

The Particle Model of Matter

Every solid, liquid, and gas is made of tiny moving particles, and how those particles behave explains why matter acts the way it does.



Figure 1: A bright classroom science corner with three large glass jars on a table, one packed with tightly clustered small marbles, one with marbles

Learning intentions

We are learning to:

- Explain that all matter is made of tiny particles that are always moving and have spaces between them.
- Describe how particles are arranged and how they move in solids, liquids, and gases.
- Explain how attractive forces between particles differ across the three states.

Success criteria

I can:

- State the three main ideas of the particle model of matter.
- Draw and label particles in a solid, a liquid, and a gas.
- Explain why particles in a solid stay close together while particles in a gas spread far apart.
- Use the words "attractive forces" to describe why solids hold their shape and gases do not.

Curriculum alignment

- Investigate the particle model of matter in relation to solids, liquids, and gases ([Outcome](#), [Outcome](#)).
- Understand that the particle model of matter explains the behaviour of particles in matter ([Understanding](#), [Understanding](#)).
- Understand that the movement and arrangement of particles affect the physical properties of matter ([Understanding](#), [Understanding](#)).
- Know the core ideas of the particle model, including particle arrangement, motion, spacing and attractive forces in each state ([Knowledge](#), [Knowledge](#), [PDF p.1](#)).
- Represent solids, liquids, and gases using the particle model, and relate particle movement and arrangement to state and attractive forces ([Skills](#), [Skills](#)).

Materials

- Three clear jars or containers (or drawings of them)
- A bag of marbles, dried beans, or small pom-poms (about 30, enough to show three densities of packing)
- Whiteboard or chart paper with three large circles drawn (labelled Solid, Liquid, Gas, without giving away the answer yet)
- Student notebooks or a printed particle diagram worksheet (three blank boxes for solid, liquid, gas)
- Video: Matter - Movement and Arrangement of Particles ([Resource](#)), and a way to play it
- Coloured pencils

Lesson sequence

1. Hook (5 minutes)

Hold up a jar of marbles packed tightly together and shake it gently, then hold up a jar with marbles spread loosely and shake it, then hold up a jar with just a few marbles that rattle around freely. Ask the class:

"What do you notice is different about how these marbles move in each jar?"

"If I told you each jar represents a different state of matter, which jar do you think is a solid? Which is a liquid? Which is a gas? Turn and tell your neighbour why."

Take two or three quick answers without confirming or correcting yet. Say: "Let's find out if you're right."

2. Direct instruction (10 minutes)

Play the video Matter - Movement and Arrangement of Particles ([Resource](#)). Before playing, give students a listening job: "While you watch, listen for three ideas about particles that are true no matter what state the matter is in."

After the video, gather the three ideas on the board:

- All matter is made up of small particles ([PDF p.1](#), [Knowledge](#)).
- Particles of matter are always moving ([PDF p.1](#), [Knowledge](#)).
- Particles of matter have spaces between them ([PDF p.1](#), [Knowledge](#)).

Then explain the three states directly, using the jars from the hook as the model:

"In a solid, particles are packed close together and vibrate in place, like the marbles in the tightly packed jar. They don't slide around. That's why a solid keeps its shape" ([Knowledge](#)).

"In a liquid, particles have more space and can slide past each other, like the marbles in the loosely packed jar. That's why a liquid can pour and take the shape of its container" ([Knowledge](#)).

"In a gas, particles have large spaces between them and zoom around in every direction, like the few marbles bouncing loosely in the jar. That's why a gas spreads out to fill a whole room" ([Knowledge](#)).

Introduce the term attractive forces: "Attractive forces are like invisible pulls between particles that hold them together. In solids, this pull is strongest, which is why the particles stay locked in place. In gases, this pull is weakest, which is why the particles fly apart" ([Knowledge](#), [Skills](#)).

3. Guided practice (10 minutes)

Draw three large blank circles on the board labelled Solid, Liquid, Gas. As a class, fill each one with dots (particles) following the rules just taught. Ask guiding questions as you draw:

"Should the dots in the solid circle be touching or spread out? Should they be lined up neatly or vibrating in place?"

"In the liquid circle, do the dots stay in exactly the same spot, or can they slide past each other?"

"In the gas circle, should I draw 5 dots or 20 dots? Should they be close together or scattered with lots of empty space?"

Ask one volunteer at a time to come add or fix a detail, explaining their reasoning out loud. Prompt with: "Explain to us why you placed that particle there."

Finish by asking: "Where would the attractive force be strongest, and where would it be weakest? Show me with a thumbs signal: thumbs up for strong, thumbs down for weak, as I point to each circle" ([Skills](#)).

4. Independent practice (10 minutes)

Hand out the particle diagram worksheet with three blank boxes labelled Solid, Liquid, and Gas. Students draw particles in each box, then write one sentence under each drawing using this sentence starter:

"In a _____, the particles _____ because _____."

Example for the board: "In a solid, the particles vibrate in place because the attractive forces are strong."

Circulate and ask individual students: "Why did you draw more space between your gas particles than your liquid particles?"

5. Consolidation (5 minutes)

Bring the class back together. Ask:

"If I put a lid on a jar of gas and shook it really hard, would the particles move faster or slower? Why?"

"Which state has particles with the weakest attractive forces, and how do you know?"

Do a quick exit check: students hold up one, two, or three fingers to show which box on their worksheet (solid, liquid, or gas) they feel least confident explaining. Note who holds up which number for tomorrow's follow-up.

Differentiation

Extension: Ask students to predict what happens to the particle diagram when a solid is heated until it melts into a liquid, and have them sketch a fourth box showing the "in-between" moment. Challenge them to explain why melting weakens the attractive forces between particles ([Knowledge](#), [Skills](#)).

Support: Provide a partially completed particle diagram (dots already placed correctly in the solid box) so students can compare their liquid and gas drawings against a working example. Pair students with a peer for the sentence-writing task and allow them to complete sentences orally before writing.

Assessment

Formative check: Collect the completed particle diagram worksheets and review each student's three drawings and sentences.

Look for:

- Particles drawn close and tightly packed in the solid box, with more space in the liquid box, and wide gaps in the gas box ([Knowledge](#)).
- Correct use of the words "vibrate," "slide," and "move freely" (or similar) to describe motion in each state ([Knowledge](#)).
- Any mention, even attempted, of attractive forces being stronger in the solid than in the gas ([Skills](#)).

Students who reverse the arrangement (for example, drawing gas particles close together) need a follow-up small-group review using the marble jars before moving on to density and compressibility.