YEAR 7

Science

STUDENT COMPANION

Pearson | Secondary Teaching Hub

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Pearson Secondary Teaching Hub Science 7

Student Companion

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We respect the living cultures of Aboriginal and Torres Strait Islander peoples and their ongoing connection to Country across lands, sky, seas, waterways and communities. We celebrate the richness of Indigenous Knowledge systems, shared with us and with schools Australia-wide.

We pay our respects to Elders, past and present.

Pearson Australia
(a division of Pearson Australia Group Pty Ltd)
459–471 Church Street
Level 1, Building B
Richmond, Victoria 3121
www.pearson.com.au

(a division of Pearson Australia Group Pty Ltd)
First published 2023 by Pearson Australia
2026 2025 2024 2023

10 9 8 7 6 5 4 3 2 1

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Illustrator/s: DiacriTech and QBS Learning
Proofreader: XXX
Publishing Service: Jit Pin Chong
Printed in XXX
ISBN 9780655713784
Pearson Australia Group Pty Ltd ABN 40 004 245 943

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Practical investigations and inquiry activities

All practical investigations and inquiry activities, including the illustrations, are provided as a guide only and the accuracy of such information cannot be guaranteed. Teachers must assess the appropriateness of an activity and take into account the experience of their students and facilities available. Additionally, all practical investigations and inquiry activities should be trialled before they are attempted with students and a risk assessment must be completed. All care should be taken and appropriate personal protective clothing and equipment should be worn when carrying out any practical investigation or inquiry activity. Although all practical investigations and inquiry activities have been written with safety in mind, Pearson Australia and the authors do not accept any responsibility for the information contained in or relating to the practical investigations and inquiry activities and are not liable for loss and/or injury arising from or sustained as a result of conducting any of the practical investigations or inquiry activities described in this Student Companion.

Contents

Contents

How to use this Student Companion

The Student Companion is a complementary resource that offers a print medium for corresponding lessons in Pearson Secondary Teaching Hub. It is designed to support teaching and learning by providing learners with a place to create a portfolio of learning to suit their individual needs, whether you are:

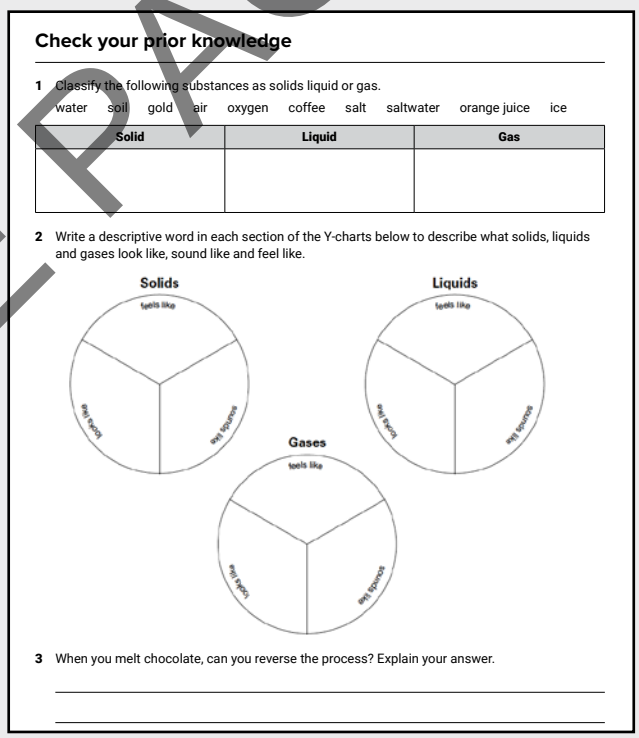
- supporting a blended classroom using the strengths of print and digital
- preparing for exams by creating a study guide or bound reference
- needing a tool to differentiate learning or
- looking for meaningful homework tasks.

Learners can develop their portfolio of learning as part of classroom learning or at home as an additional opportunity to engage and re-engage with the knowledge and skills from the lesson.

This could be done as prior learning in a flipped classroom environment or as an additional revision or homework task.

Check your prior knowledge

Each topic begins with 3–5 questions that test learners' knowledge from previous years or topics in the Australian Curriculum. These questions provide insight into learners' prior knowledge before beginning a topic, allowing teachers to adapt their teaching and support as needed.



Check your prior knowledge

1 Classify the following substances as solids liquid or gas.

water soil gold air oxygen coffee salt saltwater orange juice ice

Solid	Liquid	Gas

2 Write a descriptive word in each section of the Y-charts below to describe what solids, liquids and gases look like, sound like and feel like.

Solids — feels like — looks like — sounds like

Liquids — feels like — looks like — sounds like

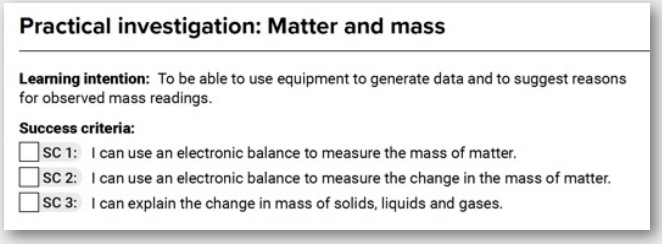
Gases — feels like — looks like — sounds like

3 When you melt chocolate, can you reverse the process? Explain your answer.

Learning intentions and success criteria

Learning intentions are provided for every lesson. The learning intentions are goals or objectives that align to the corresponding digital lesson. They describe what learners should know, understand or be able to do by the end of the lesson.

Success criteria clarify expectations and describe what success looks like. The success criteria are specific, concrete and measurable so learners can actively engage with and reflect on their evidence of learning within each lesson.



Practical investigation: Matter and mass

Learning intention: To be able to use equipment to generate data and to suggest reasons for observed mass readings.

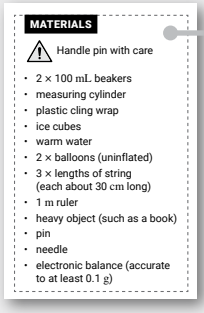
Success criteria:

- ☐ SC 1: I can use an electronic balance to measure the mass of matter.
- ☐ SC 2: I can use an electronic balance to measure the change in the mass of matter.
- ☐ SC 3: I can explain the change in mass of solids, liquids and gases.

Icons and features

The Teaching Hub icon prompts learners to engage with supporting digital resources to enhance their learning.

SPARKlab icons direct learners to alternative, online practical investigations.



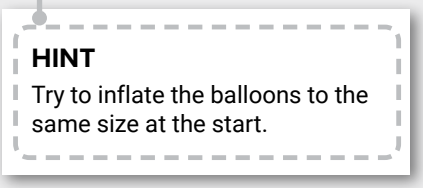
MATERIALS

⚠ Handle pin with care

- 2 × 100 mL beakers
- measuring cylinder
- plastic cling wrap
- ice cubes
- warm water
- 2 × balloons (uninflated)
- 3 × lengths of string (each about 30 cm long)
- 1 m ruler
- heavy object (such as a book)
- pin
- needle
- electronic balance (accurate to at least 0.1 g)

Materials boxes list all the materials needed to complete a practical investigation. Some include a safety icon that highlights any substances or equipment that require care when preparing or using them.

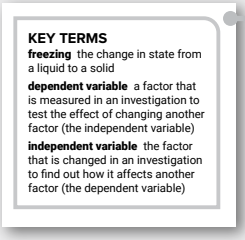
Hint boxes provide hints and tips where relevant in practical investigations and inquiry activities.



HINT

Try to inflate the balloons to the same size at the start.

The **safety icon** highlights substances or equipment that may cause harm. Be sure to prepare a risk assessment for these activities and take care when preparing or using these substances and equipment.



KEY TERMS

freezing the change in state from a liquid to a solid

dependent variable a factor that is measured in an investigation to test the effect of changing another factor (the independent variable)

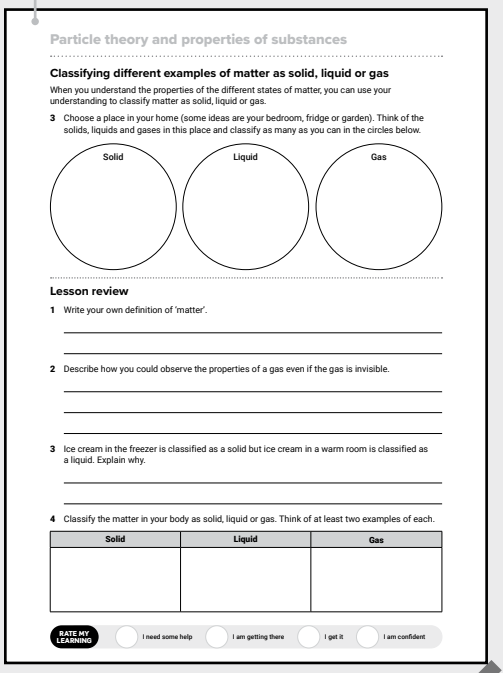
independent variable the factor that is changed in an investigation to find out how it affects another factor (the dependent variable)

Key term boxes provide learners with definitions for the bolded key terms found throughout the text, supporting the development of their scientific vocabulary and literacy.

Check-in boxes prompt learners to check their risk assessment, method or plan with a teacher before proceeding with the ¬¬practical investigation or inquiry activity.

☐ Check in with your teacher to discuss your method and risk assessment.

Theory lessons support the development of science knowledge and understanding by providing content in short, accessible chunks. Questions to check learners' understanding are provided at regular intervals throughout the lesson. Each theory lesson ends with a lesson review that includes 3–6 questions.



Particle theory and properties of substances

Classifying different examples of matter as solid, liquid or gas

When you understand the properties of the different states of matter, you can use your understanding to classify matter as solid, liquid or gas.

3 Choose a place in your home (some ideas are your bedroom, fridge or garden). Think of the solids, liquids and gases in this place and classify as many as you can in the circles below.

Solid | Liquid | Gas

Lesson review

1 Write your own definition of 'matter'.

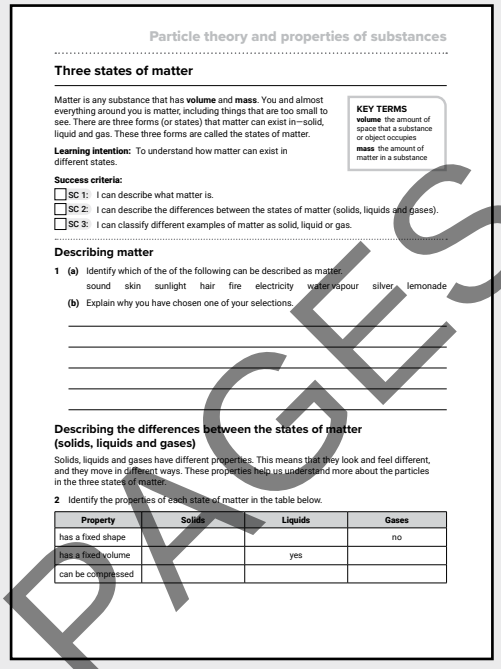
2 Describe how you could observe the properties of a gas even if the gas is invisible.

3 Ice cream in the freezer is classified as a solid but ice cream in a warm room is classified as a liquid. Explain why.

4 Classify the matter in your body as solid, liquid or gas. Think of at least two examples of each.

Solid	Liquid	Gas

RATE MY LEARNING — I need some help | I am getting there | I get it | I am confident



Particle theory and properties of substances

Three states of matter

Matter is any substance that has **volume** and **mass**. You and almost everything around you is matter, including things that are too small to see. There are three forms (or states) that matter can exist in—solid, liquid and gas. These three forms are called the states of matter.

KEY TERMS
volume the amount of space that a substance or object occupies
mass the amount of matter in a substance

Learning intention: To understand how matter can exist in different states.

Success criteria:
- SC 1: I can describe what matter is.
- SC 2: I can describe the differences between the states of matter (solids, liquids and gases).
- SC 3: I can classify different examples of matter as solid, liquid or gas.

Describing matter

1 (a) Identify which of the of the following can be described as matter.
sound skin sunlight hair fire electricity water vapour silver lemonade

(b) Explain why you have chosen one of your selections.

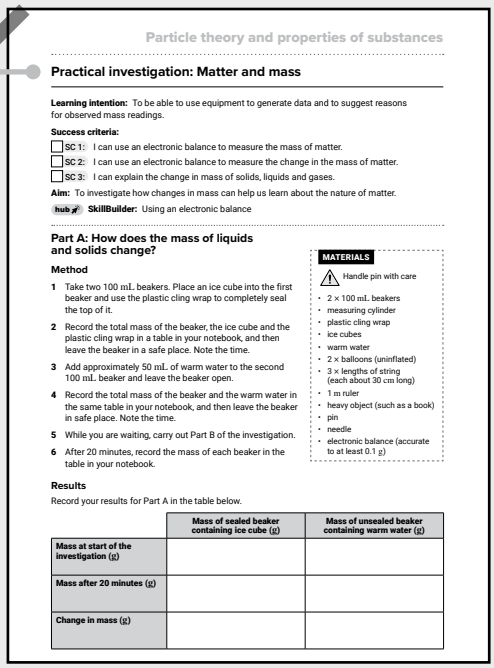
Describing the differences between the states of matter (solids, liquids and gases)

Solids, liquids and gases have different properties. This means that they look and feel different, and they move in different ways. These properties help us understand more about the particles in the three states of matter.

2 Identify the properties of each state of matter in the table below.

Property	Solids	Liquids	Gases
has a fixed shape			no
has a fixed volume		yes	
can be compressed			

Practical investigations offer learners the chance to complete practical work related to the topics in their Student Companion. They will have the chance to design and conduct experiments, record results, analyse data, and prepare evidence-based conclusions. Risk assessments will need to be completed for all practical investigations, to ensure learners understand how to conduct investigations safely. SPARKlab icons indicate where an alternative, online practical investigation is available <TBC>.



Particle theory and properties of substances

Practical investigation: Matter and mass

Learning intention: To be able to use equipment to generate data and to suggest reasons for observed mass readings.

Success criteria:
- SC 1: I can use an electronic balance to measure the mass of matter.
- SC 2: I can use an electronic balance to measure the change in the mass of matter.
- SC 3: I can explain the change in mass of solids, liquids and gases.

Aim: To investigate how changes in mass can help us learn about the nature of matter.

hub **SkillBuilder:** Using an electronic balance

Part A: How does the mass of liquids and solids change?

MATERIALS
- ⚠ Handle pin with care
- 2 × 100 mL beakers
- measuring cylinder
- plastic cling wrap
- ice cubes
- warm water
- 2 × balloons (uninflated)
- 3 × lengths of string (each about 30 cm long)
- 1 m ruler
- heavy object (such as a book)
- pin
- needle
- electronic balance (accurate to at least 0.1 g)

Method

1 Take two 100 mL beakers. Place an ice cube into the first beaker and use the plastic cling wrap to completely seal the top of it.

2 Record the total mass of the beaker, the ice cube and the plastic cling wrap in a table in your notebook, and then leave the beaker in a safe place. Note the time.

3 Add approximately 50 mL of warm water to the second 100 mL beaker and leave the beaker open.

4 Record the total mass of the beaker and the warm water in the same table in your notebook, and then leave the beaker in safe place. Note the time.

5 While you are waiting, carry out Part B of the investigation.

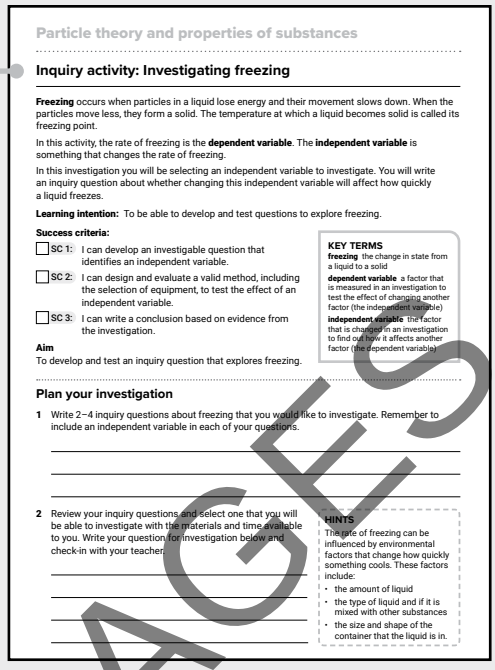
6 After 20 minutes, record the mass of each beaker in the table in your notebook.

Results

Record your results for Part A in the table below.

	Mass of sealed beaker containing ice cube (g)	Mass of unsealed beaker containing warm water (g)
Mass at start of the investigation (g)		
Mass after 20 minutes (g)		
Change in mass (g)		

Inquiry activities are open-ended investigations that encourage learners to plan and design solutions to problems. Learners are encouraged to improve and evaluate their ideas, designs or investigations. Inquiry activities require learners to use their understanding of scientific concepts and the science inquiry skills that they have developed throughout each topic in the Student Companion.



Particle theory and properties of substances

Inquiry activity: Investigating freezing

Freezing occurs when particles in a liquid lose energy and their movement slows down. When the particles move less, they form a solid. The temperature at which a liquid becomes solid is called its freezing point.

In this activity, the rate of freezing is the **dependent variable**. The **independent variable** is something that changes the rate of freezing.

In this investigation you will be selecting an independent variable to investigate. You will write an inquiry question about whether changing this independent variable will affect how quickly a liquid freezes.

Learning intention: To be able to develop and test questions to explore freezing.

Success criteria:

- ☐ SC 1: I can develop an investigable question that identifies an independent variable.
- ☐ SC 2: I can design and evaluate a valid method, including the selection of equipment, to test the effect of an independent variable.
- ☐ SC 3: I can write a conclusion based on evidence from the investigation.

KEY TERMS
freezing the change in state from a liquid to a solid
dependent variable a factor that is measured in an investigation to test the effect of changing another factor (the independent variable)
independent variable the factor that is changed in an investigation to find out how it affects another factor (the dependent variable)

Aim
To develop and test an inquiry question that explores freezing.

Plan your investigation

1 Write 2–4 inquiry questions about freezing that you would like to investigate. Remember to include an independent variable in each of your questions.

2 Review your inquiry questions and select one that you will be able to investigate with the materials and time available to you. Write your question for investigation below and check-in with your teacher.

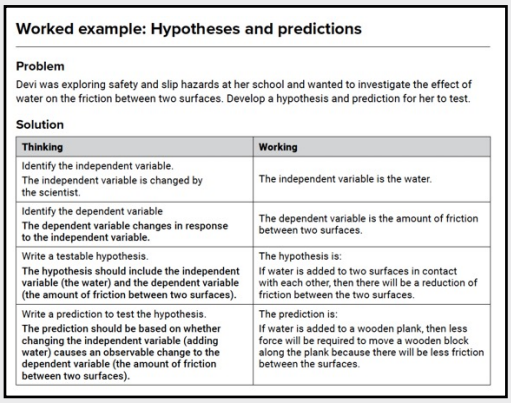
HINTS
The rate of freezing can be influenced by environmental factors that change how quickly something cools. These factors include:
- the amount of liquid
- the type of liquid and if it is mixed with other substances
- the size and shape of the container that the liquid is in.

Worked examples

Worked examples provide learners with a step-by-step demonstration of how the skill or concept is applied in a geographical context. The worked examples in the Student Companion are provided to:

- scaffold learning
- support skill acquisition
- reduce the cognitive load.

The worked examples are an effective tool to demonstrate what success looks like. The 'try yourself' format of the worked examples in the Student Companion support the gradual release of responsibility. Learners can view a completed worked example and a video walkthrough of the worked example in the corresponding digital lesson and then apply the scaffolded steps themselves to solve a unique problem.

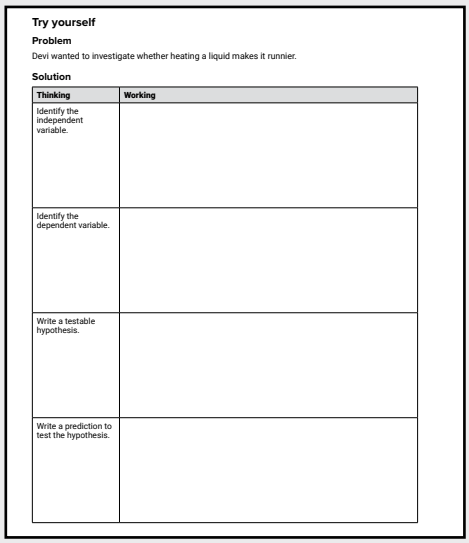


Worked example: Hypotheses and predictions

Problem
Devi was exploring safety and slip hazards at her school and wanted to investigate the effect of water on the friction between two surfaces. Develop a hypothesis and prediction for her to test.

Solution

Thinking	Working
Identify the independent variable. The independent variable is changed by the scientist.	The independent variable is the water.
Identify the dependent variable **The dependent variable changes in response to the independent variable.**	The dependent variable is the amount of friction between two surfaces.
Write a testable hypothesis. **The hypothesis should include the independent variable (the water) and the dependent variable (the amount of friction between two surfaces).**	The hypothesis is: If water is added to two surfaces in contact with each other, then there will be a reduction of friction between the two surfaces.
Write a prediction to test the hypothesis. **The prediction should be based on whether changing the independent variable (adding water) causes an observable change to the dependent variable (the amount of friction between two surfaces).**	The prediction is: If water is added to a wooden plank, then less force will be required to move a wooden block along the plank because there will be less friction between the surfaces.



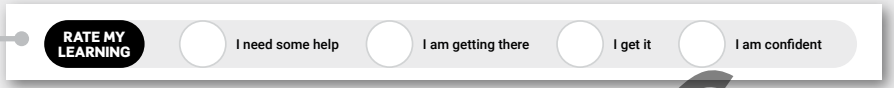
Try yourself

Problem
Devi wanted to investigate whether heating a liquid makes it runnier.

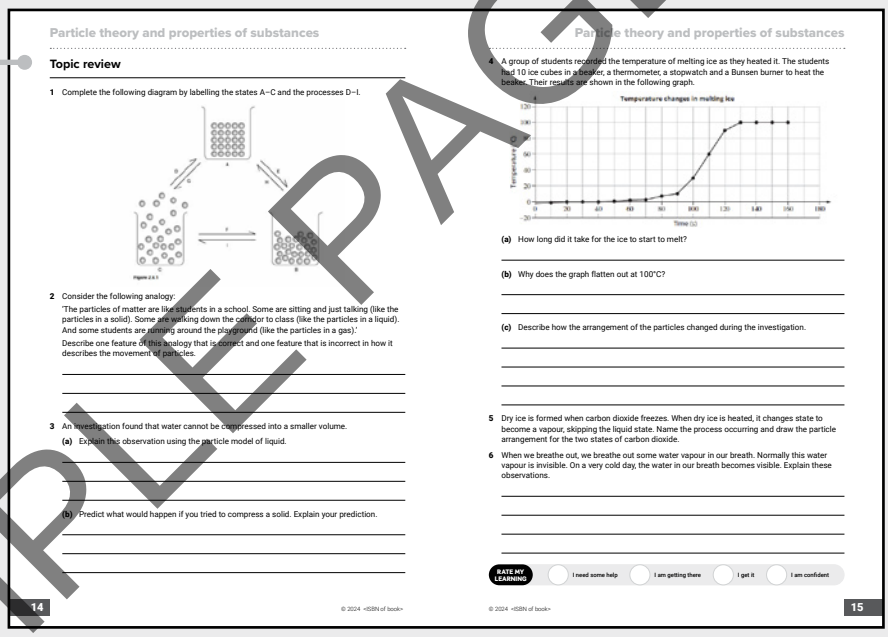
Solution

Thinking	Working
Identify the independent variable.	
Identify the dependent variable.	
Write a testable hypothesis.	
Write a prediction to test the hypothesis.	

Reflection tool (Rate my learning horizontal bar) Each lesson in the Student Companion contains a space for students to reflect on their understanding. The simple and intuitive design of the lesson reflection tool allows students to scale their confidence, reflect on their learning and identify areas in which they need support.



Topic review Each topic finishes with a topic review that includes 8–15 questions that address every learning intention in the topic. These questions give learners the opportunity to apply the knowledge and skills they have developed throughout the topic.



Particle theory and properties of substances

Topic review

1 Complete the following diagram by labelling the states A–C and the processes D–I.

2 Consider the following analogy:
'The particles of matter are like students in a school. Some are sitting and just talking (like the particles in a solid). Some are walking down the corridor to class (like the particles in a liquid). And some students are running around the playground (like the particles in a gas).'
Describe one feature of this analogy that is correct and one feature that is incorrect in how it describes the movement of particles.

3 An investigation found that water cannot be compressed into a smaller volume.
(a) Explain this observation using the particle model of liquid.

(b) Predict what would happen if you tried to compress a solid. Explain your prediction.

4 A group of students recorded the temperature of melting ice as they heated it. The students had 10 ice cubes in a beaker, a thermometer, a stopwatch and a Bunsen burner to heat the beaker. Their results are shown in the following graph.

(a) How long did it take for the ice to start to melt?

(b) Why does the graph flatten out at 100°C?

(c) Describe how the arrangement of the particles changed during the investigation.

5 Dry ice is formed when carbon dioxide freezes. When dry ice is heated, it changes state to become a vapour, skipping the liquid state. Name the process occurring and draw the particle arrangement for the two states of carbon dioxide.

6 When we breathe out, we breathe out some water vapour in our breath. Normally this water vapour is invisible. On a very cold day, the water in our breath becomes visible. Explain these observations.

Particle theory and properties of substances

Heat and particles

Heat is always present, and it affects what we do and how we feel. Even when we feel cold, heat is still there, it is just less heat than when we feel hot. Heat is a form of energy, which means it can cause change or movement.

Materials are all made of **particles,** and heat **energy** make the particles move. The more heat a material has, the more the particles move. If the heat is reduced, the particles move less. We can measure these changes in heat by measuring temperature.

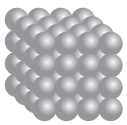
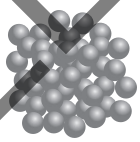
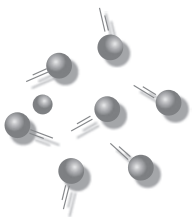
Learning intention: To understand how heat affects the movement of particles in solids, liquids and gases

Success criteria

- ☐ SC 1: I can describe changes to particle movement when particles are heated or cooled.
- ☐ SC 2: I can explain changes to the properties of solids, liquids and gases when particles are heated or cooled.

How does heat affect particle movement?

We can model how particles move in **solids**, **liquid** and **gas**.

Solid	Liquid	Gas
Particles vibrate backwards and forwards but stay in the same position. 	Particles move slowly past each other. 	Particles move in all directions at different speeds, some very fast. 

Changes in **temperature** change the energy available to particles, which affects their movement. The more energy that is available to particles in the form of heat energy, the faster they will move.

KEY TERM
Energy the ability to do work; can be in many forms including heat, movement and electricity.

As the energy of particles increases or decreases, the temperature of the substance made from these particles will also increase or decrease. Therefore, temperature is a measure of the energy of particles.

(a) Are heat and temperature the same thing? Explain your answer.

(b) Particles in a solid are fixed in one place. What will happen to these particles if the solid is cooled down?

Heating and cooling

Warming things up requires adding heat energy and cooling things down requires removing heat energy. As you have learnt, when particles are heated and cooled, their energy and movement change. These changes in particle movement affect the properties of solids, liquids and gases.

What do we observe when the movement of particles changes?

When a substance is heated, the particles in it move faster and further apart because they have more energy. This will cause the substance to **expand**.

When a substance is cooled, the particles in it move slower and closer together because they have less energy. This will cause the substance to **contract**.

A student placed an inflated balloon in the freezer for two hours. Describe what will be observed when the balloon is taken out of the freezer. Use a diagram to explain your answer.

Lesson review

1 Helium balloons are often used at parties. Describe two ways that the behaviour of particles in a helium balloon will change as the balloon cools down at night.

2 Thermometers work because the liquids inside the glass tube expand and are forced up the narrow tube. Predict, with a reason, if the glass tube itself will expand as the thermometer heats up.

3 When railway tracks are joined, a small gap is left as shown in the photograph. Describe, in terms of particles in solids, why this is done.

RATE MY LEARNING ○ I need some help ○ I am getting there ○ I get it ○ I am confident

Particle theory and properties of substances

Practical investigation: How a thermometer works

Learning intention: To be able to develop and test a hypothesis to explore the particle model

Success criteria:

- ☐ SC 1: I can predict the effect of heat on a liquid using particle theory.
- ☐ SC 2: I can measure accurate experimental readings to test the prediction.
- ☐ SC 3: I can evaluate how well the experiment tested the hypothesis.

Suggestion duration: 40 minutes

Background

When the temperature increases, particles in substances gain energy and move more. This can cause the substance to **expand**. This can cause problems, such as cracking or bending of solids, and explosions of gases. But can we use this property for a useful purpose?

KEY TERMS
expand

In this practical investigation you will make a thermometer to investigate how the expansion of a liquid can be used to measure temperature change.

Aim

To explore whether the expansion and contraction of a liquid can be used to measure temperature.

Hypothesis

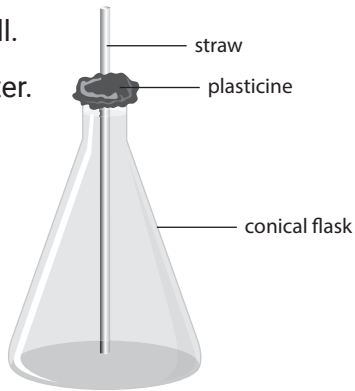
Write a **hypothesis** that describes how the **volume** of water will change when the temperature is increased and when the temperature is decreased.

In this investigation, the volume of the water is the **dependent variable**, and temperature is the **independent variable**.

hub **SkillBuilder:** Hypotheses and predictions
Worked example: Hypotheses and predictions
SkillBuilder: Writing a hypothesis

Method: Making a thermometer

1. Fill the 250 mL conical flask with room temperature water to almost full.
2. Add 2–3 drops of food dye to the water.
3. Insert the clear drinking straw into the flask.
4. Use the plasticine to make an airtight seal over the top of the flask, with the straw going through the middle of the plasticine, as shown in the diagram.

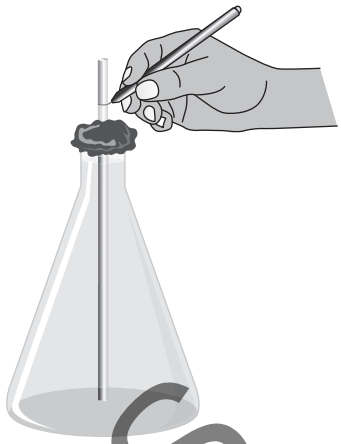


MATERIALS

⚠ The hot water should be no hotter than 60°C.

- 250 mL conical flask
- food dye
- clear drinking straw
- plasticine
- water (cold, room temperature and hot)
- ice
- permanent marker pen
- stopwatch/timer

Method: Setting up the thermometer



1 Carefully blow down the drinking straw for a couple of seconds. Water should rise up the straw. Blow into the straw until the water level stays about 1 cm above the plasticine plug.

2 Use the marker pen to mark this water level as shown in the diagram. Your 'thermometer' is now ready to use.

Prediction

What will you observe when the water in the flask is heated and then cooled? Write your prediction below.

Method: Using the thermometer

1 Hold the flask in your hand to warm the flask up for a couple of minutes. Use the permanent marker to mark the maximum height that the water reaches in the straw.

2 Half-fill a container with hot water.

3 Place the flask in the hot water for two minutes. Use the permanent marker to mark the maximum height that the water reaches in the straw.

4 Half-fill a container with cold water and ice.

5 Place the flask in the ice water for two minutes. Mark the minimum height that the water reaches in the straw.

Results

Record your observations in the table below.

Action on flask	Prediction	Above or below original mark?	Distance from original mark (mm)
warmed with hands			
warmed with hot water			
cooled in ice water			

Conclusion

Write a conclusion for your investigation by answering the following:

- How accurate was your prediction?
- What caused the observations that you saw? This should relate back to your hypothesis.

- How well do you think your thermometer could be used to measure or compare temperatures? Use evidence from your investigation to answer this question.
  - Thermometers usually do not use water but instead use coloured alcohol (ethanol). Suggest a reason why alcohol might be better than coloured water for measuring temperature.

Evaluation

How well do you think your investigation tested your hypothesis?

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