11–14 years

Dissolved substances in tap water and seawater

ROYAL SOCIETY OF CHEMISTRY

Education
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The problem

Clean rivers, lakes and the ocean sustain aquatic life including:

- plants
- fish
- other marine animals.

All these organisms need oxygen for respiration, just like those living on land.

Air contains approximately 20% oxygen gas.

How do aquatic organisms get their oxygen?

Source: © Shutterstock/Reehan Raza

Learning objectives

During this lesson you will:

- set up and carry out an evaporation practical.
- compare the dissolved substances in tap water and seawater.
- describe what happens to the particles of a substance when it dissolves.
- explain why it's important for water to contain dissolved substances.

Key terms

Solute – a substance that dissolves in a solvent to make a solution.

Solvent – a substance that dissolves the solute to make a solution.

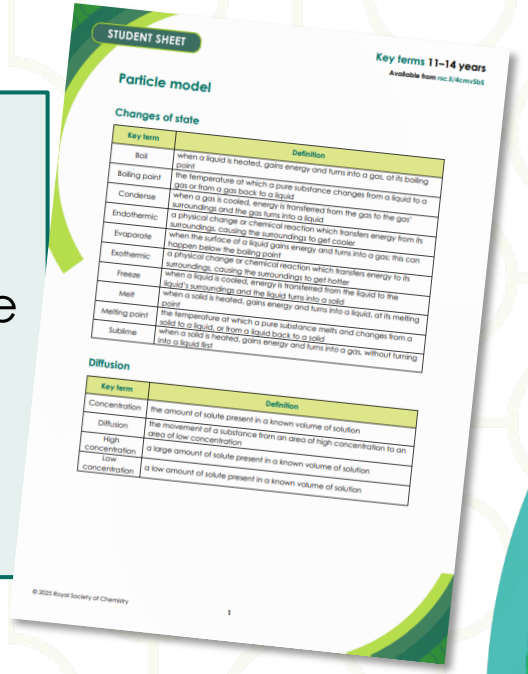
Solution – the mixture produced when a solute dissolves in a solvent.

Dissolve – when a solute is added to a solvent and the solute breaks into much smaller particles and spreads out.

Soluble – describes a substance which dissolves in a particular solvent.

Insoluble – describes a substance which does not dissolve in a particular solvent.

Find more **Key terms support** for this topic, including Frayer models, an accessible glossary and unscrambling definitions at: rsc.li/4cmvSbS


STUDENT SHEET

Key terms 11–14 years

Available from rsc.li/4cmvSbS

Particle model

Changes of state

Key term	Definition
Boil	when a liquid is heated, gains energy and turns into a gas, at its boiling point
Boiling point	the temperature at which a pure substance changes from a liquid to a gas or from a gas back to a liquid
Condense	when a gas is cooled, energy is transferred from the gas to the gas' surroundings and the gas turns into a liquid
Endothermic	a physical change or chemical reaction which transfers energy from its surroundings, causing the surroundings to get cooler
Evaporate	when the surface of a liquid gains energy and turns into a gas; this can happen below the boiling point
Exothermic	a physical change or chemical reaction which transfers energy to its surroundings, causing the surroundings to get hotter
Freeze	when a liquid is cooled, energy is transferred from the liquid to the liquid's surroundings and the liquid turns into a solid
Melt	when a solid is heated, gains energy and turns into a liquid, at its melting point
Melting point	the temperature at which a pure substance melts and changes from a solid to a liquid, or from a liquid back to a solid
Sublime	when a solid is heated, gains energy and turns into a gas, without turning into a liquid first

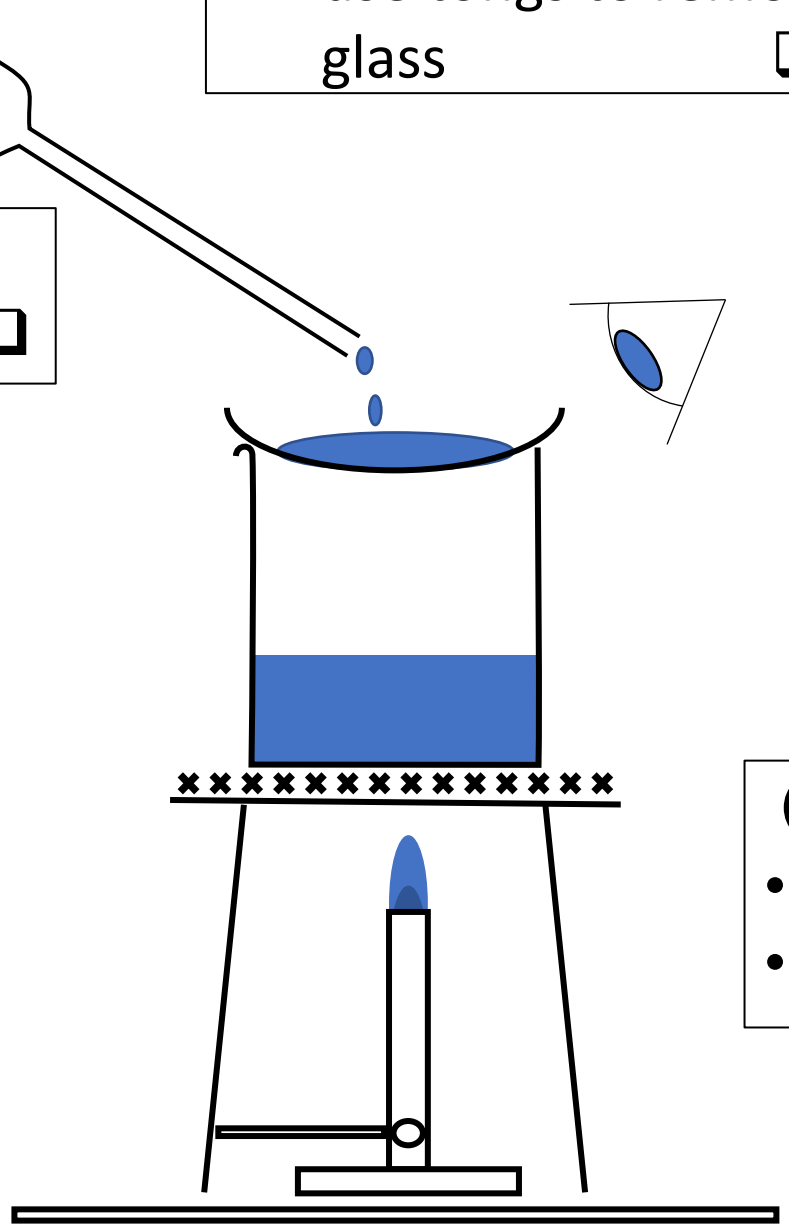
Diffusion

Key term	Definition
Concentration	the amount of solute present in a known volume of solution
Diffusion	the movement of a substance from an area of high concentration to an area of low concentration
High concentration	a large amount of solute present in a known volume of solution
Low concentration	a low amount of solute present in a known volume of solution

Method

1. Set up a Bunsen burner on a heat resistant mat. Over it, place a tripod and gauze.
2. Half fill a beaker with water and place it on the gauze.
3. Take a watch glass and place enough tap water on it to cover half its area. Place the watch glass on the beaker.
4. Heat the water in the beaker until it boils and then let it boil briskly.
5. When all the water on the watch glass has evaporated, turn off the Bunsen and use tongs to remove the watch glass. (Do not touch, it will be hot. It can safely be placed on the bench though.)
6. Examine the watch glass for traces of solid residue.
7. Repeat the steps 3 to 6 with:
    - Distilled water
    - Seawater

1. Half fill a beaker with water ❑
2. Half fill a watch glass with tap water. ❑
3. Heat the water in the beaker until it boils ❑
4. Once water evaporated use tongs to remove watch glass ❑
5. Record your observations ❑
6. Repeat with:
   - distilled water ❑
   - and seawater ❑



Results table

Type of water	Observations
Tap water	
Seawater	
Distilled water	

Questions

1. Complete the results table.
2. Suggest a reason for your observations:

(a) Tap water

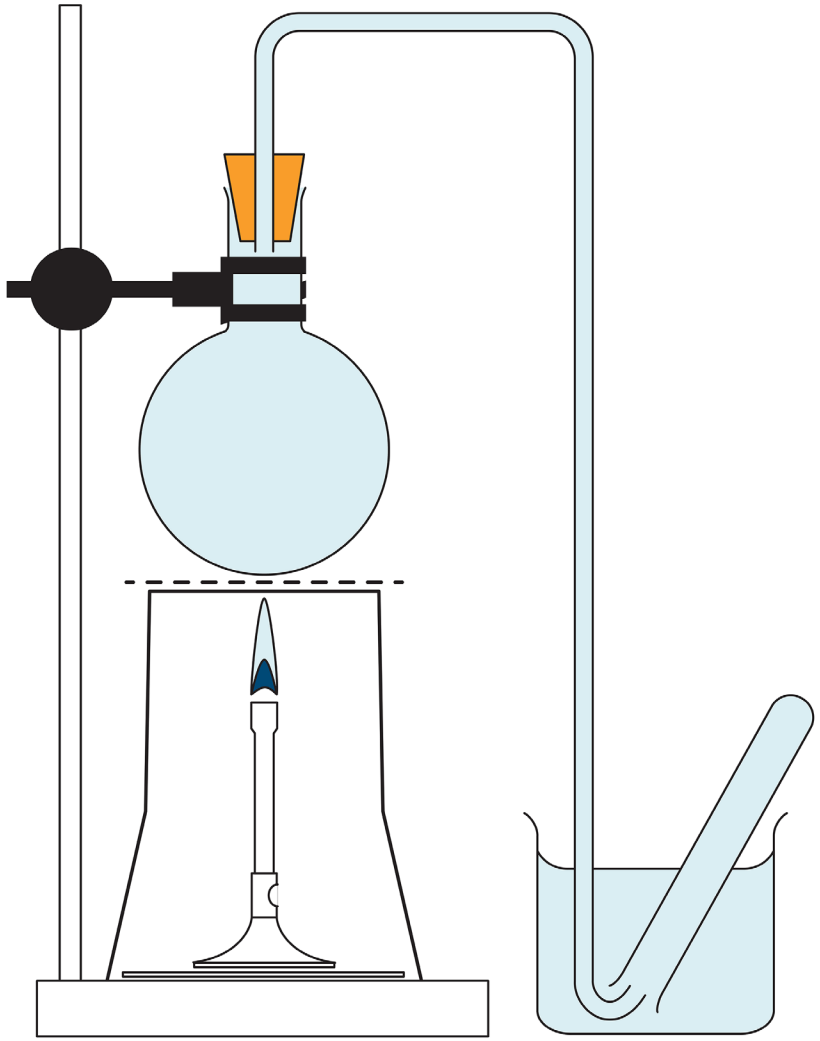
(b) Seawater

(c) Distilled water

3. Describe what happens on a particle level when a substance dissolves.
4. Explain what happened to the water particles when the seawater was heated.
5. Find out what dissolved solids are present in tap water.
6. Suggest a reason why water companies add salts such a fluorides to tap water.

Teacher demonstration questions

1. What do you observe when the round bottomed flask is heated?
2. Suggest a reason why the apparatus is completely filled with water at the start of the experiment.
3. Name a gas that is collected in the test tube. Give a reason for your answer.
4. How did the results from the tap water experiment compare to those from seawater?
5. Suggest how the gas got into the water?
6. Why is it important for seawater and freshwater to contain dissolved gases?
7. Predict what you would see if the experiment was repeated with distilled water. Suggest a reason for your answer.



Questions

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Have you met all of the learning objectives?