

Sun Warmth Detectives

Observe how sunlight starts warming on Earth.

SC.2.E.7.2 "Investigate by observing and measuring, that the Sun's energy directly and indirectly warms the water, land, and air."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline each place where the Sun warms land or water directly. Circle each place where warmed water warms the air indirectly.

A Sunny Recess Test

- ① Maya's class studies these example readings in degrees Celsius ($^{\circ}\text{C}$). A teacher uses a surface thermometer to measure the grass itself. Sunny grass reads 30°C ; shaded grass reads 22°C . Sunlight gives energy directly to land. These readings show warmer grass in the sunny spot.
- ② A tray of water sits in sunshine. A thermometer measures the water, rising from 20°C to 25°C . The Sun warms water directly. Water that is warmer than nearby air can give energy to that air. The air is warmed indirectly by the Sun, through the water.
- ③ The teacher moves the warm tray beside a cool tray in shade. Matching air thermometers sit just above each tray, out of direct sunlight and not touching water. In this example, air above the warm water rises from 22°C to 24°C ; air above the cool tray stays at 22°C . This comparison supports warming by the warm water. Real results can differ.

2 ANSWER WITH EVIDENCE _____ Use the passage

1 What thermometer measurements show that sunlight warmed the grass?

2 How did the water get warmer directly?

3 What warmed the air above the tray indirectly?

3 YOUR TURN

Your own words

Plan a two-step investigation. First show the Sun warming water directly. Then show warmed water warming air indirectly. Write possible start and end temperatures in °C. These are predictions, not measured results. Then perform the two steps with your teacher and record actual readings on extra paper, separate from predictions. Teacher supplies two matching trays with 200 mL water each, suitable water thermometers, two matching air sensors and a clock. Measure both water temperatures at Start; put one tray in a safe sunny place and the other in shade for 20 minutes, then measure both again. Move both into the same shaded area. Teacher holds the air sensors at equal heights just above the trays, away from water and direct sunlight. Record both air readings at 0, 5 and 10 minutes. Make one water table (Tray, Start degrees Celsius, 20 minutes degrees Celsius) and one air table (Time, Above sunny-tray water degrees Celsius, Above comparison water degrees Celsius). Describe your actual changes or no change. Explain which step tests direct warming and which tests indirect warming; do the readings support your prediction? Never look at the Sun or taste the water.

THING MEASURED	WHERE IT IS	START TEMPERATURE	END TEMPERATURE	WHAT CAUSED WARMING?

PART 1 • READ AND MARK

Underline each place where the Sun warms land or water directly. Circle each place where warmed water warms the air indirectly. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	What thermometer measurements show that sunlight warmed the grass?	The grass surface in sunshine was 30°C; the shaded grass surface was 22°C.
2	How did the water get warmer directly?	The tray of water sat in sunshine, so the Sun's energy warmed it directly.
3	What warmed the air above the tray indirectly?	The warmer water warmed the air above it indirectly.

PART 3 • YOUR TURN (SAMPLE ANSWER)

THING MEASURED	WHERE IT IS	START TEMPERATURE	END TEMPERATURE	WHAT CAUSED WARMING?
Water in a tray	In sunlight	20°C	25°C	The Sun warms water directly.
Air just above warm water	In shade, beside a cool comparison tray	22°C	24°C	Warmer water gives energy to cooler air.

Accept explanations of sunlight warming land or water directly and warmer water giving energy to cooler air. Table values are possible predictions. For a real test, record actual readings even if they do not rise. Use equal water amounts and matching trays; place matching air sensors at the same height just above each tray, shaded from sunlight and not touching water. Measure water with a suitable immersed sensor and grass with a surface thermometer. A teacher handles equipment. Required execution: teacher arranges safe stable locations, pretests sensors/conditions, reads the sequence and supports each child reading/recording settled displayed values. Keep water amounts, tray type and air-sensor heights equal; keep both air sensors shaded throughout the second step. Actual water/air tables are separate from the two prediction rows. Accept all honest readings, ties, cooling or no detectable change; do not substitute the example numbers. If sun-tray water is not warmer than surrounding air, this trial may not demonstrate water-to-air warming; report the limitation and repeat under suitable sunlight if needed, without hot-water/heater substitution. Different locations and small sensor differences limit a strong causal conclusion. Solar energy warms water directly; warmer water can transfer energy to cooler air indirectly. No actual land-temperature measurement is claimed by this added water/air task.