Which way will the water go?

60 minutes • D2.3.1 to D2.3.3 • Chapters 1, 2

How water dissolves ions and polar molecules, and which way water moves by osmosis between solutions of different concentration

BY THE END, STUDENTS CAN

- [ ] Explain how water dissolves ions and polar molecules, by attraction to its charges and by hydrogen bonds D2.3.1
- [ ] Say which way water moves between two solutions in terms of solute concentration, using hypotonic, isotonic and hypertonic D2.3.2
- [ ] Predict the net movement of water into or out of a cell, and explain why there is dynamic equilibrium in an isotonic solution D2.3.3

TIMING

0–5	5 min	**Do now: salt and oil**	
5–15	10 min	**Shells of water**	
15–29	14 min	**Water goes where the solute is**	
29–54	25 min	**Colourful potatoes: set up**	
54–60	6 min	**Exit**	
	60 min	**One lesson**	

STARTER

5 min

Do now: salt and oil

Salt dissolves in water and cooking oil does not. Students write why, using the word "polar". Take two answers.

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.

01 Why so much dissolves in water

CHAPTER 01 IN THE SLIDES

Step through the figure (3 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. A **sodium ion**, Na^+: the water molecules turn their δ− oxygens towards it.
2. A **chloride ion**, Cl^-: now the δ+ hydrogens face the ion.
3. **Glucose** has no charge, but its polar –OH groups form hydrogen bonds with water.

> **Predict box:** Which way do the water molecules round a dissolved K^+ ion face? Hands up or mini whiteboards first.
> **Answer B: Oxygens inwards, because the δ− oxygen is attracted to the positive ion**

02 Water goes where the solute is

CHAPTER 02 IN THE SLIDES

Step through the figure (4 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. Two solutions, split by a **partially permeable membrane**. The solute cannot cross.
2. Water crosses **both ways**, but more crosses into the more concentrated side.
3. The **net** movement raises the level on the more concentrated side.
4. Equal concentrations, **isotonic**: water still crosses, as much each way.

> **Predict box:** A cell's cytoplasm is more concentrated than the solution around it. Which is true? Hands up or mini whiteboards first.
>
> **Answer B: The solution is hypotonic to the cell, so there is a net movement of water into the cell**

THE LESSON

10 min

Shells of water

Chapter 1 and its figure, sodium, chloride and glucose. Students draw a sodium ion with four water molecules round it, oxygens in, then a chloride ion the other way round.

14 min

Water goes where the solute is

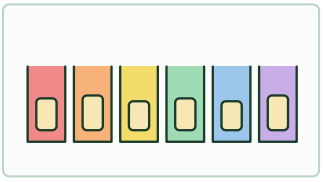
Chapter 2 and its figure. Then the quick check on mini whiteboards: which way does water move, and is the outside hypotonic or hypertonic, for four pairs of solutions read out in turn.

25 min

Colourful potatoes: set up

The practical below: pairs cut, weigh and measure their cores and put them into the six coloured solutions. The cores soak until next lesson.

ACTIVITIES



PRACTICAL

Colourful potatoes

Six sucrose solutions, 0.0 to 1.0 mol dm^{-3}, each dyed a different food colour and labelled only by colour. Pairs cut six cores with a cork borer, trim them to the same length, blot, weigh and measure each, and drop one into each colour. Next lesson they blot and reweigh, work out the percentage changes and pool them. The challenge: put the colours in order of concentration and find the isotonic point, with only the class table to go on. The teacher reveals the concentrations last.

Needs: potatoes, cork borers, tiles, knives, rulers, a balance to 0.01 g, paper towels, labelled boiling tubes or cups, the six dyed solutions. Cut on a tile, away from the body.

PLENARY

6 min

Exit

Predict: which coloured solution will make the cores gain most mass, and why can you not tell yet?

WHAT STUDENTS GET WRONG

"Water moves from high to low water concentration." Describe it by solute concentration: water moves towards the more concentrated solution.

"In an isotonic solution water stops moving." It goes on crossing both ways at the same rate: a dynamic equilibrium.

STRETCH AND SUPPORT

Support: give the captions of each figure and the film as a cut-up storyboard to put in order, and use the key terms (tap the dotted words) as a glossary.

IN THE GUIDE

1 Why so much dissolves in water

2 Water goes where the solute is

All The whole guide, with the figures that play

PPTX This lesson's slides, in the order of this plan

EXAM PRACTICE

Check yourself

Set it for homework: a fresh paper of exam-bank questions on D2.3 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=D2.3&level=SL&paper=quiz&marks=15&src=ep

PRACTISE AND REVISE

BUILD FOR YOUR CLASS

- Tarsia puzzle, dominoes and picture reveal on D2.3, built from its key terms and ready to print
- A pub quiz with rounds on D2.3, to present or run with no projector
- An escape room built from the question bank on D2.3

ALREADY ON THE SITE FOR D2.3

- Lesson: Water Potential
- Quiz: Water Potential
- Revision map: D2.3 Water potential, to fill in
- Exam questions: D2.3 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.

- D2.3 Water Potential

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.