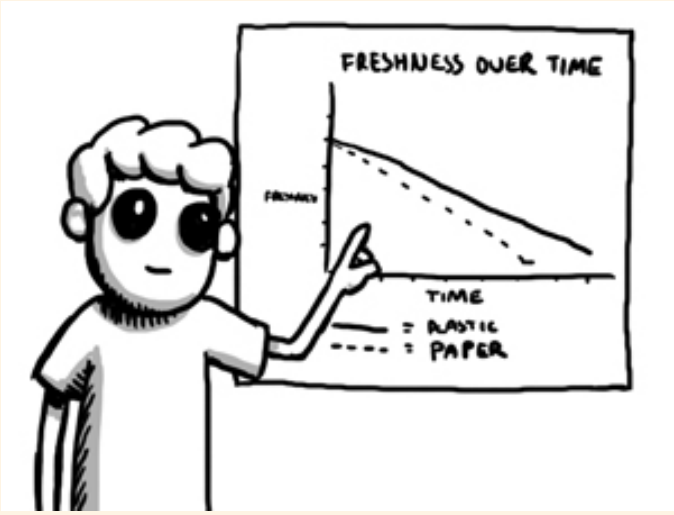
These questions stimulate student's reasoning and help them analyse, draw conclusions and make generalisations about the concepts.

Using the BitL questions, I could ask:

- *How can you review and communicate?*

In Year 4, 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 might you represent your date and ideas for others to see what you have found?*
- *What different ways are there to do this?*
- *How might 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.

Finally:

So what? What next?

I want my students to see this science in their everyday lives.

- *Which type of bag would you use to keep your bread fresh?*

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 natural and processed materials, with properties that determine their uses.

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.