

# Particle Models and States

Student Worksheet | g09\_u02\_w05

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Today I can:** connect particle motion and spacing to solid, liquid, and gas properties; interpret heating/cooling evidence; and state what a particle model leaves out.

**Time and use:** 95 minutes; class, homework, club, tutoring, or independent practice.

**Vocabulary:** state, particle model, kinetic energy, melting, freezing, vaporization, condensation, sublimation, deposition, temperature.

## A. Quick checks

1. Match state to description: fixed shape/volume; changing shape but fixed volume; changing shape and volume.

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2. Which state is most compressible? Give a particle-level reason.

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3. In a solid, do particles have zero motion? Explain.

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4. Name the change solid  $\rightarrow$  liquid and liquid  $\rightarrow$  gas.

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5. Name the reverse changes gas  $\rightarrow$  liquid and liquid  $\rightarrow$  solid.

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6. Which statements identify model limitations? Select all that apply: particles are colored circles; particles are real; particles have exact diagram spacing.

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7. A sealed balloon expands when warmed. At particle level, what changes?

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## B. Guided application

8. Sketch or describe particle arrangements for ice, liquid water, and water vapor. Include spacing and motion.

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9. A sample keeps 25.0 mL volume but takes the shape of its cup. Identify state and support with two properties.

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10. A gas in a syringe is compressed from 30 mL to 15 mL at constant temperature. Describe particle spacing and number of particles.
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11. A wet shirt dries. Is the material gone? Explain at particle level.
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12. During melting of a pure substance, temperature stays constant while heating continues. Where does energy go?
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13. Interpret: a heating curve has a flat segment at 0 °C. What process occurs and what phases coexist?
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14. Compare evaporation and boiling without claiming all liquids boil at the same temperature.
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### C. Curiosity / application

15. Why does a pressure cooker require special engineering and supervision, while this packet never asks students to seal a gas-generating system?
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16. A meteorologist says humidity rose although the air looked clear. Explain why a gas can be present without being seen.
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17. Propose data to test whether an unknown sample is more easily compressed as a gas or liquid.
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### Competition Corner

18. Equal masses of solid and liquid wax occupy different volumes. Does this alone prove particles changed size? Give a better model explanation and a measurement to test it.
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19. A capped plastic bottle feels firmer after warming, but its volume barely changes. Give two particle-level explanations and one safe way to distinguish them without opening a hot container.
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20. Three diagrams show the same number of particles: A widely spaced, B close/random, C close/ordered. Rank likely compressibility and defend limits of the ranking.
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