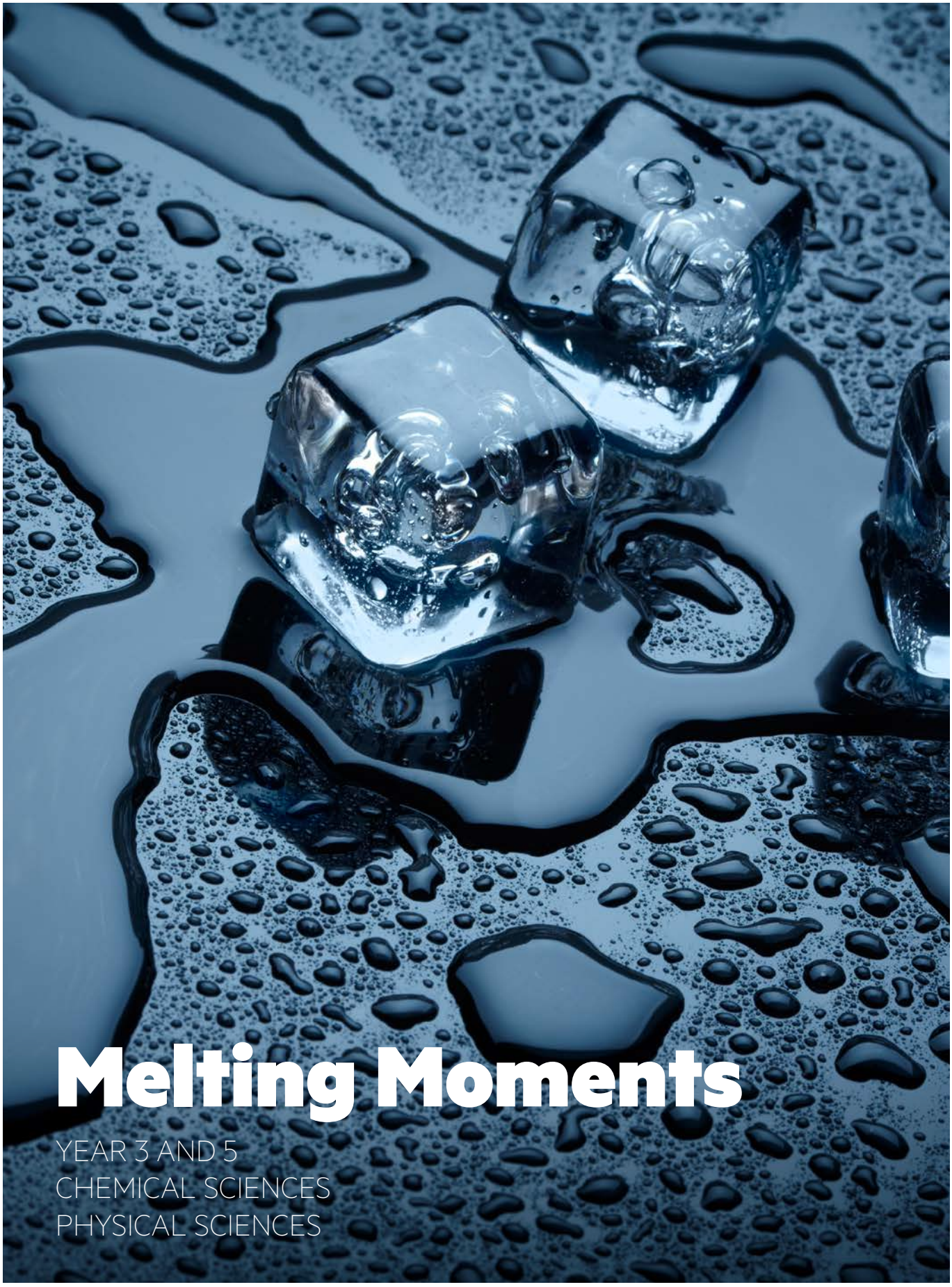

Melting Moments

YEAR 3 AND 5
CHEMICAL SCIENCES
PHYSICAL SCIENCES

QGC | FUTUREMAKERS | QUEENSLAND MUSEUM NETWORK | Queensland Government

Future Makers

Future Makers is an innovative partnership between Queensland Museum Network and Shell's QGC business aiming to increase awareness and understanding of the value of science, technology, engineering and maths (STEM) education and skills in Queensland.

This partnership aims to engage and inspire people with the wonder of science, and increase the participation and performance of students in STEM-related subjects and careers – creating a highly capable workforce for the future.

QUEENSLAND MUSEUM NETWORK

Queensland Government

ENGAGE – EXPLORE – EXPLAIN

Melting Moments

Teacher Resource

In *Melting Moments*, students explore the properties of solids and liquids, as well as how they change in response to different situations.

Students firstly participate in a teacher-led demonstration where they investigate how they can change the way a solid melts and test different solids to see how they compare. This open-ended demonstration is designed to capture students' interest at the start of a unit of work and to find out what students think they know about changes of state from solid to liquid and liquid to solid. The demonstration encourages students to ask questions, make predictions, share their observations and suggest possible explanations for what they observe.

Students then identify questions for further inquiry before planning and conducting scientific investigations to explore their chosen topics.

Melting Moments: Demonstration

Materials required to complete the demonstration include:

- Ice cube trays of frozen substances (such as ice, chocolate, coconut oil, honey)
- Esky or cooler bag
- Metal and plastic melting plates with rubber rings (self-made or purchased from an educational resource supplier)
- A variety of surfaces made from different materials (such as plastic, metal, wood or foam; surfaces could include metal or plastic lids, plates, metal pie tins, pieces of Styrofoam, bubble wrap, corflute or wooden blocks)
- Jugs of cold, room temperature and warm water
- Clear plastic containers or beakers
- Resealable sandwich bags
- Trays or plates
- Thermometer (optional) – digital, conventional or infra-red
- Stopwatch (optional)
- Rolling pin (optional)
- Chopping board (optional)
- Hairdryer (optional)
- Food colouring (optional)
- Pipettes (optional)

Detailed step-by-step instructions can be seen on the following pages. It is recommended that you use these instructions to guide your students through the activity.

1. Gather students around a table or desk, ensuring that all students can see the demonstration. Show students a tray of ice cubes and inform them that you will be working together to investigate how solids can change over time.

   Explain to students that they will be scientists during the investigation. Encourage students to actively participate in the investigation by asking questions, making predictions, thinking of ideas which could be tested, sharing observations and suggesting possible explanations for what they observe.

2. Place the metal and plastic melting plates on the table (you could also use two other surfaces made from metal and plastic). Ask students to predict what they think will happen when you place an ice cube on each of the surfaces. You could pass the surfaces around to students to help them make their predictions. As the surfaces are passed around, ask students to discuss: ***What do you notice about the surfaces? How could this change or affect what happens to the ice cube? Why do you think this is?***

   Students then share their ideas with the class.

3. Place an ice cube on each of the surfaces and wait for observable changes to occur. Ask students: ***What do you notice?***

   Student responses may include that the ice cubes are melting and that they are melting at different rates.

4. Explain to students that the ice cubes are melting because of the movement (or transfer) of heat energy. Some materials (such as metals) are very good or very effective at moving (or transferring) heat to other objects; this is why the ice cube melted quickly on the metal plate. These materials are called conductors. Other materials (such as plastics) are not very good or very effective at moving (or transferring) heat to other objects; this is why the ice cube melted slowly on the plastic plate. These materials are called insulators.

5. Inform students that they are going to be using different materials to investigate how they can change the way ice melts. Show students available materials, including a range of surfaces (made from different materials), containers of water (different temperatures) and other equipment such as a rolling pin, a hairdryer, thermometers and stopwatches.

   Ask students to suggest what materials and equipment they would like to use in the investigation. Ask students how they could use these items to melt the ice and to predict how the ice might melt.

6. The following questions can be used to guide the investigation process. It is recommended that you repeat this process two to three times, investigating the effects of new materials or methods each time.

   Throughout this process, prompt students to make predictions about how each material or method could change the way the ice melts, before testing it out. Encourage students to share observations during each test and to discuss results, suggesting possible explanations for what they observe.

   - What could we test first?
   - Let's make a prediction. What do you think will happen to the ice when we place it on [material] or in [substance]?
   - What do you notice about the [materials], [substances] or [equipment] we are using?
   - What do you notice? Is this what you thought would happen?
   - Why do you think this has happened?
   - How could we measure any changes to the ice?
   - How does this compare to other materials, methods and/or substances we have tested?
   - What else could we test? How else could we try to melt the ice?

7. After exploring a number of different materials or methods for melting the ice, ask students: ***Do you think all solids melt in the same way?***

   Introduce different frozen solids (such as chocolate, coconut oil or honey). Use the materials and equipment from prior trials to test and compare how the solids melt in different situations. You may choose to discuss fair testing with the students and how students could ensure they are making fair comparisons.

8. Facilitate a think-pair-share discussion with students: ***What surprised you the most? What did you learn during the demonstration? What might you like to explore further?***

   Ask students to think of any questions that they have after participating in the demonstration. You could use the following questions to prompt student discussion: ***What else would you like to investigate? Do you have any questions that we didn't get to test? Is there anything else you would like to explore or discover?***

   Record students' questions on post-it notes for further investigation in *Melting Moments: Investigations*.

Melting Moments: Investigations

In this activity, students work collaboratively to plan and conduct scientific investigations to explore how substances can change from one state of matter to another by adding or removing heat. Students use the questions they brainstormed during *Melting Moments: Demonstration* to develop their scientific investigations.

Materials required to complete the scientific investigations will vary. It is suggested that each student group has access to the materials used in the *Melting Moments: Demonstration* (page 1). Additional or alternate equipment or materials may be required depending on the questions that you and your students choose to investigate.

Detailed step-by-step instructions on how to facilitate this activity can be seen below. It is recommended that you use these instructions to guide your students through the activity.

1. Ask students to reflect on the *Melting Moments: Demonstration* and think about the questions they identified at the end of the activity. Display student responses in a place where all students can see them.

   Inform students that you will be working together to plan and conduct scientific experiments to investigate their questions. As a class, work collaboratively to group similar questions together. Use these groups of questions to develop overarching inquiry questions that can be investigated. Example overarching inquiry questions could include:

   - How can we use different materials or methods to change how a solid melts?
   - What happens to different solids when they are heated or cooled?
   - How does changing the shape or size of a solid affect how it melts?

   You may wish for the whole class to identify an inquiry question to investigate, investigate multiple inquiry questions as a class or for student groups to choose their own inquiry question and develop individual investigations.

2. Share or negotiate any specific investigation requirements. These may include:
   - Size of student groups (three to four students per group)
   - Student roles
   - Available materials and equipment
   - Time limits students have to complete the challenge

3. Divide students into groups, ensuring each student knows their individual role if assigned.

   Discuss how students could investigate their inquiry question/s, and then plan and conduct a scientific investigation to answer the question/s using the template on page 10 (Year 3) or page 16 (Year 5).

Additional information regarding the types of inquiry questions and scientific investigations you could explore and conduct is provided below and on the following pages. You could conduct these investigations with your students or use this information to help you plan and conduct your own investigations.

Example Scientific Investigations

How can we use different materials or methods to change how a solid melts?

Students could investigate how different materials or methods affect how a solid melts. Students could conduct a number of tests where they use different materials or methods to try to melt a solid. Students may also like to modify or expand on tests conducted as part of the *Melting Moments Demonstration*. Students could measure the amount of time taken for the solid to completely melt or compare the appearance of the solids after a set period of time.

It is recommended that students keep the type of solid used for testing constant to allow for fair comparisons between tests. It is also important that the frozen solids are the same size.

Possible student investigations include:

- How do different methods of heating [solid] affect how it melts?
- Which method of heating [solid] causes it to melt the fastest?
- How do different surfaces or materials change the time it takes for [solid] to melt?
- How does water temperature affect how [solid] melts?

What happens to different substances when they are heated or cooled?

Students could investigate how different substances change when heated and cooled. This could include investigations comparing how substances (such as ice, chocolate, coconut oil or honey) change in response to different situations.

The methods used to heat or cool the substances could include:

- Using materials and equipment from the *Melting Moments Demonstration*
- Placing the substances in different locations (at room temperature, close to an air conditioner, in the shade, in sunlight, in the fridge, in the freezer etc.)

Students could record their observations of the characteristics of each substance for each test (whether they are a solid or liquid under selected conditions) or the time taken for noticeable changes to occur.

When completing investigations such as these, it is important that the amount of each substance – and the methods to heat or cool them - are kept constant to allow for students to make fair comparisons between tests.

Possible student investigations include:

- How does heating ice, chocolate and coconut oil affect its characteristics/state?
- What happens to different liquids when they are cooled?
- What happens to different solids when we place them in different locations around the school?
- Which substance will melt fastest when heated?
- Do all substances freeze in the same way?
- Do all substances melt at the same temperature?

How does changing the size or shape of a solid affect how it melts?

Students could investigate how changing the size or shape of a solid affects the time taken for it to melt. Students could break the solid up into different sized pieces (changing shape or surface area of solids) and compare how this affects the time taken for the solid to completely melt.

In order to allow for fair comparisons between tests, students should keep the type of substance (such as ice, chocolate, coconut oil), the amount of each substance and the method used to heat the substance the same.

Possible student investigations include:

- How does the size or shape of an ice cube affect how quickly it melts?
- Does crushing an ice cube change how quickly it melts?
- Will a large chocolate melt at a different rate than a small chocolate?

Curriculum Links

Science

YEAR 3

Science Understanding

A change of state between solid and liquid can be caused by adding or removing heat (ACSSU046)

Heat can be produced in many ways and can move from one object to another (ACSSU049)

Science as a Human Endeavour

Science involves making predictions and describing patterns and relationships (ACSHE050)

Science Inquiry Skills

With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge (ACSIS053)

With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment (ACSIS054)

Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately (ACSIS055)

Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends (ACSIS057)

Compare results with predictions, suggesting possible reasons for findings (ACSIS215)

Reflect on investigations, including whether a test was fair or not (ACSIS058)

Represent and communicate observations, ideas and findings using formal and informal representations (ACSIS060)

YEAR 5

Science Understanding

Solids, liquids and gases have different observable properties and behave in different ways (ACSSU077)

Science as a Human Endeavour

Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions (ACSHE081)

Science Inquiry Skills

Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks (ACSIS086)

Decide variables to be changed and measured in fair tests, and observe measure and record data with accuracy using digital technologies as appropriate (ACSIS087)

Construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data using digital technologies as appropriate (ACSIS090)

Compare data with predictions and use as evidence in developing explanations (ACSIS218)

Reflect on and suggest improvements to scientific investigations (ACSIS091)

Communicate ideas, explanations and processes using scientific representations in a variety of ways, including multi-modal texts (ACSIS093)

General Capabilities

Literacy

Composing texts through speaking, writing and creating

Word knowledge

Numeracy

Estimate and measure with metric units

Critical and Creative Thinking

Inquiring – identifying, exploring and organising information and ideas

Generating ideas, possibilities and actions

Reflecting on thinking and processes

Analysing, synthesising and evaluating reasoning and procedures

Personal and Social Capability

Social management

Melting Moments: Scientific Investigation

Student Activity

Year 3 Scientific Investigation

Inquiry Question:

Why are you conducting this investigation? What do you want to investigate?

What happens to _____ when we _____?

Prediction: What do you think will happen? Why?

Variables: How will you make sure the test is fair? Decide what you will...

Change	Measure/Observe	Keep the same

Materials: What equipment or materials will your group need to complete the experiment?

Method: How will your group investigate your question?

Safety: How will you work safely during this investigation?

Results: What did you observe? Record your observations in the table below.

	Test A: _____	**Test B:** _____	**Test C:** _____
Before	Draw what _____ looked like at the start of the experiment.		
	Describe what _____ looked like at the start of the experiment.		
After	Draw what _____ looked like after the experiment.		
	Describe what _____ looked like after the experiment.		

Word Bank		
melted	liquid	warm
frozen	solid	cold
hard	soft	runny

Present your findings in a table and a graph.

	Test A: _____	**Test B:** _____	**Test C:** _____
How long did it take the solids to melt? (seconds/ minutes)			

Title:

Time taken for solids to melt (seconds/minutes)

Test A: _____				**Test B:** _____				**Test C:** _____			

Questions:

1. How did your results compare with your prediction?

2. Explain your results and findings. What did you find?

3. Why do you think this happened?

4. Was the investigation fair? Why or why not?

5. Reflect on your investigation. What worked well and what was challenging?

6. How could you improve your investigation?

Melting Moments: Scientific Investigation

Student Activity

Year 5 Scientific Investigation

Aim: State why you are conducting this investigation. What do you want to investigate?

Hypothesis: Predict what you think will happen. Explain why you made this prediction.

Variables: Decide which variables should be changed, measured or kept the same in your investigation.

Independent variable What will you change?	**Dependent variable** What will you measure/observe?	**Controlled variables** What will you keep the same?

Consider the elements of a fair test. Explain how you will make your investigation as fair as possible?

Materials: Identify the equipment and materials your group will need to complete your experiment.

Method: Develop a method to investigate your question.

Diagram: Create a labelled diagram showing your experimental set up.

Safety Considerations: What safety considerations must be made before, during and after this experiment? Identify at least four potential hazards and how to minimise them.

Potential hazards	How to minimise hazards

Results: Represent your results in a table and a graph. You could use a digital spreadsheet to complete this task.

Questions:

1. Describe what you observed when conducting your investigation.

2. Why do you think this happened? Apply your understanding of states of matter and the properties of solids, liquids and gases to explain your observations.

3. Create a diagram to support your explanation.

4. Compare your observations to your hypothesis. Was your initial prediction correct?

5. Explain any challenges you experienced when completing this investigation, and how you did or could overcome them.

6. Suggest how you could improve the investigation to make it more accurate or fair.