

States of matter

This resource is part of the **Structure strips** series of resources, designed to support literacy in science teaching. More resources in this series can be found at:

rsc.li/4aXYgzt

Learning objectives

- 1 Name the three states of matter and the processes of changing states of matter.
- 2 Describe, draw and recognise the particle arrangements of the three states of matter.
- 3 Describe the difference in the forces between particles in solids, liquids and gases.
- 4 Explain the properties of solids, liquids and gases using the particle model.
- 5 Write independently about states of matter.

Introduction

Matter is all around us and is classified into three states: solid, liquid and gas. All matter is made of tiny particles. The arrangement of these particles in different states of matter explains the properties of solids, liquids and gases.

How to use structure strips

Structure strips are a type of scaffolding that support learners to retrieve information independently. Use them to take an overview at the start of a topic, to activate prior knowledge, or to summarise learning at the end of a teaching topic. Visit rsc.li/3EszCfr for more ideas on how to use structure strips with your learners.

Structure strips have sections containing prompts, sized to suggest the amount that learners must write. Ask learners to glue the strips into the margin of an exercise book and write their answers next to the sections, in full sentences or in bullet points. When learners have finished using the structure strip, they will have an A4 page set of notes and examples.

Scaffolding

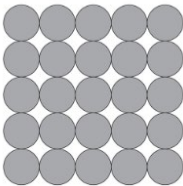
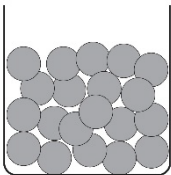
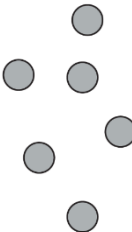
- Encourage learners to use the suggested key words in their answers. These link with our key terms support resources for **particle model**.
- To further support learners, include additional prompts in the structure strip. If learners are struggling to engage with the task, supply them with sentence starters created from the example answers.
- As learners grow in confidence, ask them to attempt the extension question first and then use the structure strip to improve or self-assess their answer.

Metacognition

This resource supports learners to develop their metacognitive skills in three key areas.

- **Planning:** the strips provide scaffolding to plan the written response. Learners will decide where to gather information from (textbooks, own notes, revision websites). Ask learners: is the source of information you are using reliable?
- **Monitoring:** learners are prompted by the questions in the structure strip and can check their own answer against the prompts. Ask learners: have you covered all of the prompts in the space provided? Do you need to change anything to complete the task?
- **Evaluation:** learners can self-assess or ask a peer to check their work against the answers. Ask learners: did you achieve what you meant to achieve? What might you do differently another time?

Example answers for the structure strip are on page 3. Look for a logical progression of ideas and coverage of both the arrangement of particles and the movement of particles.

| Structure strip States of matter | Example answer |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Describe how particles are represented in the particle model. | Particles are represented as circles or spheres. These circles can represent a single atom or a molecule. |
| Draw a diagram of the particles in a solid and write a bullet point description. |  <ul style="list-style-type: none"> • Particles are arranged in a regular structure. • They are touching. • The particles vibrate. |
| Draw a diagram of the particles in a liquid and write a bullet point description. |  <ul style="list-style-type: none"> • Particles are close together and touching. • They are not in a regular arrangement. • Particles move around by rolling over each other. |
| Draw a diagram of the particles in a gas and write a bullet point description. |  <ul style="list-style-type: none"> • Particles have gaps between them. • They are randomly arranged. • They move quickly and randomly in all directions. |
| State the order of the strength of the forces between particles in solids, liquids and gases. | Strongest → Weakest Solid → Liquid → Gas |
| Use the particle model to explain the following properties: <ul style="list-style-type: none"> • Solids hold their shape • Liquids take the shape of the container • Gases fill the space. | <ul style="list-style-type: none"> • Solids hold their shape because the particles are arranged in a regular structure and there are strong forces between the particles that keep the particles in this arrangement. • Liquids take the shape of the container because the forces between the particles are weaker than solids. The particles are able to roll over each other and fit different shapes. • Gases fill the space because the particles are moving very quickly and randomly in all directions. There are weak forces between the particles which allows the particles to move very far away from each other. |

Extension question: particle portraits

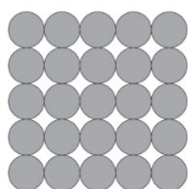
Get learners to answer the question after they have attempted the structure strip. The structure strip activates the required knowledge which learners then apply to the question.

Consider re-framing the context of this question to one your learners are more familiar with, to empower them to unlock their existing science capital. More information – rsc.li/40FAMLP

Ask more confident learners to write their extension task about a specific substance and use reference materials to look up its melting and boiling points.

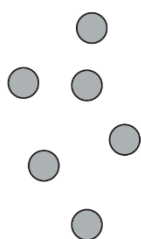
Example answers to extension question

Solid particle portrait



I am a solid particle. I am attracted to the other solid particles and we hang out in rigid ordered arrangements where we all touch. I can't break free, I just vibrate a little from side to side. Everything is so ordered that we rigidly keep our shape.

Gas particle portrait



I am a gas particle and I am free! I am only very weakly attracted to other gas particles and I move around really fast in a random motion. Sometimes I bump into other particles or into the sides of the container and us gas particles fill any container we are placed in. Us gas particles have a large distance between each other.