**SCIENCE PLANNING TEMPLATE – Part 1: Learning outcomes plan**

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| **Main idea:**Water naturally exists as a solid, liquid and gas and has a ‘thin, stretchy skin’ called surface tension. | **Science strand:**Material World: Properties and changes of matter – physical properties and changes that occur when materials are mixed, heated or cooled. | **Level:** 1–2**Year:** 1–4 |
| **Overarching learning outcomes:** In building understandings about the properties of water, students will integrate:* an introduction to the characteristics of solids, liquids and gases (scientific knowledge)
* investigations into states of matter and surface tension (science practice)
* opportunities for students to investigate and communicate as scientists (nature of science).
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| **Conceptual learning outcomes**  | **Procedural learning outcomes**  | **Nature of science outcomes**  | **Technical learning outcomes**  |
| Students will understand that:* water can be a solid, liquid or gas and can go back and forth from one form to another
* change of state always involves a transfer of heat (energy)
* properties that characterise solids, liquids and gases are related to particle behaviour
* water has a ‘thin, stretchy skin’ that scientists call surface tension.
 | Students will be able to:* identify one characteristic of water in its solid and liquid states
* recognise that water is made of particles (molecules)
* demonstrate surface tension and the effect of soap on surface tension.
 | Students will understand and appreciate that:* scientists use observation and investigation to help them learn more about the world
* scientists use equipment in their investigations.
 | Students will be able to:* demonstrate particle behaviour through investigation and drama
* use equipment in a consistent manner
* demonstrate the effect of bubble wand shape on bubble formation.
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| **Assessment:*** Several of the activities have student worksheets that can form part of the assessment.
* After the Water molecules in drama activity, play ‘Simon says’ with the commands ‘solid’, ‘liquid’ and ‘gas’. Students imitate particle behaviour.
* Upon completion of the unit, small groups can choose a favourite activity and demonstrate it, taking on the role of scientists explaining the science concepts, procedures, special vocabulary, equipment and so on. Record with a mobile device.
* Students in year 4 and above can make a [States of matter concept map](https://www.sciencelearn.org.nz/images/220-states-of-matter-concept-map) (excluding plasma and Bose-Einstein condensates). Provide small groups with a template – keep the descriptors along the sides of the arrows. Ask students to provide examples along the arrow tips.
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**Suggestions to consider while using the Observing water unit plan**

**Setting the scene**

Sometimes, students are not aware they are doing science. To counter this, consider beginning each science lesson by addressing the students as scientists, scientific researchers or even molecular scientists when you are exploring water as H2O or when using drama to explore the particle behaviour of water.

**Linking new concepts**

Begin each new session with a recap of what was learned before. Explain how the new concept you are about to teach is linked to existing knowledge. For example, when teaching about water’s ‘thin skin’ (surface tension), refer back to what the children learned about H2O molecules and the way they hold on to or interact with each other.

Each time you use an image to initiate or discuss a concept, consider printing a colour copy of it. Add a caption detailing what you’ve learned/discussed. Do the same with photos you take during the activities. Create a wall display and add to the display as you progress through the lesson. This provides opportunities for students to see, read and process information and pick up the connections between the lessons.

**Planned interactions**

The planned interactions provided in the planner are brief. These are simply suggestions to begin a discussion. Use opportunities to ask questions and to explore the concepts in greater depth as the occasions arise. Make use of student knowledge and/or curiosity to broaden the interactions.

**Resources**

The science articles listed in the resource section are written for teachers, so read them beforehand for your own background information. Each article has links to related content – articles, video clips or teaching activities that provide additional information about the topic. Use these to broaden your knowledge and/or provide ideas for extension.

Although the science articles are written for teachers, consider how you might use them with older/more capable students. Consider printing a portion of an article for use as a reading activity. Cut and paste the information into Word, changing the font and font size if appropriate. Create a couple of simple questions to answer or remove content vocabulary to create a cloze activity.

**Adapting the unit plan**

This planner is in Word. Edit it to include additional learning outcomes, planned interactions, student activities or resources.

**SCIENCE PLANNING TEMPLATE – Part 2: Lesson plan**

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| **Main idea:**  | Water has some unusual properties: it naturally exists as a solid, liquid and gas and has a ‘thin, stretchy skin’ called surface tension. |

| **Subtasks** | **Resources/focal artefacts** | **Planned interactions** | **Key student outcomes** |
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| **Meso tasks** | **Micro tasks** |
| **Day 1**Establish initial student knowledge and content vocabulary.Setting the scene for science | 1.1 Learn about student alternative conceptions(teacher only). | * Article > [Alternative conceptions about water’s states of matter](https://www.sciencelearn.org.nz/resources/616-alternative-conceptions-about-water-s-states-of-matter)
 | * Read this for awareness of alternative conceptions children often hold about states of matter (teacher only).
 | * Early identification of existing alternative conceptions.
* Plan ample activities and opportunities for students to move from their view to the scientific view.
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| 1.2 Discover what students already know. | * Image > [Iceberg floating in the sea](https://www.sciencelearn.org.nz/images/1526-iceberg-floating-in-the-sea)
 | * What can you tell me about water? As a solid, liquid and gas?
* Use the image as a prompt if students need help with ideas
 | * Establish areas of prior knowledge and uncover potential alternative conceptions.
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| 1.3 Set the scene regarding observation, investigation and being scientists | * Video > [Collecting ice in Antarctica](https://www.sciencelearn.org.nz/videos/333-collecting-ice-in-antarctica)
* Whiteboard or similar
 | * Write the words ‘scientist’, ‘investigate’ and ‘observe’ on the whiteboard. Discuss meanings.
* Watch the video. Explain that Katja is a scientist in Antarctica.
* Watch the video again. Stop it to discuss:
	+ scientists can be any age or gender
	+ scientists investigate things that interest them (ice)
	+ scientists use observation – Katja looks at and discusses the ice once it is out of the ground
	+ scientists use special equipment to help them investigate and make observations (the drill).
* Discuss how students will work as scientists to investigate water.
 | * Students see themselves as scientists.
* They are introduced to a few key words.
* Students are aware they will be involved in scientific investigations and ‘doing’ science.
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| **Day 2**Through hands-on observation and drama:* a simple introduction to the properties that characterise solids, liquids and gases
* an introduction to particle behaviour and its relation to the characteristics of solids, liquids and gases.
 | 2.1 Investigate the characteristics of water as a solid, liquid and gas. | * Article > [Solids, liquids and gases](https://www.sciencelearn.org.nz/resources/607-solids-liquids-and-gases)
* Activity > [Looking at water – solid, liquid or gas](https://www.sciencelearn.org.nz/resources/611-looking-at-water-solid-liquid-or-gas)
* Interactive > [Water: solid, liquid and gas](https://www.sciencelearn.org.nz/image_maps/4-water-solid-liquid-and-gas)
 | * Read through the science article for your own background information. Consider reading through it with the class if appropriate.
* Work through the activity – either as a student-led investigation or as a teacher-led discussion.
* Use the interactive to affirm or challenge students’ discoveries.
 | * Identify one or more characteristics of water in its solid state (ice).
* Identify one or more characteristics of water in its liquid state (water).
* Identify that gas is also a state of matter.
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| 2.2 Investigate the particle nature of solids, liquids and gases. | * Activity > [Water molecules in drama](https://www.sciencelearn.org.nz/resources/612-water-molecules-in-drama)
 | * Conduct the activity. Refer to the questions within the activity.
* Relate the drama/movement activity with what students learned through the hands-on investigation earlier.
 | * Use drama and movement to model states of matter.
* Identify at least one physical characteristic of water in its solid state.
* Identify at least one physical characteristic of water in its liquid state.
* Identify at least one physical characteristic of water in its gaseous state.
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| **Day 3**Changes of state require adding or removing heat (energy). | 3.1 Investigate the role of heat (energy) as water changes from a solid to a liquid to a gas and back again. | * Article > [Melting and freezing](https://www.sciencelearn.org.nz/resources/608-melting-and-freezing)
* Activity > [Solid to liquid to gas](https://www.sciencelearn.org.nz/resources/613-solid-to-liquid-to-gas)
 | * Read through the science article for your own background information. Consider reading through it with the class if appropriate.
* Conduct the activity. Refer to the questions within the activity.
 | * Identify a logical sequence of solids to liquids to gases and the reverse.
* Discuss in very simple terms, the role of heat in water’s changes of state.
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| **Subtasks** |  | **Resources/focal artefacts** | **Planned interactions** | **Key student outcomes** |
| **Meso tasks**  | **Micro tasks** |
| **Day 4**Explore surface tension – water’s thin ‘skin’. | 4.1 Conduct simple activities involving surface tension. | * Article > [Observing bubbles](https://www.sciencelearn.org.nz/resources/609-observing-bubbles)
* Activity > [Observing water’s thin ‘skin’](https://www.sciencelearn.org.nz/resources/614-observing-water-s-thin-skin)
 | * Read through the science article for your own background information. Consider reading through it with the class if appropriate.
* View the images within the science article. Take the time to discuss each image, asking questions and encouraging student ideas on what they think is happening with the water. (Surface tension is a difficult concept for young students to grasp. They will likely need several opportunities to experiment with the concept before real understanding takes place. This is often not until high school years.)
* Conduct one or more of the experiences within the activity.
 | * Opportunity to talk about water molecules and the way in which they are attracted to each other.
* Talk about how the various activities demonstrate surface tension.
* Use equipment in a consistent manner.
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| **Day 5**Continue to explore surface tension. Adding soap to water decreases surface tension.Work as scientists to investigate bubbles in water and soapy water. | 5.1 Continue exploration of surface tension by experimenting with bubbles.Investigate the size and shape of bubble wands on the size and shape of bubbles. | * Activity > [Investigating bubbles](https://www.sciencelearn.org.nz/resources/615-investigating-bubbles)
 | * Before the activity, review the vocabulary: ‘scientist’, ‘observe’, ‘investigate’. Remind students they are working as scientists when they make careful observations and investigate the properties of the liquids and/or the shapes of the wands.
* Conduct the activity.
 | * Demonstrate the effect of soap on surface tension.
* Demonstrate whether the shape of a bubble wand affects the shape of bubbles.
* Discuss one or more ways in which they worked as scientists to complete this activity.
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