TUMUT PUBLIC SCHOOL
SCIENCE AND TECHNOLOGY PROGRAM

Stage:	2	Year:	3&4	Unit Name:	Material World: Changing States	Term:	4, 2020	Duration:	9 weeks

Unit Description	Inquiry Questions
This unit focuses on how solids and liquids change state when heated and cooled. Students will investigate the impacts of heating and cooling on different states of matter. They will undertake a case study of the Snowy Hydro Electric Scheme to explore how melting snow and water is being harnessed to provide hydro-electric power.	How do materials change when heated and cooled? Supporting Questions: → Are all solids and/or liquids affected by adding or removing heat? → How do we use the changing state of materials in our lives?

Outcomes	Working Scientifically → ST2-1WS-S	Design and Production → ST2-2DP-T
ST2-1WS-S questions, plans and conducts scientific investigations, collects and summarises data and communicates using scientific representations **ST2-6MW-S** describes how adding or removing heat causes a change of state Students: ● identify solids, liquids and gases as states of matter **SciT** ● recognise that a change of state can be caused by adding or removing heat (ACSSU046) **ComT SciT** ● describe examples of changes of state in everyday life **SysT** ● predict and observe the effects of adding or removing heat on a variety of solids and/or liquids **SciT** **Key Concepts Explored:** ● Change ● Sustainability ● Matter Energy	The following **working scientifically skills** have been integrated into the unit: **Questioning and predicting** ● identify and pose questions in familiar contexts that can be investigated scientifically ● make predictions based on prior knowledge **Planning and conducting investigations** ● plan scientific investigations with guidance ● conduct scientific investigations to find answers to questions ● use appropriate materials and equipment safely ● consider and apply the elements of fair tests ● collect and record accurate, honest observations using labelled observational drawings, basic formal measurements and digital technologies as appropriate ● reflect on investigations, including whether testing was fair or not ● participate individually and collaboratively with clear roles and goals **Processing and analysing data** ● **Communicating**	The following **design and production skills** have been integrated into the unit: **Identifying and defining** ● **Researching and planning** ● produce labelled and annotated drawings including digital graphic representations **Producing and implementing** ● **Testing and evaluating**

Learning Across the Curriculum

The following highlighted Cross-Curriculum Priorities are embedded in this inquiry unit:

- Aboriginal and Torres Strait Islander Histories and Cultures
- Asia and Australia's engagement with Asia
- Sustainability

The following highlighted General Capabilities are embedded in this inquiry unit:

- Information and Communication Technologies
- Literacy
- Numeracy
- Critical and Creative Thinking
- Work and Enterprise
- Ethical Understanding
- Intercultural Understanding
- Difference and Diversity
- Personal and social capability
- Civics and citizenship

Thinking Skills

The following highlighted Thinking Skills are embedded in this inquiry unit:

Computational thinking – ComT
Computational thinking is a process where a problem is analysed and solved so that a human, machine or computer can effectively implement the solution. It involves using strategies to organise data logically, break down problems into parts, interpret patterns and design and implement algorithms to solve problems.

Design thinking – DesT
Design thinking is a process where a need or opportunity is identified and a design solution is developed. The consideration of economic, environmental and social impacts that result from designed solutions are core to design thinking. Design thinking methods can be used when trying to understand a problem, generate ideas and refine a design based on evaluation and testing.

Scientific thinking – SciT
Scientific thinking is purposeful thinking that has the objective to enhance knowledge. A scientific thinker raises questions and problems, observes and gathers data, draws conclusions based on evidence, tests conclusions, thinks with an open mind and communicates research findings appropriately.

Systems thinking – SysT
Systems thinking is an understanding of how related objects or components interact to influence how a system functions. Students are provided with opportunities to recognise the connectedness of, and interactions between phenomena, people, places and events in local and wider contexts and consider the impact of their decisions. Understanding the complexity of systems and the interdependence of components is important for scientific research and for the creation of solutions to technical, economic and social issues.

Curriculum Learning Links

Outcomes from other Key Learning Areas have been integrated to support the development of understanding and skills in this inquiry unit:

English:
→ Spelling EN2-5A
Mathematics:
→ Time 2 MA2-13MG
→ Data MA2-18SP
→ Length 2 MA2-9MG

Assessment For/ As/ Of Learning

Learning Sequence 1:
- Heat and Ice Cube Investigation **Assessment For Learning**
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Learning Sequence 2:
- 3, 2, 1 Bridge Thinking Routine **Assessment As Learning**
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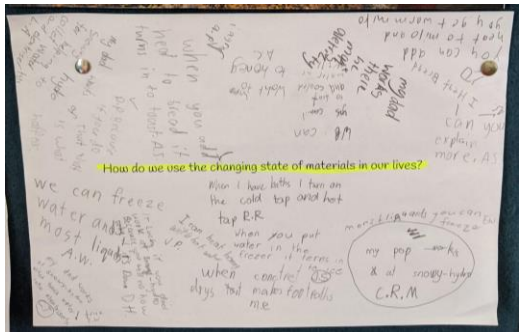
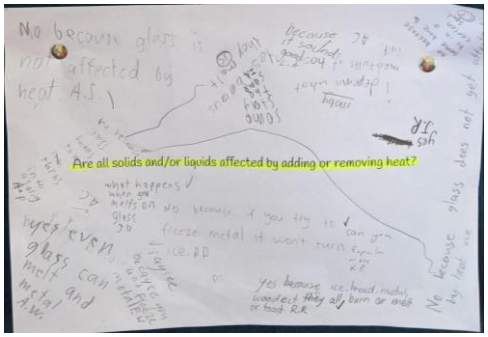
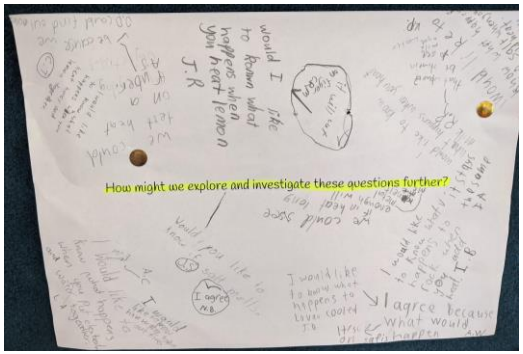
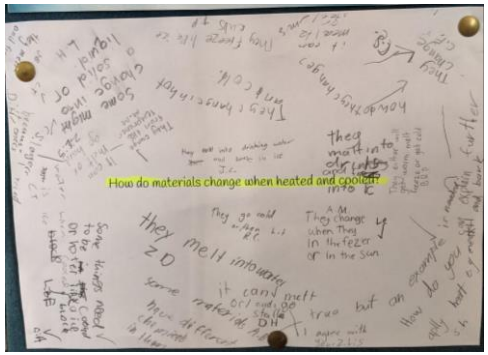
CONTENT FOCUS	LEARNING & TEACHING SEQUENCE - 1	EVALUATION	RESOURCES
How do materials change when heated and cooled? Students: • identify solids, liquids and gases as states of matter • recognise that a change of state can be caused by adding or removing heat • describe examples of changes of state in everyday life • predict and observe the effects of adding or removing heat on a variety of solids and/or liquids Curriculum Links: **Mathematics** → Time 2 MA2-13MG → Data MA2-18SP → Length 2 MA2-9MG **English** → Spelling EN2-5A	**Impact of Heating and Cooling** **Tuning In:** *What learning experiences will be used to spark curiosity, ascertain prior knowledge and understand student wonderings?* ❑ Introduce the key inquiry question: *How do materials change when heated and cooled?* ❑ Using **Kagan Cooperative Groups** students use the thinking routine Chalk Talk to unpack their thinking about this question and the supporting questions. Identify ways they can investigate the concept further through questioning and developing experiment ideas that might help us explore this topic further. Promote the **Accountable Talk Kagan Structure** to promote positive discussions amongst students (NB: use this as a springboard for designing future investigations & experiments based on student thinking → classroom chalk talk examples below.) ❑ *Are all solids and/or liquids affected by adding or removing heat?* ❑ *How do we use the changing state of materials in our lives?* ❑ *How do materials change when heated and cooled?* ❑ *How might we explore and investigate these questions further?* (What experiments might help us answer these?)    		**Kagan Cooperative Groups** thinking routine Chalk Talk Chalk Talk Scaffold **Accountable Talk Kagan Structure** Experiment scaffold Thermometers Ice cube trays Water Zip lock bags Timers Counters Paper Whiteboards Whiteboard markers iPad

	Shared Inquiry: *What learning experiences and questions will be used to develop understanding and skills? What assessment opportunities will help us monitor student learning and inform future practice? What differentiation (Support/ Extension) will be needed?* ❑ Investigate the impact heat from the sun has on an ice cube using **Kagan Cooperative Groups** and an Experiment scaffold **Assessment For Learning** ❑ Set protocols around group participation and roles ❑ Experiment Timer ❑ Temperature taker ❑ Observation Maker ❑ Group Leader and Reporter ❑ Groups measure the temperature of playground surfaces in the sun and in the shade before, during and after the experiment (**LINKS: Mathematics**) ❑ Graph results ❑ Groups place an ice cube in a zip lock bag and place it in the sun. ❑ Groups could explore how different surfaces impact this process by placing the ice cube bags on the asphalt and on another surface such as metal seat or wooden seat. ❑ Use a timer to record how long the ice cube takes to melt (elapsed time) (**LINKS: Mathematics**) ❑ Record observations about the process as the investigation is conducted. ❑ Groups using the **Talking Chips Kagan Structure** to discuss observations and create an explanation about what they think occurred and why. ❑ **NB:** Teachers capture images as the experiment is conducted and display on the wonderwall. It may also be beneficial to set up a time lapse of the ice cube in the bag and another just on the concrete to explore the difference in the process → lead into the **case study of the Snowy Hydro** → Learning Sequence 2 to be conducted alongside Learning Sequence 1! ❑ Guiding Questions: ❑ *Why do you think we use a zip lock bag to conduct this experiment?* ❑ *How do we capture and store water? What makes you say that?* ❑ *How might this experiment help us to understand how dams work?* ❑ Define the key terms *solid, liquid, gas* and *material* (**LINK: English**) ❑ Word: ❑ Origin or Type: ❑ Meaning: ❑ Connected Words: ❑ Example sentence: ❑ Examine how Indigenous people created canoes and other types of boats and explore how the process of heating and/or cooling was involved. ❑ Pose the scenario: Imagine if you were stranded on an island and you wanted to make a canoe. What would you use?		**Talking Chips Kagan Structure** Boats made from different materials Making canoes Sea.Museum

- ❑ Examine the book/video *Where the Forest Meets The Sea* by Jeannine Baker and discuss different types of water craft.
- ❑ Watch ABC Education video: Boats made from different materials along with ABC Education video: Making canoes and examine images and maps from Sea.Museum
    - ❑ Discuss the ideas and concepts present in the videos, including how heating and cooling is applied to different boat making methods, including the guiding prompts:
        - ❑ *What materials can be used to make boats? Can you think of three types of materials?*
        - ❑ *Why are those materials used to make boats?*
        - ❑ *How do Aboriginal peoples build canoes? How do they make their canoe waterproof?*
        - ❑ *Why is fibreglass used to make boats? How is the fibreglass applied to the mould?*
- ❑ Introduce the Wiradjuri term for canoe → **wargang**
- ❑ Examine the eastern Riverina Arts video and explore traditional canoe making of the Wiradjuri and Wolgalu people. Invite Shane Herrington to talk about canoe making with Stage 2 students **https://m.facebook.com/story.php?story_fbid=4895932033758259&id=159591494059027&d=null&vh=e**
- ❑ Explore the Sea Museum page: *Australia's First Watercraft* and discuss the map of Australia and the different watercraft built in different areas. *Why might this be? What does it make you wonder? How were different materials used for different purposes? How was this purpose achieved?*

❑ Investigate the impact heating or cooling has on honey, salt and lemon to support student wonderings:

- ❑ Introduce the student wonderings:
    - ❑ **What happens to honey when it is heated and cooled?**
    - ❑ **Does salt melt?**
    - ❑ **What happens when you heat lemon?**
    - ❑ **What happens when you heat milk?**
- ❑ Small groups investigate what happens when heating or cooling is applied to one of these four items - honey, lemon, salt and milk
    - ❑ Groups make a hypothesis and identify the scientific variables for this experiment
    - ❑ Groups place a small amount of their assigned material in a zip lock bag and place in the freezer.
        - ❑ Make observations about the appearance and feel of the substance
        - ❑ What happens when heat is applied to the substance? Does it return to its original state?

	❑ Explore how the sun can be used to heat different materials for the purposes of cooking https://www.homesciencetools.com/article/how-to-build-a-solar-oven-project/ https://education.abc.net.au/home#!/media/2309442/introducing-the-world-solar-challenge		

CONTENT FOCUS	LEARNING & TEACHING SEQUENCE - 2	EVALUATION	RESOURCES
How do materials change when heated and cooled? Students: • identify solids, liquids and gases as states of matter • recognise that a change of state can be caused by adding or removing heat • describe examples of changes of state in everyday life • predict and observe the effects of adding or removing heat on a variety of solids and/or liquids Curriculum Links: **English** → Spelling EN2-5A	**Case Study: Snowy Hydro** *The purpose of the case study is to develop a broader understanding of how these scientific concepts can be applied on a large scale in our community through the Snowy Hydro scheme.* **Tuning In:** *What learning experiences will be used to spark curiosity, ascertain prior knowledge and understand student wonderings?* ❑ Examine the Time Lapse of Snow Melting. Discuss and record thinking about the video. Some guiding prompts might include: ❑ *Why does snow melt?* ❑ *What happens to the snow when it melts?* ❑ *Where does the snow that's melted end up?* ❑ *How do we capture and store the snow that has melted?* **Shared Inquiry:** *What learning experiences and questions will be used to develop understanding and skills? What assessment opportunities will help us monitor student learning and inform future practice? What differentiation (Support/ Extension) will be needed?* ❑ Watch the BTN Episode The Snowy Mountains Scheme ❑ Examine a range of images depicting the dams and snowy hydro system. Share thinking, key ideas, wonderings and connections the class has. Display on the wonderwall. **Assessment As Learning** ❑ Use the thinking routine 3, 2, 1 Bridge to scaffold the discussion and gather collective thinking: ❑ 3 things you think you know about the Snowy Mountains Scheme (Snowy Hydro) ❑ 2 questions you have ❑ 1 connection you have ❑ Revise thinking at a later date and explore how our thinking has grown and changed as part of learning. ❑ Investigate how the Snowy Mountains Scheme captures and uses the melting snow for hydroelectricity ❑ Read the Snowy Hydro Popup Book and watch the YouTube video Snowy Hydro 2.0 ❑ Vocabulary Exploration: Explore a number of keywords related to the exploration of this topic. Model the exploration of the words *hydro* and *hydroelectricity* using the Online Etymology Dictionary . Use a structured model of representing meaning to show students how to gather and represent the information they find → word/ origin or type/ meaning/ connected words/ example sentence (**LINK: English**) ❑ Kagan groups or small groups are given one word to find the meaning of and report back to the class, including the words: *turbine, reversible, generate, energy, sustainable, impact, recycling* ❑ Word:		Time Lapse of Snow Melting BTN Episode The Snowy Mountains Scheme Range of images thinking routine 3, 2, 1 Bridge Snowy Hydro Popup Book YouTube video Snowy Hydro 2.0 Online Etymology Dictionary scaffold

	❑ Origin or Type: ❑ Meaning: ❑ Connected Words: ❑ Example sentence: ❑ Develop an explanation for how hydroelectricity works using the **Round Table Team Writing Kagan Structure**. One person from each group shares the explanation developed by the group. ❑ Explore the student wondering **What happens when water and electricity mix?**		**Round Table Team Writing Kagan Structure** Kids News - Snowy 2.0 article BTN Snowy Mountains teacher notes ABC Education Snowy Mountains Scheme Kids News - Snowy Hydro expansion Britannica - SNowy Hydro Article Snowy Mountains Scheme Snowy 2.0 explanation video Video - Australia's Greatest engineering feat Snowy Hydro Popup Book

3, 2, 1 Bridge - Thinking Routine

Initial Thinking	New Thinking
3 things you think you know • • •	3 things you know now • • •
2 questions you have • •	2 questions you have now • •
1 connection you have •	1 new connection you have made •

Bride: *How has your thinking grown and changed? What has helped to grow your thinking?*