Year 9

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

Chemical reactions are important in both non-living and living systems and involve energy transfer.

What concepts do I want my students to understand?

- Chemical reactions involves the rearrangement of atoms to form new substances.
- Chemical reactions, including combustions and the reactions of acids, are important in both living and non-living systems and involve energy transfer.

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.

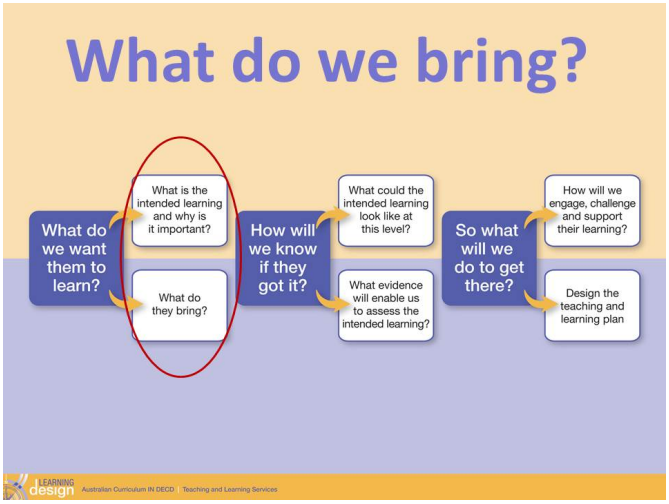
Note: Not all concepts are specifically addressed in each year level.

Introduction

What might my students already know about this concept?

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.

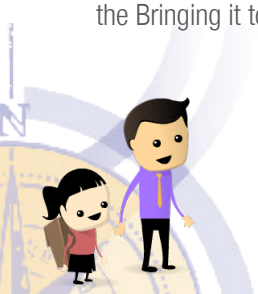
Compounds can have a number of pure substances or elements joined together through chemical reactions. New substances are formed when a chemical reaction occurs.



What content could I use to explore this concept?

We could investigate this concept through combustion and oxidation reactions, exothermic or endothermic reactions, or compare respiration and photosynthesis reactions.

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 9, we want our students to understand that chemical reactions are important for both living and non-living systems and involve energy transfer.

Year 9 example

For this example, I want my students to see the chemical reactions of acids in living and non-living systems.

What do you observe?

How can I help my students make observations?

Using the BitL questions, I could ask:

- *What do you observe?*

At Year 9 I want my students to make observations of chemical changes over time. I will get the students to add hydrochloric acid to marble, teeth and meat in separate test tubes. Questions I might ask my students are:

- *What do you see?*
- *What do you hear?*
- *What do you feel when you touch the outside of the test tube?*

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 9, I want my students to classify their observations according to scientific theories based on the similarities, and differences of the reaction of acid with both living and non-living things. Questions I may ask:

- *Does hydrochloric acid react the same with marble, meat and teeth?*
- *Did you observe any differences?*

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?*

At Year 9, I want my students to predict what they think might happen by formulating a scientific testable hypothesis. I would provide my students with other living and non-living things to investigate the reactions of acids with things such as, calcium carbonate, metal and hair. I may prompt them with:

- *How could you determine if an acid reacts the same on magnesium as it does with marble?*
- *Do all carbonates react the same with acids?*
- *Do all acids react the same with marble?*
- *Do all non-living things produce the same gas when they are reacted with an acid?*

What investigations could you design?

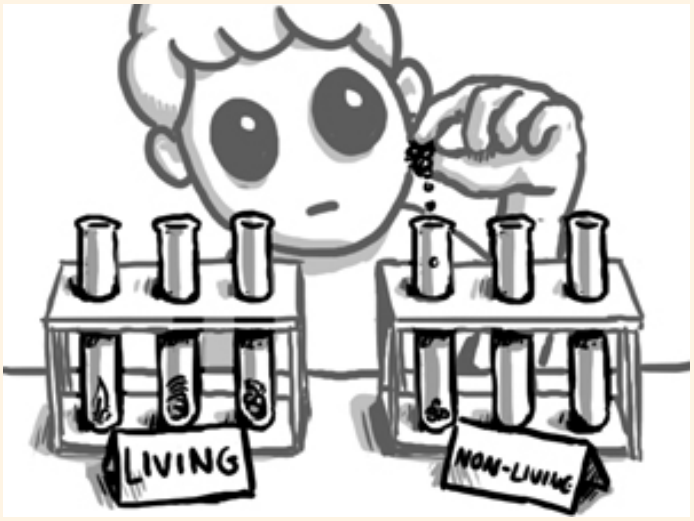
These questions support students to develop science inquiry skills and problem solve.

Using the BitL questions, I could ask:

- *What investigations could you design?*

At Year 9, I want my students to not only know how to use an inquiry approach to answer scientific questions, but to design their own investigations. I would ask the students:

- *How might you test your predictions?*
- *Which variables will you keep constant?*
- *How will you consider fairness?*
- *Which safety and ethical issues should you consider in your 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 conclusions and make generalisations about the concepts.

Using the BitL questions, I could ask:

- *How can you review and communicate?*

At Year 9, I want my students to analyse and communicate any patterns they discover, and evaluate their results. I also want them to consider the source of error in their results and ways to improve the quality of the data. I would ask my students:

- *How can you best represent your data to identify and communicate trends you found?*
- *What can you infer from the data?*
- *What new questions might you ask to find out more about acids?*

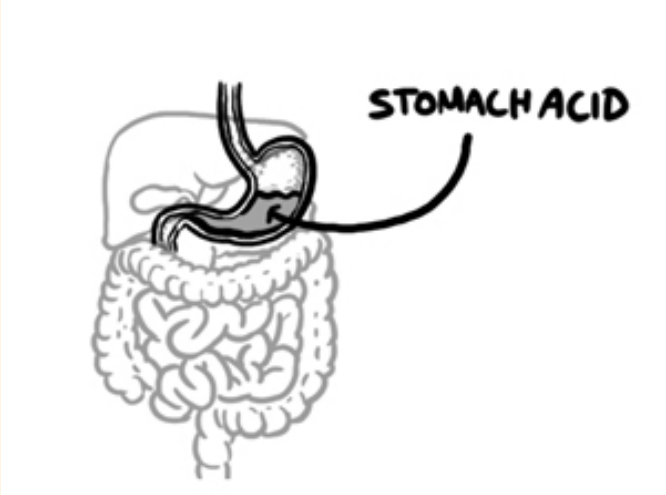
So what? What next?

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?*
- *Why is it important for us to understand how acids work in our body and other living things?*
- *What impact are acids having on the environment and on non-living things?*
- *How could you use your learning to inform your community or others? Why?*
- *What acids are found naturally in our world?*
- *Why do industries make acids?*



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.