Heat Map Connections

Trace how technical terms explain a city's warmer neighborhoods.

10.RI.2.B "Analyze key terms (e.g., words and phrases, technical terminology) and ideas of historical, scientific, and technical texts to clarify the relationships and understandings among key concepts."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each technical term, then draw arrows between terms that the passage connects through cause, effect, or contrast. Use your arrows to track how surfaces, water, and air temperature are related.

Why Some City Blocks Stay Hot

1 On a hot summer afternoon, a city can be several degrees warmer than nearby countryside. This difference is called the urban heat island effect. Asphalt roofs and paved parking lots are impervious surfaces, meaning water cannot soak through them. They also have low albedo, so they absorb much of the Sun's energy instead of reflecting it. After sunset, these materials release stored heat slowly. In contrast, soil and plants cool the air partly through evapotranspiration, the process in which water evaporates from land and leaves. Replacing vegetation with pavement therefore changes how a neighborhood gains and loses heat.

2 Researchers measure this pattern with air temperature, but surface temperature helps explain its causes. A dark roof may become far hotter than the air above it because absorbed radiation heats the material directly. That heat can then move into the surrounding air, especially when wind is weak. The heat index is different from air temperature because it estimates how hot conditions feel to people by combining temperature with humidity. High humidity slows the evaporation of sweat, reducing the body's ability to cool itself. Thus, a neighborhood can face both elevated temperatures from its surfaces and greater health risk when humid air limits cooling.

3 Cities can reduce the effect, but each strategy works through a particular relationship. Cool roofs use light-colored coatings with higher albedo, which reflects more incoming solar energy and can lower roof temperatures. Tree canopies shade sidewalks and buildings, while their leaves support evapotranspiration when enough water is available. Permeable pavement allows water to enter the ground, unlike ordinary impervious pavement, and may support cooler conditions after rain. These approaches do not make every block equally cool. A young tree provides less shade than a mature one, and a reflective roof changes roof heating without adding a place where residents can rest outdoors. Planners often combine strategies to address several linked causes.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do impervious surfaces and low albedo each contribute to hotter conditions in a neighborhood?

2. What relationship does paragraph 2 establish among absorbed radiation, surface temperature, and air temperature?

3. Why does the passage distinguish heat index from air temperature? Explain how humidity affects the heat index.

4. Why might planners combine tree canopies with cool roofs instead of using only reflective roofs?

3 YOUR TURN

Your own words

A bus stop sits beside a wide black parking lot and has no shade. Propose two changes for this block in 3 to 4 sentences. Use at least three technical terms from the passage and explain how each change affects another concept.

ANSWER KEY

Heat Map Connections

GRADE 10 · 10.RI.2.B

PART 1 · READ AND MARK

Underline each technical term, then draw arrows between terms that the passage connects through cause, effect, or contrast. Use your arrows to track how surfaces, water, and air temperature are related. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do impervious surfaces and low albedo each contribute to hotter conditions in a neighborhood?	**Impervious surfaces prevent water from soaking into the ground and replace vegetation that can cool air through evapotranspiration. Low albedo causes surfaces to absorb more solar energy instead of reflecting it.**
2	What relationship does paragraph 2 establish among absorbed radiation, surface temperature, and air temperature?	**Absorbed radiation heats a surface directly, making its surface temperature much higher than nearby air temperature. The stored heat can then move from the surface into the surrounding air.**
3	Why does the passage distinguish heat index from air temperature? Explain how humidity affects the heat index.	**Air temperature measures the air's temperature, while heat index estimates how hot conditions feel to people. Humidity raises the heat index because it slows sweat evaporation and reduces body cooling.**
4	Why might planners combine tree canopies with cool roofs instead of using only reflective roofs?	**Cool roofs reduce roof heating by reflecting solar energy, but tree canopies shade sidewalks and buildings and can support evapotranspiration. Trees can also improve outdoor comfort in ways a reflective roof cannot.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Plant tree canopies beside the bus stop and install light-colored permeable pavement in part of the lot. The canopies create shade, and evapotranspiration can cool nearby air when water is available. The pavement lets rain enter the ground rather than acting as an impervious surface, and its higher albedo reflects more incoming solar energy.

Accept responses that accurately explain relationships among at least three passage terms, rather than merely listing terms or strategies. For the open task, accept reasonable proposed changes when the student clearly connects each change to an effect on heat, water, shade, or human comfort.