



Food Coloring Race

Mission: Nobody can see particles moving. But you can see their effects! Race food coloring through cold and hot water and use the results as evidence for the particle model.

Big question: What evidence shows that particles move faster at higher temperatures?

★ Warm-up: Real-world riddle

Explain each with particles.

Why can you smell cookies baking from another room? ✓ **Scent particles move and spread through the air.**

Does a tea bag make tea faster in hot or cold water? ✓ **Hot water: particles move faster.**

Key vocabulary

Diffusion	Particles spreading from where there are many to where there are few.
Evidence	Observations that support a claim.
Kinetic energy	The energy of motion.
Controlled variable	Something kept the same in a fair test.

1 Box 1

Predict the winner

PREDICTION Beaker A is 10 °C, Beaker B is 70 °C. Which will mix completely first?

☐ Beaker A (cold) ☐ Beaker B (hot) ☐ A tie

Race!

In the simulator: Add food coloring (A = 10 °C, B = 70 °C) and wait until both are fully mixed.

Record the time to fully mix.

Beaker	Time (s)
A: 10 °C	from simulator
B: 70 °C	from simulator

2 Box 2

Explain the winner

You predicted: _____. Why did the hot beaker mix faster?

☐ Hot water particles move faster and bump the dye around more ☐ Hot water is thinner
☐ The dye melts in hot water ☐ Cold water has no particles

✓ **Hot water particles move faster and bump the dye around more**

3 Box 3

Fair test check

In the simulator: Run a race with both beakers at 40 °C.

Both beakers were the same temperature. What happened, and why is this trial useful?

☐ About a tie. It shows temperature was the cause of the difference ☐ Beaker A always wins ☐ It proves nothing

✓ **About a tie. It shows temperature was the cause of the difference**

4 Box 4

Find the pattern

In the simulator: Collect times for at least 4 different temperatures.

What is the relationship between temperature and mixing time?

☐ Higher temperature → shorter mixing time ☐ Higher temperature → longer mixing time ☐ No relationship

✓ **Higher temperature → shorter mixing time**

5 Box 5

Legend: a gas Legend only

Perfume spreads across a room faster on a hot day than a cold day. Which part of the particle model explains this?

☐ Particles have more kinetic energy at higher temperatures ☐ Hot air has no particles

☐ Perfume particles get lighter in heat

✓ **Particles have more kinetic energy at higher temperatures**

6 Box 6

Evidence report (CER)

What evidence shows particles move faster at higher temperatures?

Claim

Look for: States the relationship; at least 6 words

Evidence

Look for: Uses timing data; a number from the simulator; at least 12 words

Reasoning

Look for: Uses particles; Explains motion/collisions; at least 10 words

Exit ticket: answer the big question in your own words

What evidence shows that particles move faster at higher temperatures?

Look for: Food coloring spreads (diffuses) through water because water particles are always moving and bumping the dye particles. In hot water it spreads faster because the particles move faster. This is evidence that temperature measures how fast particles move.

Completion codes

Students see a code like **ABC-I3** when they finish. The first part must match below. The letter is the level (E = Explorer, I = Investigator, L = Legend), and the number at the end is how many stars they earned.

Level	Code starts with
 Explorer	6HG-E
 Investigator	16F-I

 Watch for these misconceptions

- "Particles in a solid do not move." They vibrate in place.
- "The bubbles in boiling water are air." They are water vapor (gas).
- "Particles expand when heated." Particles themselves do not grow; the spaces between them get larger.