Investigate and Innovate with CSIRO

Indigenous Research Methodology (IRM) - Water

Water in the environment and groundwater

My name:	
My team:	
Our focus question:	

Student workbook and resources

Acknowledgement of Country

CSIRO acknowledges the Traditional Owners of the lands, seas and waters of the area that we live and work on across Australia. We acknowledge all Aboriginal and Torres Strait Islander peoples and their continuing connection to their culture and pay our respects to Elders past and present. CSIRO is committed to reconciliation and recognises that Aboriginal and Torres Strait Islander peoples have made contributions to all aspects of Australian life including culture, economy and science.

'Eternal Wisdom, Infinite Innovation'
artwork by Rachael Sarra, working with Gilimbaa.

Contents

Indigenous Research Methodology (IRM) – what is the IRM?

The Indigenous Research Methodology (IRM) (Moggridge, 2022) is a framework for learning science through Aboriginal and Torres Strait Islander Peoples' deep knowledge of Country. It connects Indigenous and western scientific approaches through shared practices like observing, predicting and testing.

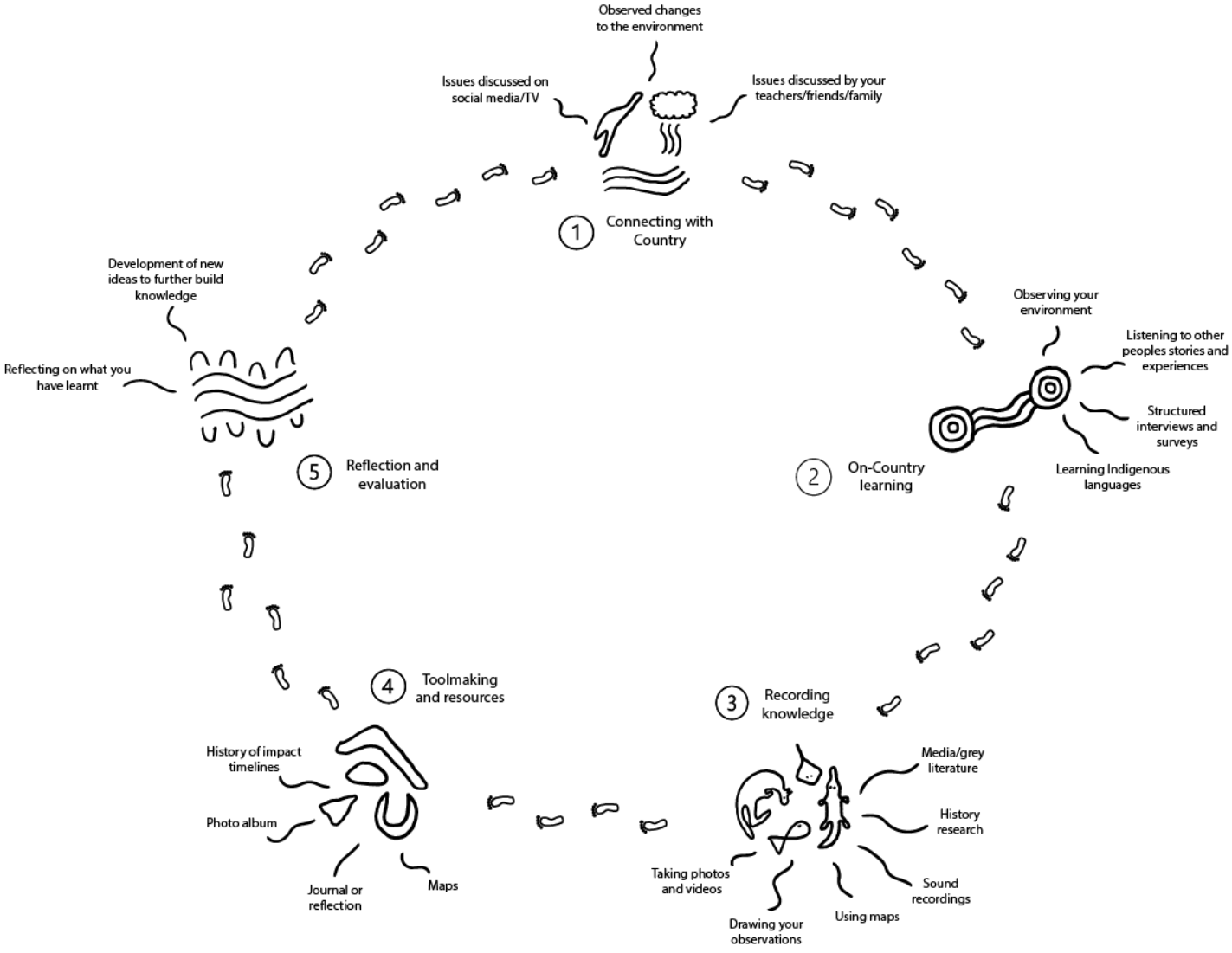


Figure 1 Indigenous Research Methodology diagram

IRM Stage	Image	Explanation
1. Connecting with Country		Elements of Country, including the Great Emu in the Sky constellation, rainfall and a flowing river, represent the first stage. Indigenous Peoples have been observing Country since time immemorial. They comprehensively understand all elements of Country including Land, Water and Sky Country. For example, if a river flow changes, Indigenous Peoples can foresee the flow on effects to other parts of Country.
2. On-Country learning		The symbol of places on Country connected by waterways represents the second stage. Indigenous Peoples learn about Country by walking, seeing, smelling, hearing and feeling Country. Country is constantly changing and therefore Indigenous Knowledge is always flowing and evolving. For example, senior Indigenous Peoples may walk Country to monitor wind behaviour, temperature and soil moisture levels before conducting a cultural burn.
3. Recording knowledge		Sandstone engravings of culturally significant animals symbolise the third stage. Indigenous Peoples have recorded and preserved data and knowledge for thousands of years. They store knowledge in Dreaming stories, rock art, technology, ceremonies, songs, dances and Songlines. Kinship systems including human and non-human relations, age and gender, guide how knowledge is held, communicated and passed on.
4. Toolmaking and resources		Cultural objects, including a boomerang, grinding stone, fishhook and spearhead, represent the fourth stage. Preserving, sharing and passing on knowledge of Country has allowed Indigenous Peoples to continually create new tools and resources to manage their Country, live sustainably and adapt to environmental change. For example, fish traps are another helpful tool that Indigenous people continue to preserve and modify to source food more efficiently and sustainably.
5. Reflection and evaluation		The symbol of people gathering and fishing along a river represents the fifth stage. When new tools or practises are implemented to respond to Country, Indigenous Peoples to have always monitored, evaluated and managed their impacts on Country and their communities. For example, the return of cultural species after a cultural burn or flood may indicate healthy Country.

Icons:

Throughout your workbook you will see these icons (below) to highlight the type of activity and guidance recommended.

Investigation #1: Science: IRM water in the environment

How much do you know about water in your environment? Have you seen and understood where water goes and how it shapes your school?

In this activity, you will be closely observing Country and using an Indigenous Research Method to explore how water travels through your environment. Just like the CSIRO scientists who are using these methods to study Australia's water and its history, you will collect data from your own observations On Country to learn about how water has and is shaping our world.

Figure 2 Narran River, May 2025

Connecting with Country

How does water move through and shape the school grounds?

Acknowledgement of Country

- Who are the Traditional Owners of the Country you are on?
- What does Country mean to you?
- What observations have you made of Country?

Make a sketch here:

Illustrate what Country means to you.

Connecting with Country:

- What do you know about the way water moves on Country?
- What have you seen or heard about water?

Make a sketch here:

How does water move through and shape the school grounds?

Investigation #1
Conducting investigation on Country

Plan and conduct a reproducible investigation:

A scientific experiment must have to ability to get consistent results. That means, the experiment must get the same results if repeated under the same conditions. Therefore, only one variable is changed, at least one is measured, and as much as possible, all other variables are kept the same.

How will you ensure this experiment has a high reproducibility?

In this investigation, I am going to:

Change _____ and observe
_____, while keeping
_____ the same.

Prediction:

How do you think the movement of water will be different in each site? Why do you think this will happen? The water will:

Safety note: wear weather appropriate clothing and sun protection.

Make a sketch here:

Equipment

Per group:

- Watering can (2.5L or larger)
- Access to water source
- Wet weather gear

Procedure

Part 1 – watering can

1. Choose 4 places around the school to test, select areas with different surfaces, like grass, dirt, concrete, or gravel. Write them in the boxes below.

Site 1	Site 2	Site 3	Site 4
•	•	•	•

2. Fill the watering can 2L of water.
3. Walk to the first place you picked.
4. Notice what the area looks like and write your observations in your results table or on your map.
5. Slowly pour all the water from the watering can onto one spot on the ground.
6. Watch what happens to the water and write it down in your results table.
7. Repeat steps 2 – 6 for each of the test spots.

Part 2 – rainy day

1. Choose 4 places around the school to test, select areas with different surfaces, like grass, dirt, concrete, or gravel. Write them in the boxes below.

Site 1	Site 2	Site 3	Site 4
•	•	•	•

2. Walk to the first place you picked.
3. Notice what the area looks like and write your observations in your results table or on your map.
4. Watch the rainwater and note if it soaks into the ground, forms puddles, or flows away. Record your observation
5. Repeat steps 1 – 3 for all sites.

Results

Record your observations

Site no.	Site description	Water observation
• Example : • Centre of school oval	• Example: • Short, green grass (1.5cm) • Dry dirt under the grass • Slight slope from the centre of the oval down to the edges of the oval	• Example: • Water pools on surface of oval • Most of the water trickles east. • Trickle stops after 2m and water soaks into soil. • Some water soaks in where it was poured
•	•	•

•	•	•
•	•	•
•	•	•
•	•	•

Optional-Create a sitemap

Annotated site map or descriptive results

Investigation #1
Reflection and evaluation

Reflect on what you have learnt, develop new ideas to build knowledge

Analysis

What did you observe when you poured water (or watched rain fall) in this environment?

Do your results support your prediction? Why or why not?

Discussion

What do your results tell you about how water moves and shapes the Country you are on? What evidence do you have?

How does water movement on Country impact you?

Evaluation

Are your results reliable, why, or why not?

Describe any problems you encountered during this investigation and outline what changes you would make to overcome them next time.

If you were going to do this investigation again, what changes would you make?

Conclusion

What conclusion can you make about the way water moves in your local environment, was it supported by the data you collected from conversations?

Investigation #2 – Science IRM groundwater

Water stored underground is called groundwater. Groundwater can protect and environment from the devastating impacts of drought. But how does the water get there?

In this activity you will be closely observing Country and use an Indigenous Research Method to explore how surface water can get deep down into the groundwater. Just like the CSIRO scientists who are using these methods to study Australia's water and its history, you will collect data from your own observations on Country and combine it with data from local people's memories to learn about how water has and is shaping our world.

Figure 3 Grawin Creek, May 2025

Investigation #2
Groundwater investigation on Country

On-Country learning:

- What do you know about water that is found under the ground?
- What have you learnt about groundwater on Country from discussions, walking on Country and listening to stories?
- Have you learnt some language words from the Country you are on?

Plan and conduct a reproducible investigation:

A scientific experiment must have to ability to get consistent results. That means, the experiment must get the same results if repeated under the same conditions. Therefore, only one variable is changed, at least one is measured, and as much as possible, all other variables are kept the same.

How will you ensure this experiment has a high reproducibility?

In this investigation, I am going to:

Change _____ and observe
_____, while keeping
_____ the same.

Prediction:

How do you think the water will impact each tray? Why do you think this will happen?

The water will:

Safety note: Peat moss can irritate airways. Keep it moist and wear gloves, mask, and safety glasses. Wash hands after use. Cutting trays with scissors - use scissors carefully.

Make a sketch here:

Equipment

Per group:

- Safety equipment: safety glasses, mask and gloves
- Plastic or aluminium trays
- Scissors
- Peat moss – moistened to reduce dust
- Propagating sand
- Pre-prepared grass trays
- Leaf litter
- Container/beaker (approx. 1L capacity)
- Large tray
- Measuring cup/cylinder
- Watering can
- Camera

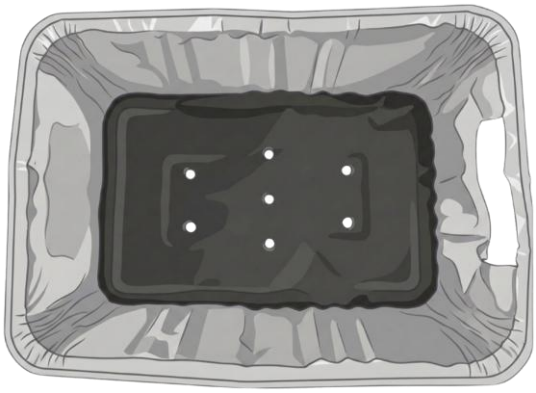
Procedure

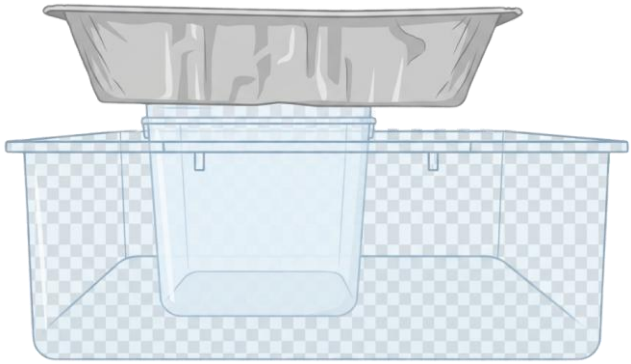
Water trays

1. Prepare two trays:
    a. Cut a small hole (about 4 cm long × 2 cm high) near the top edge on one short side of each tray. This lets extra water, 'runoff' drain out.
    b. Poke 3 small holes in the middle of the tray's base. These will collect 'groundwater'.
    c. Fill both trays with damp peat moss.

2. Set up your test trays:
    a. Tray 1: Uncovered peat moss.
    b. Tray 2: Peat moss covered with a layer of leaf litter.
    c. Tray 3: Pre-prepared grass tray.
3. Place the container/beaker inside the large tray.

4. Stand Tray 1 on top of the container/beaker. Make sure the holes in the bottom line up so water can drip into the beaker, and the side hole lets runoff flow into the large tray.





5. Fill the watering can with 500mL water.
6. Slowly pour the water over Tray 1 and watch what happens, photograph and record your observations.
7. Measure how much water ends up in the beaker (groundwater) and in the large tray (runoff).
8. Repeat steps 5 – 9 for Tray 2 (with leaf litter) and then for Tray 3 (pre-grown grass).

Data table

Record your observations

Sample	Runoff (ml)	Groundwater (ml)	Observations
• Plain soil	•	•	•
• Leaf litter/pebbles	•	•	•
• Grass	•	•	•

Results -Create a sketch

Create a photo story about your observations or sketch your observation.

Investigation #2
Reflection and evaluation

Reflect on what you have learnt, develop new ideas to build knowledge

Analysis

What did you observe when you poured water over the different samples?

Do your results support your prediction? Why or why not?

Discussion

What do your results tell you about how ground cover impacts whether rain fall can reach groundwater? What evidence do you have?

How does water movement on Country impact you?

Evaluation

Are your results reliable, why, or why not?

Describe any problems you encountered during this investigation and outline what changes you would make to overcome them next time.

If you were going to do this investigation again, what changes would you make?

Conclusion

What conclusion can you make about the relationship between ground cover and groundwater, was it supported by the data you collected from conversations?

Investigation: process diary

Here is where you are going to keep track of your progress towards your goals. You will reflect on what you have learned, your progress, and what you need to do in future lessons to stay on track.

Lesson date	Reflection
	Today I:
	Next lesson I will:
	Today I:
	Next lesson I will:

Lesson date	Reflection
	Today I:
	Next lesson I will:
	Today I:
	Next lesson I will:

Teamwork Check-in

(rate your group's skills out of 5 stars)

We are listening carefully to each other's ideas: ☆☆☆☆☆

We are sharing the work: ☆☆☆☆☆

We are staying on task: ☆☆☆☆☆

Lesson date	Reflection
	Today I:
	Next lesson I will:
	Today I:
	Next lesson I will:

Teamwork Check-in

(rate your group's skills out of 5 stars)

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We are staying on task: ☆☆☆☆☆

Lesson date	Reflection
	Today I:
	Next lesson I will:
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Lesson date	Reflection
	Today I:
	Next lesson I will:
	Today I:
	Next lesson I will:

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(rate your group's skills out of 5 stars)

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We are staying on task: ☆☆☆☆☆

Lesson date	Reflection
	Today I:
	Next lesson I will:
	Today I:
	Next lesson I will:

Teamwork Check-in

(rate your group's skills out of 5 stars)

We are listening carefully to each other's ideas: ☆☆☆☆☆

We are sharing the work: ☆☆☆☆☆

We are staying on task: ☆☆☆☆☆

Optional: presentation plan

How will your team present your project? What is the best way to share everything you have learned?

Use this table to plan your presentation, including who is responsible for each task/section.

Task	Team member/s responsible	Due date
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•

Presentation notes

Use this space to plan your presentation. You might like to draw what your set-up will look like or write a script and some dot points to talk about.

Investigation reflection

What parts of the investigation were successful? Why were they successful?

•

How did learning through Country (observing, listening, yarning) differ from how you usually learn science?

•

Describe two challenges you had to overcome during this investigation. What steps did you have to take to overcome them?

•

What would you do differently if you had to complete this investigation again? What could have made this investigation even better?

•

Where will you use what you have learned in your life outside of school? How can you use your knowledge from this investigation to make a difference (big or small)?

•

Take it further: extension activity

Extension activity

- Design a rain garden.
- Test with native plants/grasses.
- Test with soil samples from the local environment.
- Create recommendations for water/erosion management.

Additional investigation task

Research local, or Australian, Dreaming Stories related to water – what do you think they are telling us about water on Country?

- Bedtime Stories | Common Ground

Science investigation planner

How much do you know about water in your environment? Have you seen where water goes, how it moves, and how it shapes your school grounds? In this activity, you will closely observe Country and use an Indigenous Research Methodology (IRM) to investigate how water travels through your environment. Just like CSIRO scientists who apply these methods to study Australia's water systems and their long history, you will collect data from your own observations on Country to understand how water has shaped and continues to shape the world around us.

Water stored underground is called groundwater, and it plays a vital role in protecting environments from the impacts of drought. But how does water get below the surface?

In this investigation, you will explore how surface water moves, soaks into the soil and eventually reaches groundwater stores. By observing, recording and interpreting water movement on Country, you will build your understanding of how water supports healthy ecosystems and resilient landscapes.

Use this planner to organise your investigation.

Remember that your investigation should be:

- **Indigenous led:** this methodology relies on respectful relationships and consent from Community to collect and share their knowledges.
- **Embedded in Country:** Indigenous people have been observing Country for millennia, they comprehensively understand all elements and can foresee the flow on effects of changes to other parts of Country. This investigation honours and respects that knowledge.
- **Reliable:** Repeating the procedure multiple times or collecting data from more than one source will improve the reliability of the data collected. Someone repeating the procedure should generate similar results.
- **Valid:** The procedure and data collection should be specific to the investigation question.
- **Pre-learning:** We recommend completing CSIRO's Cultural Considerations e-learning modules prior to commencing exploration of this topic.

Introduction

Name _____

Date _____

Group members _____

_____

Sections of this investigation will be carried out in collaboration with community, and others you will manage independently.

Look for these symbols:

 **Community collaboration**

 **Independent analysis and reflection**

 What are you going to investigate? Write the focus question for the investigation:

_____

_____

_____

_____

_____

_____

_____

What do you think will happen? Make a prediction and explain why:

Connecting with Country

We believe [changes] are affecting Country. Is this an important issue to your Country and community? What kinds of changes have you observed?

On-Country learning

How would you like us to learn your knowledge? Are there any language words or names that you can share? List the steps you will follow in your investigation:

Make a sketch here:

Our team timeline

Now that you know more about the topic, it is time to make a plan for your team's project.

Week/Lesson	Task/Activity	Resources, materials or support needed
•	• Choose our team's focus. •	•
•	•	•
•	•	•
•	•	•
•	•	•
•	• Finalise our presentation. • Prepare for presentation. •	•

Risk assessment

When designing an investigation, it is important to think about safety. A risk assessment will help you to identify the hazards (something that could potentially cause harm) and record the actions/controls that you are going to put in place to reduce the risk.

Activity	Hazard identification (type/case)	Level of risk (high, medium or low)	Elimination or control measures
• E.g. cutting templates with scissors	• e.g. cut to skin	• e.g. medium	• e.g. when using scissors, cut in direction away from the body.
• Collecting and communicating cultural knowledge	• Misrepresenting Indigenous Cultural Intellectual Property	• Low	• Ensure all collected information is reviewed by any knowledge holders before it is finalised. Discussing with knowledge holders where knowledge can be shared.
•	•	•	•
•	•	•	•
•	•	•	•
•	•	•	•
•	•	•	•

Results: Recording Knowledge

- What knowledge would you like us to record?
- How would you like us to record your data?
- How would you like us to acknowledge your input?

Record your data in a table in your science journal. Don't forget to include headings for each of your table columns.

You can also record your results using words and sentences, by drawing diagrams, taking photos or videos, or using digital devices.

Can you communicate your results using a graph? If it is appropriate to do so, create a graph. Draw your own axes and label them. Give your graph a title.

Results

Explain your results:

What do the results tell you about Country?

Did the results support your prediction? If not, how were they different?

Toolmaking and resources

What tools, outputs and resources would you like to create? What can you create to present and communicate the results?

Reflection

Reflect on what you have learnt? What new knowledge have you learnt that could be applied and shared back with community?

Evaluation

How could you improve the fairness, reliability or validity of this investigation? What challenges did you encounter in completing this investigation?

Glossary page and notes

Use this space to note down any words or scientific terms you discover as you conduct your investigation.

Word	Definition
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•

Notes

Research journal

Use this space to write down any resources you find and use in your investigation/s:

Resource name	What I found out
•	•
•	•
•	•
•	•
•	•
•	•

•	•
•	•
•	•
•	•
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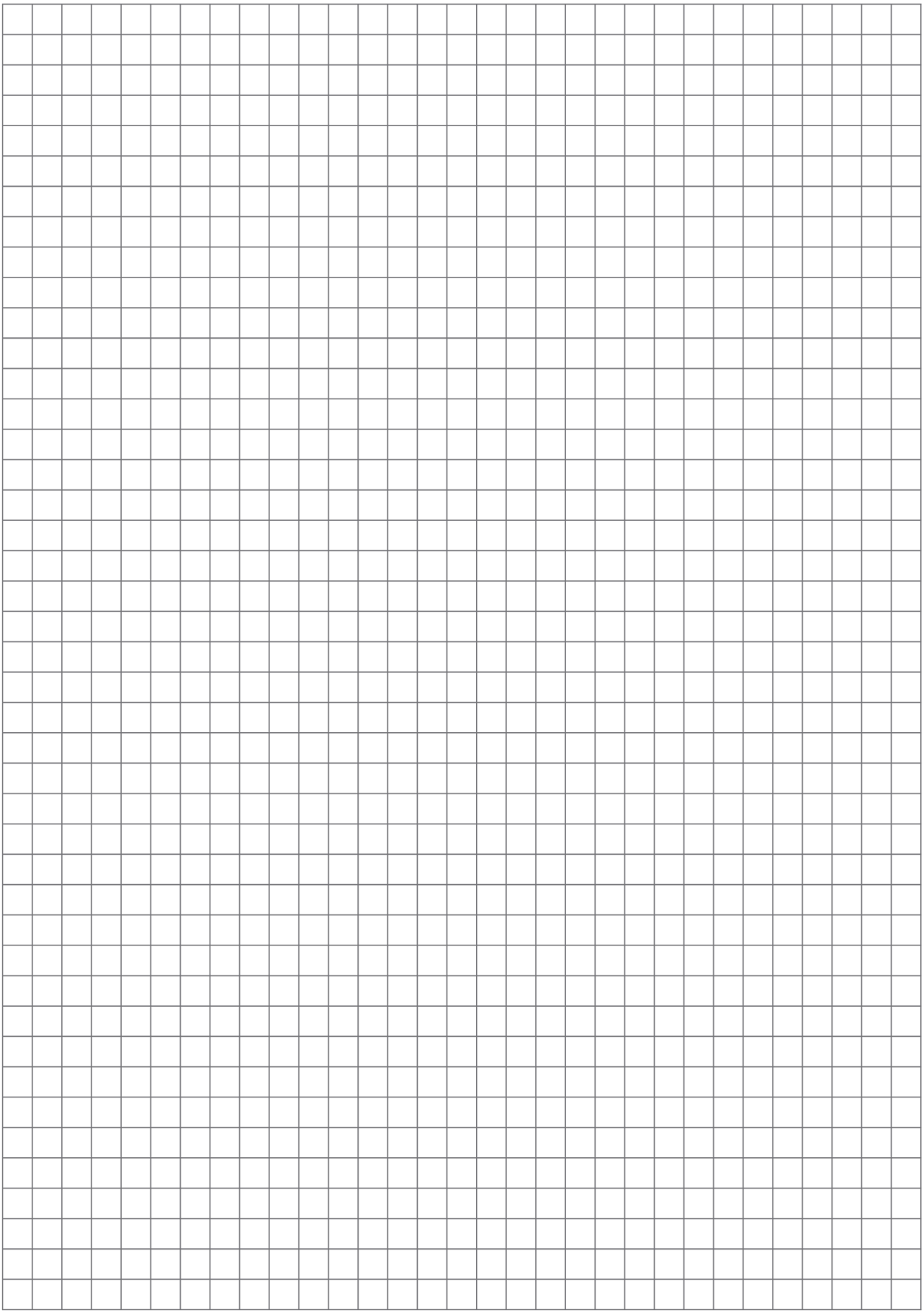
Graph paper (5mm)



Graph paper (10mm)