

Heat Test Detectives

Plan fair tests that connect energy, matter, mass, and temperature change.

MS-PS3-4 "Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample..."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline conditions the teams keep the same. Circle each factor they change or measure, then number the steps that help make the test fair. Marking these details will help you see how scientists plan an investigation.

Planning Temperature Investigations

- ① Temperature gives scientists a way to track the average kinetic energy of particles in a sample. When a sample warms, its particles move faster on average, so its temperature rises. When it cools, their average motion slows, so its temperature falls. Temperature change can show a relationship, but it does not tell the total thermal energy transferred by itself. Matter type and mass also affect how much a sample's temperature changes when energy moves into or out of it.
- ② At a picnic, a team plans to test how mass affects temperature change in water. They place 100 grams of water in one insulated cup and 200 grams in another. Both samples begin at 20°C. They use identical immersion heaters for the same time and setting, then stir each sample carefully and measure its final temperature with the same thermometer. The team keeps the material, starting temperature, heater setting, heating time, cups, and thermometer the same. Mass is the changed variable, and temperature change is the measured result.
- ③ To compare types of matter, a second team uses equal masses of water and cooking oil in matching cups. The samples begin at the same temperature. Each cup receives energy from an electrical heater at the same setting for the same amount of time. The team records the starting and final temperatures and calculates each temperature change by subtracting the starting temperature from the final temperature. If the changes differ, the evidence shows that material type is related to temperature change under these controlled conditions. A fair test changes one chosen variable while holding other important conditions steady.

2 ANSWER WITH EVIDENCE Use the passage

1 In the water investigation, what factor does the team change, and what result do they measure?

2 List four conditions the water team keeps the same.

3 How does the second team use temperature data to investigate the effect of material type?

4 What is the rule for a fair test stated in the passage?

3 YOUR TURN Your own words

Plan an investigation to test how the mass of dry sand affects its temperature change when the same energy is added. Write 3 or 4 sentences that name two masses, the changed factor, the measured result, at least three conditions held the same, and how you would use the results.

PART 1 • READ AND MARK

Underline conditions the teams keep the same. Circle each factor they change or measure, then number the steps that help make the test fair. Marking these details will help you see how scientists plan an investigation. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	In the water investigation, what factor does the team change, and what result do they measure?	They change the mass of water and measure the temperature change.
2	List four conditions the water team keeps the same.	Any four: material, starting temperature, heater setting, heating time, cups, or thermometer.
3	How does the second team use temperature data to investigate the effect of material type?	They compare the temperature changes of equal masses of water and cooking oil after the same heating conditions.
4	What is the rule for a fair test stated in the passage?	Change one chosen variable while holding other important conditions steady.

PART 3 • YOUR TURN (SAMPLE ANSWER)

I will place 80 grams and 160 grams of dry sand in matching insulated containers. The changed factor is sand mass, and I will measure each sample's temperature change after heating. I will keep the sand type, starting temperature, heater setting, heating time, containers, and thermometer the same. If the 80-gram sample has a larger temperature change, the results show that mass is related to temperature change when the same energy is added.

Accept equivalent controls and clear plans that change only mass while measuring temperature change before and after heating. For Part 3, students should include a testable comparison, controlled conditions, and a conclusion based on comparing the temperature changes.