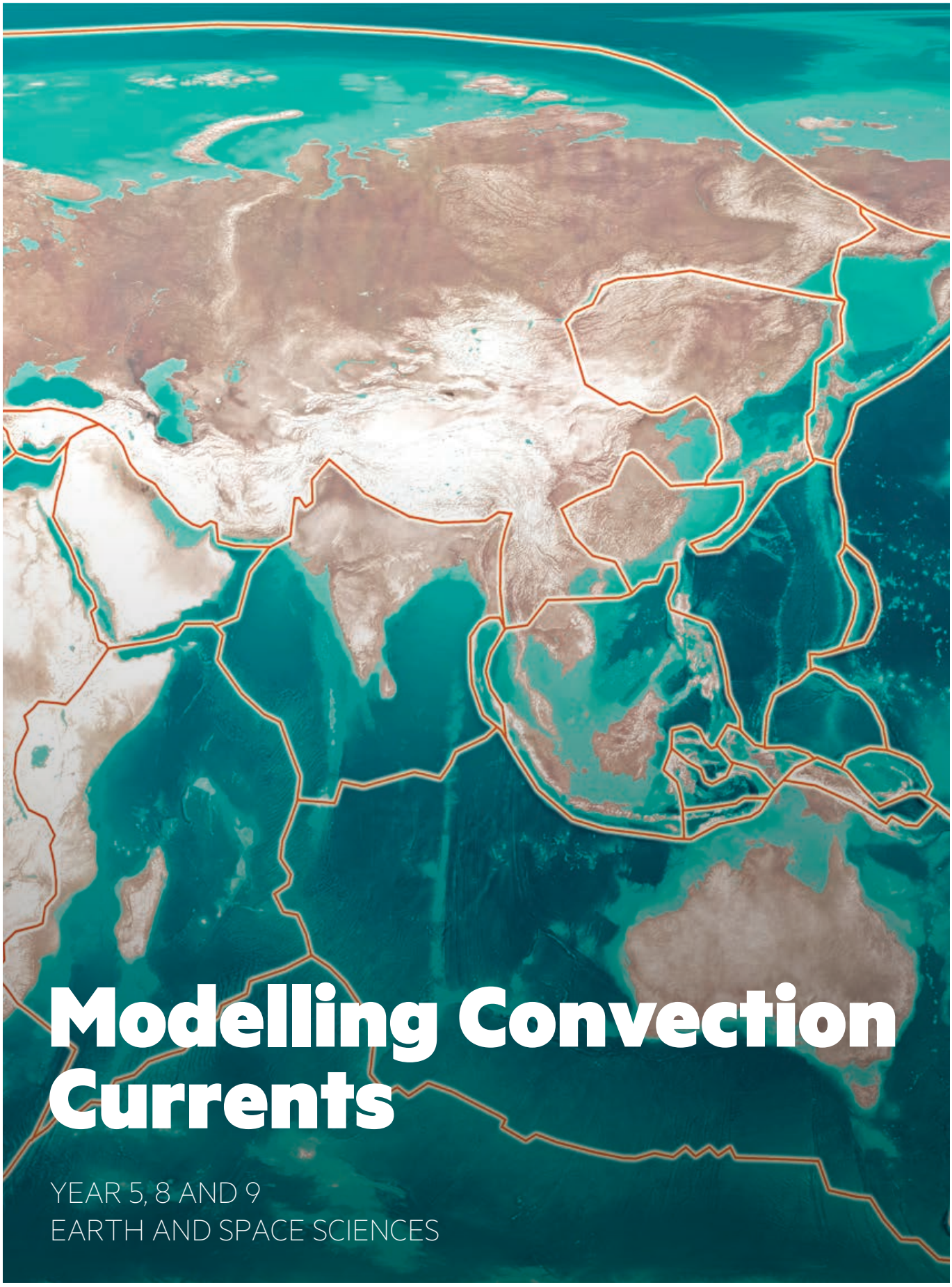

Modelling Convection Currents

YEAR 5, 8 AND 9
EARTH AND SPACE 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

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

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Thank you to the University of Queensland School of Education for contributing to a number of the activities included in this workbook.

ELABORATE

Modelling Convection Currents

Teacher Resource

Before starting the following activity, it is recommended that students draw and label a cross section of the Earth including the following labels: crust, mantel, core, ridge, divergent plate boundary, convergent plate boundary, convection current, movement.

The Earth is made of four layers: the inner and outer core, the mantle and the crust. The mantle is the largest layer. The top of the mantle near the crust is cooler than near the core. The temperature differential through the mantle causes convection currents, driving the gradual flow of the mantle. The flow from the convection currents also drives the movement of the tectonic plates!

Rheoscopic fluid highlights the currents in a liquid and can be used to model convection currents, similar to the Earth's mantle. It can be purchased from science suppliers; alternatively, you can find instructions for making a similar fluid online. Food dye can be added to the rheoscopic fluid to make it easier to observe these currents.

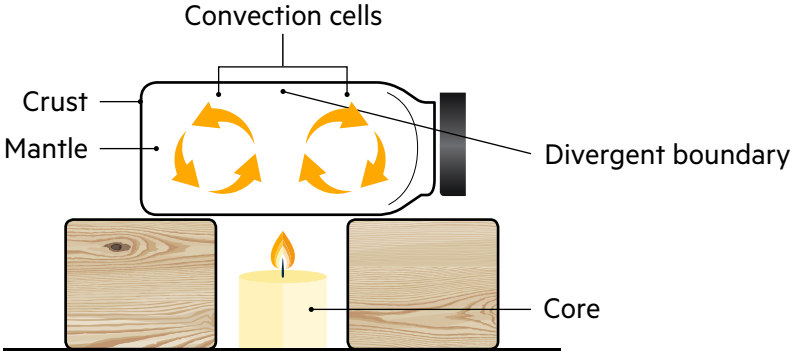
When a candle is used to heat the liquid, the particles in the liquid expand and the density decreases, causing the hotter liquid to move to the top of the bottle. This displaces the cooler liquid which sinks below, and is then heated continuing to drive the convection current.

In the following activity, students conduct an experiment and explain and analyse the experiment as a model for convection currents and plate tectonics.

After this activity you may wish explore visualisations of convection currents and continental drift. *Tectonics Investigator* on *Scootle* is a valuable interactive.

It can also be valuable for students to reflect on how their increased understanding of convection currents can help explain the world around them.

Rheoscopic fluid is useful for teaching heat transfer and particle theory, as well as modelling convection currents in the mantle and plate tectonics. The model represents the processes and materials as shown below.



How the model represents the process of continental drift (a possible response for Question 4).

Curriculum Links

Science

YEAR 5

Science Understanding

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

YEAR 8

Science Understanding

Energy appears in different forms, including movement (kinetic energy), heat and potential energy, and energy transformations and transfers cause change within systems (ACSSU155)

YEAR 9

Science Understanding

The theory of plate tectonics explains global patterns of geological activity and continental movement (ACSSU180)

Energy transfer through different mediums can be explained using wave and particle models (ACSSU182)

Science as a Human Endeavour

Scientific understanding, including models and theories, is contestable and is refined over time through a process of review by the scientific community (ACSHE157)

Science Inquiry Skills

Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (ACSIS170)

Evaluate conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data (ACSIS171)

Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations (ACSIS174)

General Capabilities

Critical and Creative Thinking

Inquiring – identifying, exploring and organising information and ideas

Analysing, synthesising and evaluating reasoning and procedures

Modelling Convection Currents

Student Activity

Aim

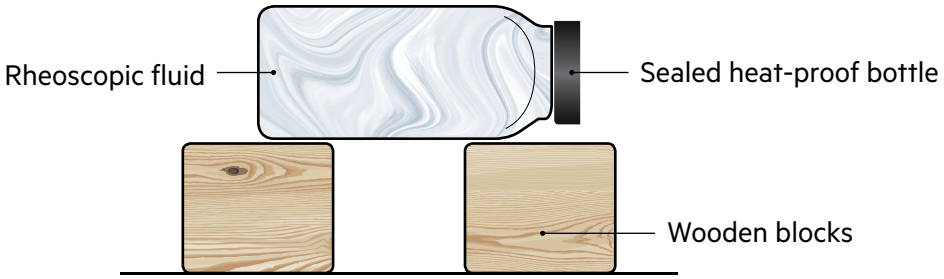
To observe a model of convection currents, and understand how convection currents link to the movement of tectonic plates.

Materials

- Rheoscopic convection fluid
- Sealed heat-proof bottle
- Tea light candle
- Matches
- Wooden blocks
- Blu tack/plasticine

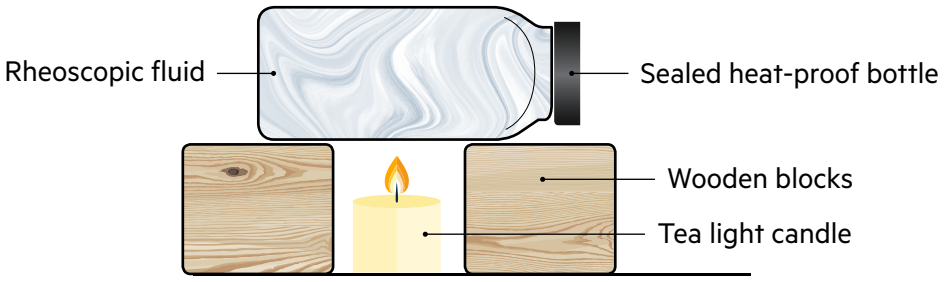
Method

1. Complete the K (what I know) and W (what I want to know) parts of the KWL chart (page 17).
2. Set up materials as shown in the diagram below. Use blu tack to secure bottle to wooden blocks.



Material set-up.

3. While the bottle is stationary, observe current flow in the rheoscopic fluid for 1 minute. Record observations in results table on page 17.
4. Place a tea light candle under the heat-proof bottle (see below). Observe current flow in the rheoscopic fluid for 3 minutes. Record observations and complete the questions below.



Using heat to model convection currents.

Questions

1. Before your experiment, complete the K and W sections of the KWL chart below.

Table: KWL chart on convection currents.

What I **K**now about convection currents:	What I **W**ant to know about convection currents:	What I **L**earned about convection currents and how tectonic plates move:

2. During the experiment record your observations:

Table: Observations of results

Observations without heat source	Observations with heat source

3. Compare fluid movement without a heat source to fluid movement with a heat source. Why do you think these differences occurred?

4. This experiment can model plate tectonics. Draw a scientific diagram of material setup with the heat source and use arrows to show the fluid movement. Add the following labels to the diagram to show how the model represents continental drift:

convection current	crust	mantle	core	divergent plate boundary	ridge

5. Explain how this experiment represents the convection currents that occur within the Earth and the movement of tectonic plates.

6. Discuss similarities and differences between this model and tectonic plate movement.

7. How could you improve this model?

8. What did you learn? Complete the L section of the KWL chart.