

Particles in Motion

Read how temperature connects to particle motion.

7.8.C “explain the relationship between temperature and the kinetic energy of the particles within a substance.”

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline each sentence that states how a temperature change is connected to the particles' average kinetic energy.

Hot Cocoa, Moving Particles

- ① When Maya takes a mug of hot cocoa from the microwave, the cocoa is warmer than the room. Its particles are always moving. In a liquid, particles slide past one another and collide. The energy of this motion is called kinetic energy. Temperature measures the average kinetic energy of the particles in a substance. It does not tell the exact kinetic energy of each particle, because individual particles can move at different speeds at any moment.
- ② When thermal energy is transferred to the cocoa, its temperature can rise. On average, the particles gain kinetic energy and move faster. They collide more energetically while continuing to slide past one another. If the cocoa is left on a counter, thermal energy transfers from the warmer cocoa to the cooler surroundings. Its temperature falls, and the particles have less average kinetic energy. They move more slowly on average. This change happens over time as the drink cools.
- ③ Scientists use temperature to compare the average motion of particles, not the motion of one chosen particle. For the same substance, a higher temperature means greater average kinetic energy, and a lower temperature means less average kinetic energy. This pattern applies to solids, liquids, and gases. In a solid, particles mainly vibrate in place. When the solid is warmed, those vibrations become faster on average, so its temperature rises as their average kinetic energy increases.

2 ANSWER WITH EVIDENCE _____ Use the passage

1 What does temperature measure about the particles in a substance?

2 What happens to the cocoa particles when thermal energy is transferred to the cocoa?

3 As the cocoa cools on the counter, how do its temperature and the particles' average kinetic energy change?

4 A solid is warmed. How do its particles move differently, and what happens to its temperature?

3 YOUR TURN _____ Your own words

Choose a substance other than cocoa. Complete the table to compare a cooler sample with a warmer sample of that substance.

SAMPLE	TEMPERATURE	PARTICLE MOTION AND AVERAGE KINETIC ENERGY

PART 1 • READ AND MARK

Underline each sentence that states how a temperature change is connected to the particles' average kinetic energy. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	What does temperature measure about the particles in a substance?	Temperature measures the average kinetic energy of the particles.
2	What happens to the cocoa particles when thermal energy is transferred to the cocoa?	Their average kinetic energy increases, and they move faster on average.
3	As the cocoa cools on the counter, how do its temperature and the particles' average kinetic energy change?	Its temperature falls, and the particles have less average kinetic energy.
4	A solid is warmed. How do its particles move differently, and what happens to its temperature?	Its particles vibrate faster on average, and its temperature rises as their average kinetic energy increases.

PART 3 • YOUR TURN (SAMPLE ANSWER)

SAMPLE	TEMPERATURE	PARTICLE MOTION AND AVERAGE KINETIC ENERGY
Cooler water	lower	particles move more slowly and have less average kinetic energy
Warmer water	higher	particles move faster and have greater average kinetic energy

Accept any correctly chosen substance if the cooler sample has slower particle motion and less average kinetic energy, while the warmer sample has faster particle motion and greater average kinetic energy. For the Your Turn table, equivalent wording about particle motion and average kinetic energy is acceptable.