Science and Technology sample unit: Let's celebrate!

Stage 3	Duration: 10 weeks (1.5 hours per week)

Unit context

National celebrations and family and community events are familiar experiences for Stage 3 students. In the context of celebrations, students extend their understanding of changes materials undergo and how the properties of materials determine their use for specific purposes.

Target outcomes

A student:

ST3-1VA	shows interest in and enthusiasm for science and technology, responding to their curiosity, questions and perceived needs, wants and opportunities
ST3-4WS	investigates by posing questions, including testable questions, making predictions and gathering data to draw evidence-based conclusions and develop explanations
ST3-5WT	plans and implements a design process, selecting a range of tools, equipment, materials and techniques to produce solutions that address the design criteria and identified constraints
ST3-12MW	identifies the observable properties of solids, liquids and gases, and that changes made to materials are reversible or irreversible
ST3-13MW	describes how the properties of materials determine their use for specific purposes
ST3-16P	describes systems used to produce or manufacture products, and the social and environmental influences on product design

Unit overview

This unit builds on students' prior knowledge about changes in state in solids and liquids from Stage 2 and introduces them to air as a gas. They investigate how changes in the state of everyday materials relate to the addition and removal of heat and whether these changes are reversible or irreversible. Students integrate the processes of Working Scientifically and Working Technologically in designing a system to produce ice cream. They use their understanding of the effect of heat in changing the state of materials, to design and conduct a fair test to evaluate the effectiveness of a portable product brought from home used to keep a can or carton of drink cold during an outdoor event. Throughout the unit, each student will maintain a digital and/or hard copy portfolio. The portfolio will be used by students to record and share findings and ideas, and to monitor and reflect on their own learning, and for the teacher to provide feedback.

Teachers should be aware that students may have food and other allergies that can result in serious medical consequences. This is an important consideration in selecting the foods to be handled and potentially consumed.

Content – Working Scientifically and Working Technologically Skills	Content – Knowledge and Understanding	Suggested teaching, learning and assessment experiences
Working Scientifically Students conduct investigations by: • working individually and collaboratively in conducting a range of appropriate investigation methods, including fair tests, to answer questions or solve problems Students process and analyse data and information by: • constructing and using a range of representations, including tables, graphs (column, picture, line and divided bar graphs) and labelled diagrams • drawing conclusions and providing explanations based on data and information gathered first-hand or from secondary sources	**Material World** Solids, liquids and gases have different observable properties and behave in different ways. (ACSSU077) Students: • observe and compare the differences in the properties and behaviour of solids and liquids, eg shape and ability to flow	**Is it solid, is it liquid?** **Teacher background** *In the context of family celebrations and special events, students build on their prior knowledge of solids and liquids from Stage 2. They carry out simple investigations to compare the observable properties and behaviour of solids and liquids. In the process of classifying materials as solid or liquid, they identify that some materials cannot easily be placed into one of these groups.* *Each student establishes a digital and/or hard copy portfolio to record and share their findings and ideas, to monitor and reflect on their own learning, and for the teacher to provide feedback.* **Class activity** Students brainstorm about special events and the range of celebrations they have experienced. **Pair activity** Students discuss their favourite celebration or special event. In their individual portfolios, they record: • the type of celebration • why it was held • when and where it was held • who attended the celebration • the food, drink and other items that were part of the celebration. Students conduct a first-hand investigation to identify the materials that make up a range of items and classify the materials as solid or liquid. For the investigation, the teacher sets up around the classroom numbered containers each with an item/material to be observed. The containers should include some of the items that have been suggested by the students from their favourite celebrations. Items/materials that could be provided for the investigation could include wrapping paper, paper whistles, gift boxes, sweet bags, cordial, tomato sauce, ice cream, popcorn, sweets, water, ice, fizzy drink, jelly, sherbet. To assist students in classifying the properties of the items/materials as solid or liquid, containers of different types, sizes and shapes, pouring and measuring equipment, tongs, tweezers, spoons, and paddle-pop sticks could be made available. In their individual portfolios, students construct or use a teacher-provided table to record their observations, eg Attachment A: Sample worksheet – Is it solid, is it liquid? **Group activity** **Is slime solid or liquid?** The students share their previous experiences with the material known as slime. They use a teacher-selected method to safely make slime, eg http://sciencesquad.questacon.edu.au/activities/cornflour_slime.html. They identify potential risks and how these will be avoided. Students use the equipment and materials safely to make slime and conduct first-hand observations to: • explore, identify and record the observed properties of slime

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		• compare the properties of slime with those already identified for solids and liquids • pose an answer to the question 'Is slime solid or liquid?' and explain their answer. **Class activity** The students compare their recorded observations and classification of the items/materials as solid or liquid. They identify why they found some items/materials (eg slime) difficult to classify as either a solid or a liquid. Each student records in their portfolio, any relevant additional information from the discussion. Through teacher-guided questioning, students discuss and use their findings to identify and record the distinguishing properties of solids (eg keep their volume and shape) and liquids (eg keep their volume but take the shape of the container). They use digital technologies to construct a table to summarise the properties of solids and liquids. Following their investigation of gases, the students could add the properties of gases to this table.
Working Scientifically Students conduct investigations by: • using suitable equipment and materials, checking observations and measurements by repeating them where appropriate Students process and analyse data and information by: • drawing conclusions and providing explanations based on data and information gathered first-hand or from secondary sources Students communicate by: • constructing and using a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data including using digital technologies as appropriate (ACSIS090, ACSIS107)	**Material World** Solids, liquids and gases have different observable properties and behave in different ways. (ACSSU077) Students: • demonstrate that air has mass and takes up space, eg in an inflated basketball, bubbles, balloons and beaten egg white	**Conducting first-hand investigations to identify observable properties of air** **Teacher background** *Through these activities, students are introduced to gases as a third state (form) in which materials can occur. Using air as an example of a material in a gaseous state, students carry out simple investigations to identify some of the observable properties and behaviour of gases. Prior to carrying out investigations to find answers to questions about the properties of air, students should review their understanding of mass and volume from Stage 2 Mathematics. By measuring the mass of a sample of air, students recognise that while they may not be able to see the air, there is a material inside the football/basketball, not just empty space. In Stage 4, students learn that air is made up of a mixture of gases.* **Class activity** To introduce the concept of materials occurring in a third state as gases, the teacher invites students to explore the occurrence of gases in their surroundings by: • engaging in simple first-hand activities such as those provided in Attachment B: What is a gas? • identifying and recording other everyday places where we find gases, eg in helium balloons, natural gas in cook tops, ovens and gas bottles for BBQs, the smell of perfume or aftershave, exhaust from cars, and air inside footballs/basketballs and the tyres of bikes and cars. **Group activities** Students conduct first-hand investigations to identify some properties of air. **Collecting and testing a sample of air** Students work in groups to suggest possible ways of collecting a sample of air, eg gently sweeping an open plastic bag through the air and tying it to contain the air. They discuss their proposed method for collecting a sample of air with another group and, if necessary, change or modify the design. Students use the method to collect a sample of air and observe whether air: • can be seen

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		• can be felt • changes or keeps its shape. Through teacher-guided questioning, students identify that air is invisible and cannot be observed directly using their eyes and that they will need to use other ways to find out about the properties and behaviour of air. **Does air have mass?** Students use an electronic kitchen balance to measure the difference in mass of a deflated and inflated football/basketball or observe identical football/basketball bladders, one inflated and one deflated, at either end of the suspended lever of a pan balance. Students check results by repeating the measurements and summarise their results in a table. They use observations and measurements to answer the questions posed. **Does air take up space?** Students use a teacher-provided procedure to conduct an investigation to find an answer to the question Does air take up space?, eg Attachment C: Conducting first-hand investigations to identify whether air takes up space. In their individual portfolios students, reflect on and record their findings about the properties of gases, including: • how the air collection was carried out • their observations and results for each of the tests • what they conclude from their results about the properties of air • whether air could be grouped with solids or liquids. **Class activity** Each group shares their results with the class. With teacher guidance, the students: • select and use an appropriate method to collate and compare the class results • describe the properties of air that they have observed • watch a video to observe the behaviour of a coloured gas, eg www.youtube.com/watch?v=ow3mIB2CH1A • use their findings about the properties of air to draw conclusions about the properties of gases • record their conclusion in an extra column in the table they constructed to summarise the properties of solids and liquids. **Assessment for learning activity** Students could use a simple key to classify a range of items as solids, liquids or gases, eg Attachment D: Individual assessment for learning activity.

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Working Scientifically Students plan investigations by: • with guidance, planning appropriate investigation methods to test predictions, answer questions or solve problems including surveys, fieldwork, research and fair tests (ACSIS086, ACSIS103, ACSHE081, ACSHE098) **Working Technologically** Students explore and define a task by: • identifying the users' needs and wants using techniques, eg observations, surveys, interviews and market research • planning the process considering constraints where relevant, eg time, finance, resources and expertise Students generate and develop ideas by: • selecting and using techniques for documenting and communicating design ideas to others, eg drawings, plans, flowcharts, storyboarding, modelling and presentations, using digital technologies	**Material World** Changes to materials can be reversible, such as melting, freezing, evaporating; or irreversible, such as burning and rusting. (ACSSU095) Students: • observe and describe some readily observable reversible changes that materials can undergo, by melting and then solidifying chocolate, and dissolving and retrieving salt or sugar from water **Products** Systems are used to produce or manufacture products. Students: • investigate a system to produce or manufacture a product, eg using an assembly line to produce a food product for sale in the school canteen, or the use of robotics in manufacturing a product • compare the production process in a domestic setting to mass production, eg baking bread in the home to making it in a bakery.	**Designing a system to produce ice cream** **Teacher background** *Ice cream is a popular food at many celebrations. To assist students design a system to produce ice cream, the class may need to review their understanding of a design process. During the process of making the ice cream, students observe changes in the state (form or appearance) of the ice cream. These changes of state occur as a result of the addition or removal of heat. When heat is removed, the milk mixture gets cold and changes state from liquid to solid (freezes). The ice mixture changes from a solid to a liquid (melts) as heat is added to it. Students compare their system for the production of ice cream in a school setting with large-scale production in a factory. Instruction on procedural text type may need to be included during the activity.* **Class activity** In a class discussion, students: • identify their favourite ice cream types and flavours and what they know about the materials that are used to make ice cream • list some properties of ice cream • describe what happens when ice cream is taken out of the freezer and left on the bench (heat is added from the surroundings) and what happens after it is returned to the freezer (heat is removed). The teacher introduces the task in which the class is to design a system and use a plan and production sequence to safely, efficiently and hygienically make ice cream. The class discusses a suitable method for making ice cream in the classroom or school kitchen (eg http://science.howstuffworks.com/innovation/edible-innovations/ice-cream3.htm), identifying potential risks and how these will be avoided. The teacher guides students through a design process, ensuring that they reflect on cost, time, environmentally responsible use of materials, safety and hygiene considerations. The students: • view a method used to make ice cream in a home kitchen • develop a design brief for the system • brainstorm ideas for possible designs for the production system, including identifying user needs and wants • break the agreed ice cream production method into individual parts that are easier to implement • order and reorder the steps of production into an efficient system • record the production steps as a procedural text • discuss the effects of one system component breaking down, on the whole system. The students apply a system to make ice cream using the agreed method, eg Attachment E: Designing a system to produce ice cream. **Class activity** Students investigate the large-scale production of ice cream by: • visiting a factory and/or viewing a video of mass production of ice cream in a factory,

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• identifying a range of appropriate materials for the task Students produce solutions by: • developing a plan and specifications to guide production • using their plans and production sequence Students evaluate by: • identifying the strengths and limitations of the process used • self or peer assessing the final product by using the established design criteria		eg www.youtube.com/watch?v=IO6DiuUAvil • identifying the main steps in the production process • constructing a flowchart to show the steps in the production, using digital technologies as appropriate • comparing the process they used to make ice cream with the process used in the factory. Students reflect on: • what they know and have learned about changes of state, including the meanings of the terms freezing and melting • their design of a small-scale production system and the product, using the established criteria in the design brief.
Working Scientifically Students question and predict by: • with guidance, posing questions to clarify practical problems or inform a scientific investigation (ACSIS231, ACSIS232) Students plan investigations by: • collaboratively and individually selecting suitable methods for gathering data and information first-hand and from reliable secondary sources Students conduct investigations by: • using equipment and materials safely,	**Material World** Changes to materials can be reversible, such as melting, freezing, evaporating; or irreversible, such as burning and rusting. (ACSSU095) Students: • observe and describe some readily observable reversible changes that materials can undergo, by melting and then solidifying chocolate, and dissolving and retrieving salt or sugar from water	**What are reversible changes?** **Teacher background** *Using everyday examples related to celebrations, students undertake first-hand investigations to observe changes in state (form or appearance) as reversible changes. In reversible changes, no new materials are formed. Students are introduced to, and use appropriately, some terms with specific meanings in science and technology including freezing, melting, evaporating and dissolving. Water can occur as a solid (ice), as liquid water and as water vapour. It is important not to confuse the mist (steam) that forms when liquid water boils, which is made up of visible droplets of water, with water vapour that is an invisible gas.* **Pair activity** Students conduct first-hand investigations to observe some reversible changes in materials at workstations set up around the classroom or in the school kitchen. The class discusses potential risks associated with each investigation and ways of avoiding those risks. If there are concerns about student safety, some of the activities could be demonstrated by the teacher. Suggested workstation activities could include: • melting chocolate buttons in a resealable bag in hot water and pouring melted chocolate into a small mould • freezing and defrosting cordial in a small plastic bottle • leaving a small quantity of water to evaporate in a warm place. Where does the water go? • observing water droplets forming on the outside of a container of melting ice. Where does the water come from? In their individual portfolios, students construct a table and record for each suggested practical activity, the change investigated, a description of what they observed, whether heat was added or removed, and why the observed change

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identifying potential risks (ACSIS088, ACSIS105)		in state is described as 'reversible'. Students compare their results and conclusions with another pair and discuss questions raised with their peers and teacher. **Individual activity** Students identify and record, using their own experience and prior knowledge, other everyday examples of changes of state and how these are useful in their everyday lives. **Group activity** Students conduct first-hand investigations to observe the changes when materials dissolve by: • stirring a small amount of sugar or salt into water until it dissolves • leaving a small quantity of the sugar or salt solution in a warm place for 2–3 days. In their individual portfolios, students record a description of what they did, their observations, and why the observed change is described as 'reversible'. Students compare their results and conclusions with another pair and discuss questions raised with their peers and teacher. **Individual activity** Students record using their own experience and prior knowledge to identify other everyday examples of changes where materials dissolve and how these are useful in their everyday lives. Students use digital photography or video to record changes of state.
Working Scientifically Students question and predict by: • with guidance, posing questions to clarify practical problems or inform a scientific investigation (ACSIS231, ACSIS232) • predicting what the findings of an investigation might be (ACSIS231, ACSIS232) Students plan investigations by: • with guidance, planning appropriate investigation methods to test predictions, answer questions or solve	**Material World** Changes to materials can be reversible, such as melting, freezing, evaporating; or irreversible, such as burning and rusting. (ACSSU095) Students: • make and test predictions about the effect of temperature on the state of some substances, eg adding and removing heat from water	**Designing and conducting a fair test** **Teacher background** *This activity extends students' understanding of designing a fair test and that adding or removing heat changes the state of some materials. Heat can be detected by receptors in the skin and is measured using a thermometer.* **Class activity** In a teacher-led discussion, the students review and record in their individual portfolios what they know about making tests fair. **Group activity** Students design and conduct a fair test to investigate the effect of heat on one of the states of water. In their groups, students design a fair test by: • posing a suitable question to investigate using a fair test such as Does water evaporate faster from wide or narrow containers? OR Does the location affect how fast ice melts? • predicting, based on their experience, what the findings of the investigation might be, eg that the water in the wide container will evaporate fastest OR that the ice will melt slower in the container in the shade • planning a proposed safe method to test their prediction, that includes the materials required for the investigation and how they will measure, record and analyse their results using digital technologies as appropriate

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problems including surveys, fieldwork, research and fair tests (ACSIS086, ACSIS103, ACSHE081, ACSHE098) • deciding which variable should be changed and measured in fair tests while keeping everything else the same (ACSIS087, ACSIS104) • collaboratively and individually selecting suitable methods for gathering data and information first-hand and from reliable secondary sources Students conduct investigations by: • using suitable equipment and materials, checking observations and measurements by repeating them where appropriate Students process and analyse data and information by: • comparing gathered data with predictions, and use as evidence in developing explanations of events and phenomena (ACSIS218, ACSIS221, ACSHE081, ACSHE098)		• describing how they will make the test fair (which variable should be changed while keeping everything else the same). Each group: • discusses their proposed procedure with the teacher and includes changes/modifications as necessary • follows their procedure to conduct the investigation, recording observations and measurements • analyses their findings and draws conclusions based on data/information collected. **Class activity** In a class discussion, the students share and compare their findings. With teacher-guided questioning, students: • construct a simple flowchart to summarise the changes in state of water, where the processes of freezing, melting and evaporating occur and where heat is added or removed • jointly construct the meaning of the terms freezing, melting and evaporating • use cause-and-effect relationships to explain their results.
Working Scientifically Students conduct investigations by: • using equipment and materials safely, identifying potential risks	**Material World** Changes to materials can be reversible, such as melting, freezing, evaporating; or irreversible, such as burning and rusting. (ACSSU095)	**What are irreversible changes?** **Teacher background** *Preparing for a celebration often involves cooking food. Students investigate the effect of heat on a variety of foods and other common materials related to celebrations, to observe changes in which new materials are formed (irreversible changes). If there are concerns about student safety in performing any of the suggested hands-on experiences, teachers could demonstrate these changes.*

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(ACSIS088, ACSIS105) Students communicate by: • constructing and using a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data including using digital technologies as appropriate (ACSIS090, ACSIS107)	Students: • observe some irreversible changes that common materials undergo to identify that the changes may result in new materials or products, eg rusting iron, burning paper, cooking a cake and making toffee • classify some observable changes that materials undergo as reversible or irreversible	**Class activity** The students observe a teacher demonstration of a burning sparkler. This should be conducted outdoors, with the teacher wearing a glove and goggles, and students standing at a safe distance**.** In a class discussion, students describe the appearance of a sparkler before the teacher sets it alight, what they observed while the sparkler was alight and after it has stopped burning. With teacher-guided questioning, the students identify that when the sparkler burned new materials formed. **Pair activity** The teacher sets up workstations around the classroom or in the school kitchen. Students conduct first-hand investigations to observe changes in some common materials before and after heating. The teacher and students discuss the potential risks associated with each activity and ways of avoiding those risks. The students follow the procedures at each workstation. Suggested workstation activities could include: • one new tea light (before) and one that has been allowed to burn for a few minutes (after) • a cup of water and a cup of sugar (before) and a prepared toffee (after) • a raw egg cracked into a saucer (before) and a hard boiled egg peeled and sliced (after) • a beaten egg white in a bowl (before) and a purchased meringue (after) • some popping corn (before) and some prepared popcorn (after). The students record their observations of the appearance of the materials before and after they are heated, using the teacher-provided worksheet, eg Attachment F: What makes a change irreversible? They compare their observations and results with another pair of students and discuss questions raised with their peers and teacher. **Class activity** The students use the class findings to: • identify why the observed changes in the materials are irreversible • describe how they would distinguish between a reversible and an irreversible change. **Assessment for learning activity** **Think/Pair/Share** Students could be provided with an example of a concept cartoon relating to a new situation involving an irreversible or reversible change (eg Naylor, S and Keogh, B, *Concept Cartoons in Science Education*). Individually, the student thinks about and records their response to the scenario presented in the cartoon. They discuss the idea/concept presented in the cartoon with another student and compare their responses. Following the discussion, the students review their responses.

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Working Scientifically Students question and predict by: • predicting what the findings of an investigation might be (ACSIS231, ACSIS232) Students plan investigations by: • collaboratively and individually selecting suitable methods for gathering data and information first-hand and from reliable secondary sources Students conduct investigations by: • working individually and collaboratively in conducting a range of appropriate investigation methods, including fair tests, to answer questions or solve problems Students process and analyse data and information by: • reflecting on their gathered evidence in relation to: – the process used to gather, process and analyse their data and information – their own prior knowledge as well as accepted scientific explanations – their own and others' conclusions	**Material World** The properties of materials determine their use for specific purposes. Students: • identify the properties of materials used in a familiar product and relate them to its use	**Why do some foods need to be kept hot or cold?** **Teacher background** *Students discuss the importance of protecting food sources and keeping foods hot or cold to improve taste, reduce the problems of food getting stale and food wastage. Students are introduced to the idea that the properties of some materials make them act as insulators by keeping heat in or out.* **Pair activity** Students review their previous list of special events and celebrations. They select their favourite **outdoor** event and add information about how the food for the event was kept hot or cold. **Class activity** Students share what they know about: • the foods and drinks that taste better if they are kept hot or cold • what happens to food that is not kept at the right temperature • what might happen if food that has not been kept at the right temperature is eaten • what we do with food that we can no longer eat. Students review their ideas about why food is an essential requirement for living things. They discuss where our food comes from, why it is important to protect our sources of food and reduce food wastage. Using suitable secondary sources such as FoodWise or Caring for Our Country websites, students record some of the implications of food wastage and ways that they can minimise wastage, eg www.foodwise.com.au – see food wastage and security links. **Class activity** The students and teacher create a display of portable products they bring from home, for keeping food or drinks hot or cold. They observe the feature of the products and/or materials that are used to keep food hot or cold and record their findings on a table that they construct or that is provided by the teacher. With teacher-guided questioning, they identify similarities and differences in the materials used in these products. The students brainstorm to identify other everyday examples of natural and made products and/or materials that are used to keep heat in or out (acts as insulators). Examples may include: • birds' feathers and fur/hair of mammals • woollen clothing, thermal wear, doonas, blankets • the material (neoprene) used to make wetsuits • insulating material used in the ceiling and walls of buildings.

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Working Scientifically Students question and predict by: • applying experience from similar situations in the past to predict what might happen in a new situation Students plan investigations by: • deciding which variable should be changed and measured in fair tests while keeping everything else the same (ACSIS087, ACSIS104) Students conduct investigations by: • working individually and collaboratively in conducting a range of appropriate investigation methods, including fair tests, to answer questions or solve problems • accurately observing, measuring and recording data, using digital technologies as appropriate (ACSIS087, ACSIS104) • suggesting improvements to the methods used to investigate a question or solve a problem (ACSIS091, ACSIS108) Students process and analyse data and information by: • using numerical techniques to analyse data and information, including	**Material World** The properties of materials determine their use for specific purposes. Students: • describe how scientific and technological knowledge about the properties of materials can be used to inform decisions about use for their specific purposes	**Conducting a fair test of a portable product for keeping drinks cold** **Teacher background** *The students could review from their portfolios, their understanding of some criteria that need to be considered when designing a fair test. In this investigation, they design and conduct a fair test to determine the effectiveness of a range of portable products brought from home, in keeping an identical-sized container of drink cold. The class uses an agreed procedure to test the products and, based on the findings of their investigation, identify the features of the product that is most effective in keeping the can or carton of drink cold.* **Class activity** The students discuss, identify and record the question they will investigate in the fair test, eg Which is the most effective container for keeping a can/carton of drink cold? Using the data/information gathered and recorded during the unit, they discuss which portable products may be the most effective in keeping a can/carton of drink cold and the reasons for their choices. **Team activity** Students: • discuss and record a plan for the fair test, including equipment they will need and how they could make measurements (including the correct units to be used if appropriate), and record data/information and results over the agreed time intervals • describe how they will make their plan a fair test by identifying the variable that needs to be kept the same and how they could repeat the test to check their results • appoint a team member to present the plan of the fair test to the class for consideration. **Class activity** The appointed team members present their team plan to the class for review. With teacher guidance, students: • evaluate each plan and collaboratively decide on the most suitable fair test to answer the question posed • identify potential risks and how these will be avoided in conducting the selected method. **Team activity** Each team selects a portable product from the display and, using the plan agreed on by the class, conducts the fair test. **Class activity** With teacher-guided questioning, the students: • analyse the class results and select an appropriate way to show the difference between the effectiveness of the portable products in keeping the drink cold • draw conclusions about the portable products that were most effective in keeping the drink cold • use the results and information gathered, to develop an explanation for why some products were more effective

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calculating the means and percentages of small sets of data • drawing conclusions and providing explanations based on data and information gathered first-hand or from secondary sources • reflecting on their gathered evidence in relation to: – the process used to gather, process and analyse their data and information – their own prior knowledge as well as accepted scientific explanations – their own and others' conclusions **Working Technologically** Students generate and develop ideas by: • identifying a range of appropriate materials for the task • selecting and using techniques to investigate the suitability of materials		than others in keeping the drink cold • reflect on the method used to carry out the investigation and suggest how it could be improved. **Individual or team activity** Students: • compare the findings from the test with suggestions and reasons about which product would be the most effective • identify what they learned about the design process and conducting fair tests • reflect on what they learned from working with others in a team.

Resources	Assessment overview
Materials and equipment • A variety of 'party-related' solids and liquids in numbered containers • Tongs, tweezers, spoons, paddle-pop sticks • Containers of different types, sizes and shapes, including pouring utensils, measuring jugs and cups • Plastic shopping bags, identical basketballs or footballs (or the bladder of the ball), pan balances or electronic kitchen balance • Egg whisks or eggbeaters • A variety of portable products brought from home for keeping drinks cold • Identical cans/cartons of drink – one for each team **Online file sharing:** Google Earth, SkyDrive, School Portal **Applications:** Excel and Numbers Spreadsheets **Presentation applications:** PowerPoint, SMART Notebook **Word-processing/Publishing:** Word, Publisher, Pages **Websites** **Safety information for science teachers** www.csiro.au/resources/science-safety www.csiro.au/~/Media/CSIROau/Corporate%20Units/Education/SECAdlMiniChemLabSafety_EE_pdf%20Standard.pdf **Interactive – Solids, liquids and gases** www.sciencekids.co.nz/gamesactivities/gases.html **Cornflour slime** http://sciencesquad.questacon.edu.au/activities/cornflour_slime.html www.csiro.au/en/Portals/Education/Programs/Do-it-yourself-science/Chemical-sciences-activities/best-of-slime/Cornflour-slime.aspx **Making ice cream in a bag** http://science.howstuffworks.com/innovation/edible-innovations/ice-cream3.htm www.kidspot.com.au/kids-activities-and-games/Messy%20activities+24/make-ice-cream-in-a-bag+12050.htm **Making ice cream in a factory** www.youtube.com/watch?v=lO6DiuUAvIl **Fun experiments** www.sciencekids.co.nz/experiments/eggbubbles.html **YouTube –** Show me science – states of matter: solid, liquid and gas www.youtube.com/watch?feature=player_embedded&v=kGQ9-csX61c#! **FoodWise** – a national campaign to get Australians to reduce the environmental impact of their food consumption. http://foodwise.com.au **NSW EPA** www.lovefoodhatewaste.nsw.gov.au/	Assessment opportunities could include: • classification of unknown substances as solid, liquid or gas, using a key • construction of a table using digital technology to summarise the properties and behaviour of solids, liquids and gases, including examples • use of cause-and-effect relationships to explain results • use of digital applications • application in their everyday lives, of their understanding about the need to protect food sources and prevent food wastage • student record of planning a system using the design process • student reflection on the design process and their own learning • student record of the conducting a fair test • peer feedback on the design and conducting of a fair test • use of practical skills during a scientific investigation and/or design project • student record of investigation in portfolio including making predictions, gathering and recording data, constructing a graph, analysing results and drawing conclusions • student self-assessment of learning.

Resources	Assessment overview
Waste not – want not recyclingweek.planetark.org/documents/doc-80-unit13.pdf **Caring for Our Country project** www.nrm.gov.au/funding/approved/pre-2008/wa/narg/2006-04.html **Life cycle analysis of products** www.infochangeindia.org/kids/findout_02.php **YouTube videos related to keeping drinks cold** www.youtube.com/watch?v=LfKgOpJc7Ps&feature=related www.youtube.com/watch?v=EFrZohRRskY **My Science –** a program that supports the teaching of science in primary schools http://myscience.com.au/ **World Association of Technology Teachers** Information about design problems and design briefs www.technologystudent.com/designpro/problem1.htm **Print resources** NSW Dept of Education and Training, Chemical Safety in Schools Kit, Vol 2, 2000 Naylor, S and Keogh, B, *Concept Cartoons in Science Education*, Milgate House Publishers, 2000 Science and Technology K–6 – *Material World*, Board of Studies NSW, 1992 Primary Connections: Stage 3 – *Package It Better* and *Change Detective* Primary Connections: Year 3 – *Melting Moments* *Dictionary of Classroom Strategies K-6* – Board of Studies NSW, 2010 **Links to other KLAs** **English** EN3-1A communicates effectively for a variety of audiences and purposes using increasingly challenging topics, ideas, issues and language forms and features EN3-2A composes, edits and presents well-structured and coherent texts EN3-9E recognises, reflects on and assesses their strengths as a learner **History** HT3-2 describes and explains different experiences of people living in Australia over time **Maths** MA2-11MG measures, records, compares and estimates volumes and capacities using litres, millilitres and cubic centimetres MA2-12MG measures, records, compares and estimates the masses of objects using kilograms and grams	

Attachments

Stage 3: Let's celebrate!

A: Sample worksheet – Is it solid, is it liquid?

At each workstation, you will find an item in a numbered container. For each item, name the material(s) of which it is made. Use your senses to observe the properties of each material. From the properties you observe, classify each item as solid or liquid by ticking (✓) the appropriate box. If you are not sure, tick the 'Not sure' box.

An example of a suggested table students could use to record their findings or construct using digital technologies, as appropriate, is shown below:

Item number	Material(s) of which it is made	Observation	Solid	Liquid	Not sure

B: What is a gas?

Teacher information

The following are some examples of ways the students could explore for the presence of gases in their surroundings by:

- feeling air movement when inhaling and exhaling
- feeling air movement using a piece of paper or a fan
- detecting the presence of the wind with their eyes closed
- making balloon animals
- inflating a balloon then letting go (balloon rocket)
- observing bubbles of gas released from a fizzy drink
- bursting the 'bubbles' of bubble wrap.

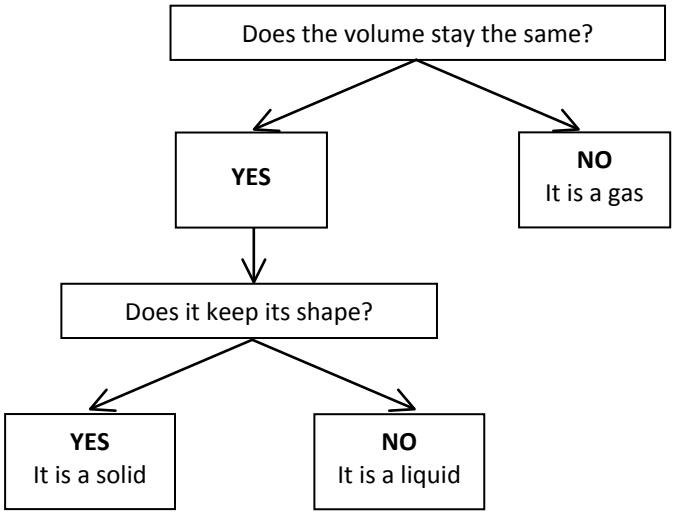
C: Conducting first-hand investigations to identify whether air takes up space

Students could conduct the following first-hand investigations to gather information to answer the question Does air take up space?

- Invert an 'empty' clear container into a large bowl of water containing a small amount of food colouring and observe whether the water goes into the container.
- Crumple a tissue into the clear container before inverting it into a bowl of water and observe whether the tissue gets wet.
- Measure the volume of an egg white before and immediately after it is beaten.
- Measure a known volume of fizzy drink immediately after opening the can and after it has 'gone flat'.
- Measure the volume of a balloon that has been squeezed and after it has bounced back to shape.

D: Individual assessment for learning activity

Using teacher-provided materials, the students observe the properties of a solid, liquid and gas. Based on their observations and prior learning, they use the key below to identify these materials.



E. Designing a system to produce ice cream

Designing the production system

The teacher introduces the design task and the students develop the design brief. The class divides into suitably sized groups. Each group:

- generates ideas about the different steps and how these might be sequenced to produce the ice cream in an efficient, safe and hygienic manner. These could include:
  - assembling the required ingredients
  - gathering the equipment and measuring instruments
  - measuring the correct quantity of each ingredient
  - mixing the ingredients
  - safely assembling the equipment
  - examining and testing the finished product
  - photographing/videoing/reporting on the production process
- records a possible sequence of steps for the production of ice cream
- reviews their plan, including identifying potential health and safety risks with peers and the teacher.

Class activity

In a teacher-guided class discussion:

- each group shares their plan which is evaluated by the class. The students decide on a plan for the production process and adjust/modify the plan, as necessary, considering:
  - time required for the task
  - availability and cost of resources
  - selecting a range of suitable, easily obtained materials that have minimal environmental impact
  - discussing potential health and safety risks and how these will be avoided
  - agreeing on techniques and a sequence for the development of the product
  - testing the suitability of various materials as appropriate
- the students jointly construct a flowchart to show the sequence of steps in the agreed production process
- the groups negotiate and each accepts responsibility for a part of the production process.

Producing the ice cream

Each group allocates roles to the members and follows the relevant part of the plan to safely and correctly use materials and techniques to make the ice cream (product).

Individual activity

Students:

- record in their portfolios the final production plan, the flowchart for the process and their role in the process
- record their observations of changes in the product over a period of time
- use their senses to observe the finished product
- describe the changes of state observed in the process, and how these relate to the removal and addition of heat
- identify that as no new materials are formed in the process, making ice cream is a reversible change
- identify the strengths and limitations of the part of the process that they conducted.

Class activity

Using the students' individual records as a basis for discussion, each group evaluates the process used and the product, and suggests how it might have been improved.

F: Sample worksheet – What makes a change irreversible?

Your teacher will demonstrate or you will carry out a number of observations involving changes to materials. For each investigation, record on the worksheet the changes you observed before and after the materials are heated.

Investigation	**Change(s) observed**	
	Before heating	**After heating**
Lighting a sparkler		
Burning a tea light: Wick		
Wax		
Heating a sugar solution to make toffee		
Cooking an egg: Yolk		
White		
Using egg white to make meringues		
Making popcorn		