



Run the river: Exploring the water cycle

Lesson overview

In this activity students will investigate elements of the water cycle, including:

- cloud formation
- evaporation
- transpiration
- water moving through aquifers.

Australian curriculum outcomes

Science (years 7 and 8)	ACSSU222/225, ACSHE121/136, ACSIS125 and science inquiry skills
Geography (year 7)	ACHGK038/039/040 and gathering geographical information
Cross curriculum priority	Sustainability (systems, world views and futures)

Lesson components

- mind mapping the water cycle
- hands on activities
- further investigation

Notes

Start this lesson with a discussion about the water (hydrological) cycle. Ask students what they know about it, what interests them about it. A knowledge diagram, mind map or a cycle diagram might help. Alternatively, if you used the previous lesson in this series (*the water cycle*), just use part 1 of this lesson as revision.

Consider using the jigsaw model to encourage student sharing and interaction in this classroom activity. Divide the class into home groups. Individuals or pairs (depending on class size) from each home group go to one of the work stations and carry out the lesson activity. When they are finished their activity, students return to their home groups, each reporting to the rest of the home group what they discovered in their activity.

Useful web links and resources

[Map of the Murray–Darling Basin, showing floods and droughts as well as rainfall variability](#)

[Understanding groundwater](#)

[Bureau of Meteorology rainfall in the Murray–Darling Basin](#)

[How much water do we have to share around? \[video\]](#)



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Part 1: mind mapping

What do you already know about the water cycle? What do you find interesting? Draw a knowledge diagram, mind map or a cycle diagram to outline what you already know.

Important things to explore are:

- elements of the water cycle
- what is happening when water moves from one part of the water cycle to another
- examples of the water cycle operating and its impacts on Australia, on the Murray–Darling Basin and in your local region
- what impacts do humans have on the water cycle.

Part 2: experiment!

Your teacher (or work group) will assign you one or more investigations to set up and carry out. The instructions for each investigation are provided; make sure you read all the instructions carefully and be sure to record your observations as you go.

Part 3: further investigation

1. Design an investigation to see if all plants transpire at the same rate. What is the significance of this to communities, industry and the environment? Your investigation may involve experiments to estimate the daily transpiration of large plants such as trees.
2. On average, the Murray–Darling Basin receives a bit over 500 mm or 530,000 GL (gigalitres) of rainfall per year. About 94% is evaporated or transpired by plants. This means that the average annual flow of water into the Basin's streams is around 32,500 gigalitres a year. Not a lot to go around.

Investigate rainfall figures for the Murray–Darling Basin. Is the amount of rainfall even across months, or across years? Are rainfall figures different for the north of the Basin to the south of the Basin? How does the Murray–Darling Basin compare with other river basins overseas?

3. Design and conduct an experiment to test the permeability of soil around your school.



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Activity station 1 — making clouds

You will need

- 1 x 2 litre plastic PET drink bottle with lid
- candle
- splint, and matches to light candle
- cold water
- a notepad and pen for your observations

What to do

- Pour a small amount (about 25 ml) of cold water into the bottle and screw on the cap.
- Leave the bottle somewhere warm for about 15 minutes e.g. near a sunny window or outside in the sun. Water will evaporate in the bottle increasing the humidity inside the bottle to 100%.
- After 15 minutes put the bottle on a bench in the classroom with the lid on.
- Squeeze the bottle. What does it feel like? What do you think happens to the air pressure in the bottle while you are squeezing the bottle?
- Release your grip. What happened? What do you think happened to the air pressure in the bottle?
- Light the candle.
- Light the splint using the candle. Let it burn for a few seconds, and then blow it out. With the lid of the bottle off and the smoking splint next to the opening, squeeze the bottle a few times to suck in some of the smoke. You do not need much smoke in the bottle.
- Now put the lid back on the bottle. Squeeze the bottle. What happens? Let it go? What do you see? Try it again.
- Write down, or draw, your observations.

What is happening?

When you squeeze the bottle the temperature and pressure increases inside the bottle. When you let go, the temperature drops and so does the pressure.

Clouds form when the air is no longer able to hold water as vapour. This is affected by temperature and pressure. The lower the temperature and pressure, the less water the air can hold, and the more likely clouds form. The water vapour also needs something to condense around. This is called a nuclei. Dust blown high into the atmosphere is a great nuclei for clouds to form around.

When the bottle is only filled with water vapour, there is no nuclei for the vapour to condense around. So when smoke is put into the bottle it provides particles for the vapour to condense around. When the pressure and temperature drop, the air is unable to hold the water vapour and it condenses around the smoke particles, creating a mini cloud in a bottle!



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Activity station 2 — suck it up!

Transpiration and evaporation are gradual processes. Set up these activities and observe them over a period of two or more days.

You will need

- 500 ml cylinder
- food colouring
- 400 ml of water
- a stick of celery or a carnation with a stem
- a notebook for your observations

What to do

- Put 2 cups of water into the cylinder.
- Cut off the end of a piece of celery or a flower stem.
- Place the stem in the water in the cylinder.
- Over the next few hours you should see the plant sucking the water up through its stem (because there are no roots).
- Leave your experiment somewhere safe until your next lesson.
- Write down, or draw, your observations. What are your conclusions?

What is happening?

The plant is drawing water up through tubes in the stem (xylem) to keep a supply of water up to the leaves. Leaves need water on small openings called stomata to keep them breathing. As long as stomata are open on the leaves, water is being evaporated through them. This process of water being drawn up by a plant and then evaporating through the leaves is called evapotranspiration.



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Activity station 3 — transpiration and evaporation

You will need

- a small clear plastic bag
- sticky tape
- a live shrub (in the school yard) or a cut branch with leaves
- a notebook for your observations.

What to do

- Gently put the plastic bag around a branch of a live shrub or a cut branch with leaves. Try and get lots of leaves in the bag.
- Seal the bag around the branch so no air can get out.
- Leave for 20 minutes.
- Write down, or draw, your observations.

What is happening?

The processes of transpiration and evaporation are very significant in the Murray–Darling Basin. Most of the time water is scarce, and a significant amount either evaporates or is transpired by plants.

During the day plants transpire or sweat. That's the process of water evaporating through small holes in the leaves called stomata. This is a very important process because it helps to create the air we breathe.

When you put the bag around the leaves, you captured the water that was being transpired by the plant. It formed droplets, or condensed, onto the inside of the plastic bag.



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Activity station 4 — water under the ground

Groundwater is water that flows beneath the Earth's surface. Because of this, it's not surprising that groundwater is really difficult to see, measure and predict. It's often down very deep, and travels in a variety of ways — through cracks, porous aquifers and underground cave and stream systems.

Groundwater is often found in sedimentary rocks. Scientists use mathematical models to make predictions on how groundwater moves. One factor that is important in developing mathematical models is understanding how quickly water moves through the different types of sediments.

In this activity, you will discover how water moves through different types of sediments or soils.

You will need

- retort stands, clamps and boss heads to hold large funnels
- stockings or cloth, rubber bands and labels or pens
- a large 200 ml beaker for measuring water and pouring on samples
- a large beaker to catch the water that drains out of the funnel
- some samples of sediments of various sizes such as: samples of coarse sand, fine sand, gravel, pebbles and some soil
- a stopwatch
- a notebook for observations.

What to do

1. Set up the funnel with the retort stand so that it is suspended above a measuring cylinder.
2. For each sediment or soil sample: place the sample in the funnel until it is about half full (NOTE: To make this a good scientific test fill the funnel to the same level each time).
3. Put the measuring cylinder under the funnel.
4. Pour 200 ml of water into the funnel using the beaker.
5. START the timer as soon as you start pouring the water into the funnel.
6. In the results table record how long it takes for water to start coming through the funnel. At the end of two minutes, observe and record the volume of water that is in the measuring cylinder.

Results table — what heading would you give to this table?

Sediment type	Start time	Time when first drops appear out of the funnel	Volume of water in measuring cylinder after 2 minutes	Rate of water flow (ml/second)
Coarse				
Medium				
Fine				

7. Repeat this procedure for the other two samples.
8. When you have finished, clean up and make sure that you do not tip sediments down the sink.



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9. Record your observations in your notebook, and draw the equipment you used. Things to consider are:
 - did the water flow through the samples at the same rate, why or why not?
 - which sample allowed water through the fastest? The faster water can move through a substance, the more PERMEABLE the sediment or soil is said to be
 - which sample slows the flow of the water the most?