

Category IV Physical Science Examples

Demonstrating use of knowledge

Material B

There are no demonstrations of using the key ideas to explain phenomena or solve problems. In fact, very few explanations of phenomena using the key ideas are included in the student text. The teacher notes frequently include explanations using the key ideas in response to questions posed in the student text. The responses are typically brief and are not likely to be helpful to model explanations (p. 104st). Moreover, the material does not instruct the teachers to use the responses to demonstrate the use of knowledge. As answers in the teacher notes, the teachers might use them only to correct student papers, never actually letting the students hear or read the correct answers.

EXPLORATION 6, pp. 103–104

Set up five stations in the classroom.



Water above 55°C is scalding.

Make sure no open containers of alcohol are in the room while students are lighting their matches. You may also wish to apply the drops of alcohol yourself or have a beaker of water available for disposing of the hot matches.

Answer to Station 1, page 103

The food coloring diffuses more quickly in the hot water because the heated particles are moving faster.

Answer to Station 2

When the bottle is placed in hot water, the air particles inside speed up and move farther apart, causing the balloon to expand. When the bottle is placed in the ice water, the air particles slow down and move closer together, causing the balloon to deflate.

Answer to Station 3

The alcohol evaporates faster on the heated glass because the heated particles of alcohol move faster.

Answers to Station 4

Water condenses on the beaker. The beaker's cool surface causes particles of water vapor in the breath to slow down and gather in droplets.

Answers to Station 5

Eventually, the perfume will be smelled from across the room. The particles of perfume are moving farther apart as they change into a gas and diffuse throughout the air.

Answers to Station 6

The heat causes the wax particles to move freely as a liquid, so the wax melts. When the candle is extinguished and the wax cools, the particles slow down, and the liquid solidifies.

EXPLORATION 6, continued

STATION 2

Place a balloon over the mouth of a 2 L or 3 L plastic soft-drink bottle. Place the bottle into a container of hot water for a few minutes. Now quickly place it into a container of ice water. Use the particle model to explain what happens.

STATION 3



Heat a microscope slide with a match. Then, after extinguishing the flame, place one drop of alcohol on the heated slide and one drop on an unheated slide. Using the particle model, explain the differences you observe.

STATION 4

Pour ice water into a beaker. Now breathe on the side of the beaker. What do you observe? Explain this observation in terms of what you think the water molecules in your breath are doing.

STATION 5

Place a cotton ball on a metal lid. Add a few drops of perfume to the cotton. From how far away can you smell the perfume? What do you think the liquid particles that make up the perfume are doing?

STATION 6



Observe a burning candle. What forms at the top of the candle (not the top of the flame)? What happens after the candle is blown out? Explain these observations in terms of what the particles of wax are doing.

Analysis, Please!

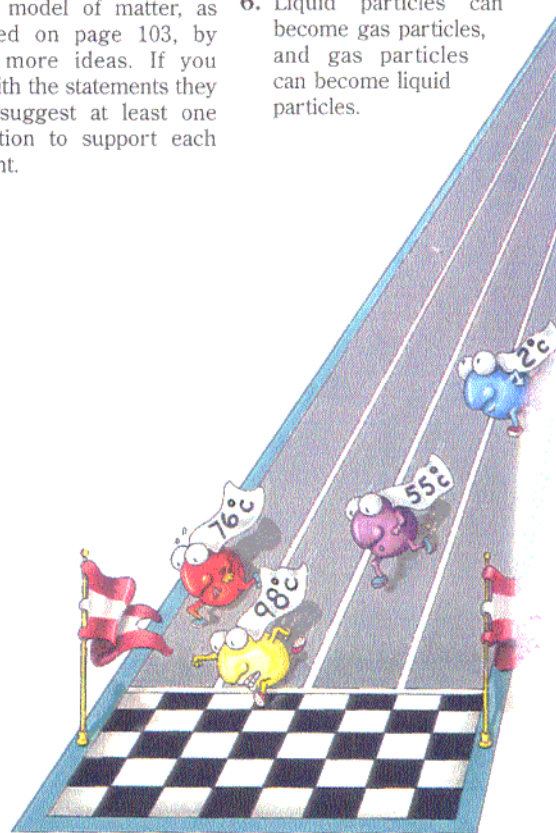
- Now add at least one more statement to the three given on page 103.
- Here are six words that help describe the processes you observed in Stations 1–6: condensation, expansion, diffusion, evaporation, melting, and solidification. Which word(s) would you associate with each station?

Expanding the Model

Mr. Chin's class expanded the particle model of matter, as described on page 103, by adding more ideas. If you agree with the statements they added, suggest at least one observation to support each statement.

More Ideas

- Particles in gases are far apart.
- Particles that make up liquids and solids must be as close together as possible.
- Particles move.
- Particles in a hot substance move faster than particles in a cold substance.
- The faster gas particles move, the more pressure they exert on the sides of a balloon.
- Liquid particles can become gas particles, and gas particles can become liquid particles.



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Answers to Analysis, Please!

- Sample statement: Heating causes the particles of the substance to move faster and farther apart.
- Condensation—Station 4; expansion—2; diffusion—1 and 5; evaporation—3 and 5; melting—6; solidification—6

- Gases diffuse.
- Raising the temperature of a liquid increases the rate of evaporation.
- Warming the air inside a balloon causes it to expand, suggesting that the particles exert more pressure on the sides of the balloon.
- Several changes of state were observed, such as water vapor condensing and liquid perfume evaporating.

Answers to Expanding the Model

- Gases can be compressed.
- We cannot easily compress liquids or solids.

The Follow-Up for Lesson 4 is on the next page. ►