

Sticky, soluble, and a place to live

60 minutes • A1.1.4 to A1.1.6 • Chapters 4, 5, 6

Adhesion and capillary action, water as the solvent, and water against air for the loon and the ringed seal

BY THE END, STUDENTS CAN

- ☐ Explain how adhesion draws water through soil and plant cell walls by capillary action A1.1.4
- ☐ Explain why water is the medium for metabolism and transport, and why some molecules work because they do not dissolve A1.1.5
- ☐ Compare water with air for buoyancy, viscosity, thermal conductivity and specific heat capacity, using the black-throated loon and the ringed seal A1.1.6

TIMING

0-5	5 min	Walking water challenge	
5-15	10 min	Paper that drinks	
15-30	15 min	The solvent	
30-50	20 min	Water against air	
50-55	5 min	Back to the cups	
55-60	5 min	Exit and homework	
	60 min	One lesson	

STARTER

5 Walking water challenge

min

Groups set up the cups (activity below) and leave them running while the lesson goes on.

ON THE BOARD, FROM THE GUIDE

Open the guide on the projector at each chapter (the links work in this PDF). Every figure plays from its own buttons, and the lesson's slides have the same figures, step by step, in the order of this plan.

04 Water clings to polar surfaces

CHAPTER 04 IN THE SLIDES

Step through the figure (5 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. Water is attracted to the polar glass wall and forms bonds with it: **adhesion**. The water's edge curves up where it meets the glass.
2. **Cohesion** drags more water up behind the edge, and the column rises until its weight balances the pull.
3. The **narrower** the tube, the higher the water climbs.
4. Wax has nothing for water to cling to: with no adhesion the surface curves down and sits **below** the level outside.
5. The same pull holds water between **soil** particles and soaks it through the gaps in a **cellulose** cell wall.

Predict box: Three cups in a row: red water, an empty cup, blue water. A strip of paper towel bridges each full cup and the empty one. What is in the middle cup a few hours later? Hands up or mini whiteboards first.

Answer C: Purple water, rising until the levels even out, because water creeps along paper from both sides

Remember it: Clones Anything (Cohesion, Adhesion).

05 The solvent cells run in

CHAPTER 05 IN THE SLIDES

Step through the figure (5 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. A grain of salt is a lattice of **ions**, sodium (Na^+) and chloride (Cl^-), held together by their opposite charges.
2. Water molecules turn to face the ions, **oxygen** towards Na^+ and **hydrogens** towards Cl^- , and together they pull ions loose.
3. Dissolved: every ion is wrapped in its own **shell** of water molecules and drifts away from the rest.
4. A sugar is covered in OH groups, which make **hydrogen bonds** with water, so it dissolves too.
5. Oil molecules are **non-polar**. Water bonds to water, not to oil, so the oil is pushed together into a droplet.

Show the figure: Ten substances sorted: five dissolve in water and five do not. The five that do not are useful because of it: wax keeps water in the leaf, fat stores energy and insulates, cholesterol is part of membranes, cellulose makes cell walls that must not dissolve, and calcium phosphate makes bones that last.

Predict box: Fish get all their oxygen from water. Oxygen molecules (O_2) are non-polar. How does the oxygen get into the water? Hands up or mini whiteboards first.

Answer C: Small non-polar molecules dissolve a little, and a little is enough to reach the gills

06 Life in water, life in air

CHAPTER 06 IN THE SLIDES

Switch the figure through Buoyancy, Viscosity, Heat flow and Heat capacity, and have the class say what will change before each.

Predict box: Ringed seal pups are born in snow caves on the sea ice, with thick woolly fur but almost no blubber. What happens to a young pup that has to stay in the sea for a long time? Hands up or mini whiteboards first.

Answer B: It chills fast: soaked fur holds no air, and water draws heat away about 23 times faster than air does

Remember it: Big Vessels Turn Slowly (Buoyancy, Viscosity, Thermal conductivity, Specific heat capacity).

THE LESSON

10
min

Paper that drinks

Coffee filter painting at the tables, then [chapter 4's](#) figure: why does the waxed tube fail? Turn over the Clones and Anything tiles.

15
min

The solvent

[Chapter 5's](#) figure, then the sorter in pairs. Ask which molecules work because they do not dissolve, and what for. Finish with the oxygen predict box.

20
min

Water against air

[Chapter 6's](#) figure on the board, one property at a time. Pairs fill the loon and seal grid, then the pup predict box.

5
min

Back to the cups

What happened in the cups, and why: adhesion first, then cohesion.

ACTIVITIES



PRACTICAL

Coffee filter painting

Drop watercolour on to a filter paper one drop at a time and watch it spread. Explain the spreading with adhesion to cellulose and capillary action.

Needs: coffee filters or filter paper, watercolours or washable felt tips, droppers, plates.

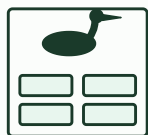


CHALLENGE

Walking water

With five cups, paper towel strips and red, yellow and blue water, make orange in one cup and purple in another: yellow, empty, red, empty, blue, with the red cup fuller. Explain it at the end of the lesson.

Needs: five clear cups per group, paper towels, food colouring.

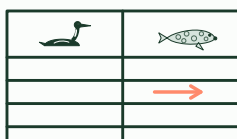


RESEARCH

An organism and its water

Choose a local species or a favourite. Outline its adaptations to at least three properties of water (cohesion, adhesion, surface tension, solvent, buoyancy, viscosity, thermal conductivity, specific heat capacity) in a one-page profile with a sketch. Finish with a gallery walk. This is an ATL research skills task.

Needs: devices or the library; a profile template with the properties as headings.

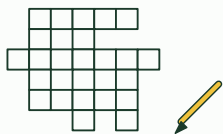


TABLE

Loon and seal: water against air

A grid of four properties by two animals, each cell split into in water and in air. Fill it from [chapter 6's](#) figure, then check it in pairs.

Needs: printed grid or exercise books.



PLENARY

Write a cryptic clue

Each student writes cryptic clues for three words from the keyword list, then swaps with a neighbour and solves.

Needs: the A1.1 key terms.

PLENARY

5

min

Exit and homework

Turn the Big Vessels Turn Slowly tiles back over and say what each stands for. Homework: research an organism and its water, and [the Check step](#).

WHAT STUDENTS GET WRONG

Cohesion and adhesion mixed up. Use Clones and Anything.

Water dissolves everything. Not fats, waxes, cellulose or bone mineral.

Hydrophilic means soluble. Cellulose is hydrophilic and insoluble.

Conductivity and heat capacity are the same. One is how fast heat flows, the other how much heat it takes to warm something.

Fur keeps seals warm in water. Blubber does, because wet fur fails.

STRETCH AND SUPPORT

Support: sentence frames for property, cause and consequence: "Because water molecules are polar, ... This means that ..."

Support: use the Remember it tiles as a starter in each lesson.

Support: give the [chapter 6](#) grid with the properties filled in.

Stretch: how high would capillary action lift water in a vessel 50 μm wide? Compare it with a 100 m tree.

Stretch: why are most large animals in cold water either well insulated or cold-blooded? Use thermal conductivity.

IN THE GUIDE

- 4 [Water clings to polar surfaces](#)
- 5 [The solvent cells run in](#)
- 6 [Life in water, life in air](#)
- A1.1 [The whole guide, with the figures that play](#)
- PPTX [This lesson's slides, in the order of this plan](#)

PRACTISE AND REVISE

BUILD FOR YOUR CLASS

- [Tarsia puzzle, dominoes and picture reveal](#) on A1.1, built from its key terms and ready to print
- A [pub quiz](#) with rounds on A1.1, to present or run with no projector
- An [escape room built from the question bank](#) on A1.1

ALREADY ON THE SITE FOR A1.1

- Lesson: [Water](#)
- Summary doodle: [Water](#)
- Quiz: [Water](#)
- Revision map: [A1.1 Water](#), to fill in
- Exam questions: [A1.1 in the exam maker](#), a paper with its markscheme

CARD SETS ON SPLYCR

Open a set to host it as a class game, or make a copy to edit.

- [A1.1 Water](#)

EXAM PRACTICE

Check yourself

Set it for homework: a fresh paper of exam-bank questions on A1.1 at standard level each time, marked as students go and saved to their Exam practice when they are signed in.

biologybybradford.com/exam-maker/sit?topics=A1.1&level=SL&paper=quiz&marks=15&src=ep



How this was made. The course structure, the activities and the teaching choices come from my own classroom, my presentations and my years of teaching IB and AP Biology. I use Claude, an AI, to help write and build the interactive guides, lesson plans, slides and practice questions, and to draw the diagrams and code the interactives. I direct the work and review it against the IB and AP specifications before it goes live.