Year 8

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

New substances are formed when a chemical reaction occurs.

What concepts do I want my students to understand?

- What is an element, mixture and compound?
- Compounds can have a number of pure substances or elements joined together through chemical reactions.
- New substances are formed when a chemical reaction occurs.

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

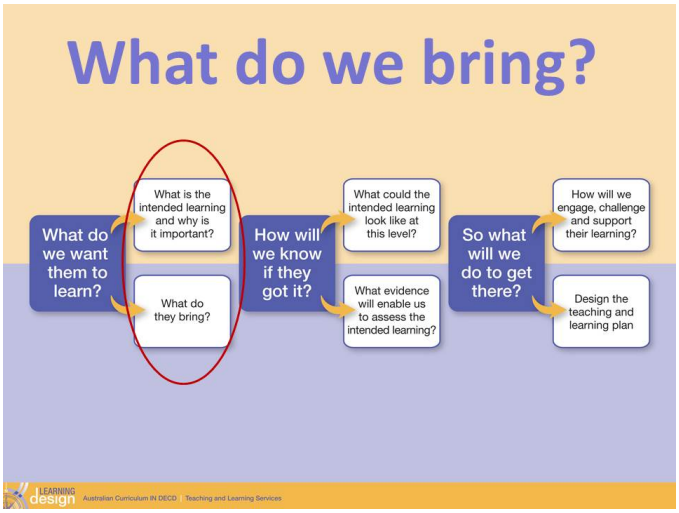
What might my students already know about this concept?

Substances can be changed physically and chemically. Reversible changes are when you can get back what you started with, whereas irreversible changes are when you cannot get back what you started with and new materials are formed.

What content could I use to explore this concept?

We could learn this concept through many different investigations of simple reactions, such as combining elements to make a compound, or the breakdown of chemicals through combustion or chemical weathering.

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 at Year 8 level is that chemical change involves substances reacting to form new substances.

Year 8 example

For this example, I want my students to investigate precipitation reactions to identify that a chemical change has taken place.

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 of the changes when substances are added together. I want them to use their senses to see, smell, hear and feel that a change has occurred. Questions I could ask my students are:

- *What do you notice about the substances before they are added together?*
- *What do you observe when sodium chloride and lead nitrate are mixed together?*
- *What do you observe when sodium chloride is mixed with potassium nitrate, and in another test with silver nitrate?*
- *What is happening when you add the chemicals together?*

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?*

In Year 8, I want my students to ask scientifically investigable questions and identify patterns and relationships in the chemical changes of precipitation reactions. I may prompt them by asking:

- *Did both reactions produce a solid? How do you know? Were there any exceptions?*

Giving them some more information: When two aqueous solutions react chemically together and produce a solid, the solid is called precipitation.

- *Which precipitates looked the same?*
- *Which precipitates looked different? Why?*
- *Do you see any rules forming about which substances form a precipitate and those that don't?*

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 might happen?*

In Year 8, I want my students to make predictions based on scientific knowledge. In this example I want my students to predict if a chemical reaction will occur when they mix the following solutions together:

- *Sodium sulphate and calcium nitrate?*
- *Sodium sulphate and barium nitrate?*
- *Sodium sulphate and potassium nitrate?*

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?*

In Year 8, I want students to design a fair test based on their predictions. Questions I might ask my students are:

- *Which variable are you going to test?*
- *How will you control the other variables?*
- *What are you going to measure?*
- *How can you organise your data?*

How can you review and communicate?

How can I help students share their observations and questions?

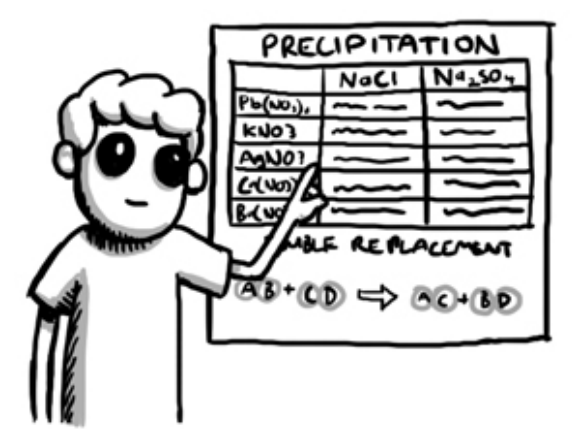
These questions stimulate student's reasoning and help them analyse, draw conclusions and make generalisations about the concepts.

Using the BitL questions, I could ask:

- *How can you review and communicate?*

At Year 8, I want my students to use precipitation rules to develop their explanations of what they have found through their investigation. I could ask them:

- *How does the precipitation rules explain your data?*



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 useful in society. I could ask my students:

- *What sources give you confidence that precipitation rules are accurate?*
- *Who might need to know this? 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 be able to think, work and process scientifically. Students can connect science to their world and consider why they need to learn that chemical change involves substances reacting, to form new substances.

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.