

Learning Target (S5P1.b): Construct an argument based on observations to support a claim that the physical changes in the state of water are due to temperature changes, which cause small particles that cannot be seen to move differently.

FSI Reading for Meaning: How Temperature Changes the State of Water

Water is one of the few substances on Earth that naturally exists in all three states of matter: solid, liquid, and gas. These changes in state are called **physical changes** because the water itself does not become a new substance. No matter what state it is in, water is still made of the same tiny particles that are too small to be seen.

When **temperature changes**, it affects how these tiny particles move. As water **gains thermal energy (heat)**, the particles move faster and spread farther apart. As water **loses thermal energy**, the particles slow down and move closer together. These changes in particle motion cause water to change from one state of matter to another.

When water freezes, it changes from a **liquid to a solid**. This happens when thermal energy is removed. The water particles slow down and lock into place, forming ice. Even though the particles are still moving slightly, they vibrate instead of sliding past one another.

When ice melts, it gains thermal energy from its surroundings. The particles begin to move faster, allowing them to slide past each other again. This causes the ice to change back into liquid water.

If liquid water continues to gain thermal energy, the particles move even faster. Some particles move so quickly that they escape into the air as a gas. This change from liquid water to water vapor is called **evaporation**. When water vapor cools and loses energy, the particles slow down and move closer together, changing back into liquid water through **condensation**.

These physical changes show that **temperature controls how water particles move**, which determines the state of matter. Even though we cannot see the particles, scientists use evidence like changes in state, volume, and movement to explain what is happening at the particle level.

1. A student places a sealed container of ice on a table and observes water forming inside the container after an hour. Which explanation best describes what is happening to the water particles? (DOK 3)

- A. The particles are breaking apart into new substances
- B. The particles are gaining thermal energy and moving faster
- C. The particles are disappearing into the air
- D. The particles are stopping all movement

2. Which two statements correctly explain why melting ice is a physical change? (Select TWO.) (DOK 3)

- A. The water particles remain the same substance
- B. The particles change into a new kind of matter
- C. Thermal energy causes particles to move differently
- D. The mass of the water is destroyed

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3. A puddle of water slowly disappears on a warm, sunny day. Which evidence best supports that this change is caused by particle motion? (DOK 3)

- A. The water particles turn into air
- B. The particles gain energy and move into the gas state
- C. The particles stop moving
- D. The particles freeze underground

4. How does removing thermal energy from liquid water affect particle motion? (DOK 3)

- A. Particles move faster and spread apart
- B. Particles stop existing
- C. Particles slow down and move closer together
- D. Particles change into a new substance

5. Which claim is best supported by evidence from the passage? (DOK 3)

- A. Temperature changes only affect gases
- B. Water particles can be seen during evaporation
- C. Temperature changes cause particles to move differently
- D. Physical changes always change the type of matter

6. A student claims that evaporation and melting happen for the same reason. Which explanation best supports this claim? (DOK 4)

- A. Both involve adding thermal energy to water particles
- B. Both involve removing thermal energy
- C. Both create new substances
- D. Both stop particle motion

7. Which two observations would provide evidence that water particles are moving faster? (Select TWO.) (DOK 4)

- A. Ice forming in a freezer
- B. Water boiling in a pot
- C. Water evaporating on a hot day
- D. Water freezing overnight

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8. Why can scientists explain state changes even though particles cannot be seen? (DOK 4)

- A. Particles are visible with the naked eye
- B. Scientists guess what happens
- C. Evidence from temperature and state changes shows particle motion
- D. Particles stop moving during changes

9. Which model best explains what happens to water particles as ice melts? (DOK 3)

- A. Particles spread far apart and escape into the air
- B. Particles slow down and lock into place
- C. Particles gain energy and slide past one another
- D. Particles change into a new substance

10. Which conclusion best explains how temperature, particle motion, and state of matter are related? (DOK 4)

- A. States of matter change randomly
- B. Temperature affects particle motion, which determines state of matter
- C. Particle motion does not affect matter
- D. Only solids are affected by temperature