My NASA Data

Student Name: Date: Period:

Creation of Urban Heat Islands

Link to Story Map:

https://nasa.maps.arcgis.com/apps/MapSeries/index.html?appid=44b9c8738f0e47e68d9e8ae2c530ed08

Part A: Engage

A.1 On the following chart, fill in whether the surfaces shown in the image are typically warmer or cooler than the air temperature on a hot summer day.

Surface	Warmer or Cooler than Air Temperature?
Grass	
Concrete	
Water	
Wood	

A.2 What is the temperature difference between sunlit concrete and shaded concrete? What does this difference in temperature tell you about how surfaces are heated?

A.3 Based on what you have seen in this image, which type of area do you think is warmer, urban areas (cities and towns) or rural areas (countrysides)?

A.4 Based on what you already know about the temperatures of different surfaces, which surface do you predict was warmer during the month of October, the pond or the sidewalk?

A.5 Describe what you see on graph. How do the lines change?

A.6 What do these changes in the lines mean?

A.7 What patterns do you notice between the sidewalk and pond data?

A.8 What surprises you about this line graph? Come up with a research question you would like to know the answer to.

A.9 Using the chart below, rank the five different surfaces based on how much more heat you think they absorb than the surrounding air temperature.

Surface Description (Can you identify the material? Is it in direct sunlight?)	**Artificial or Natural?**	**Color**	**Rank** (1 being hottest compared to air temperature)
1.			
2.			
3.			
4.			
5.			

A.10 Make a Claim: How can human activities and construction impact surface temperature?

Part B: Explore

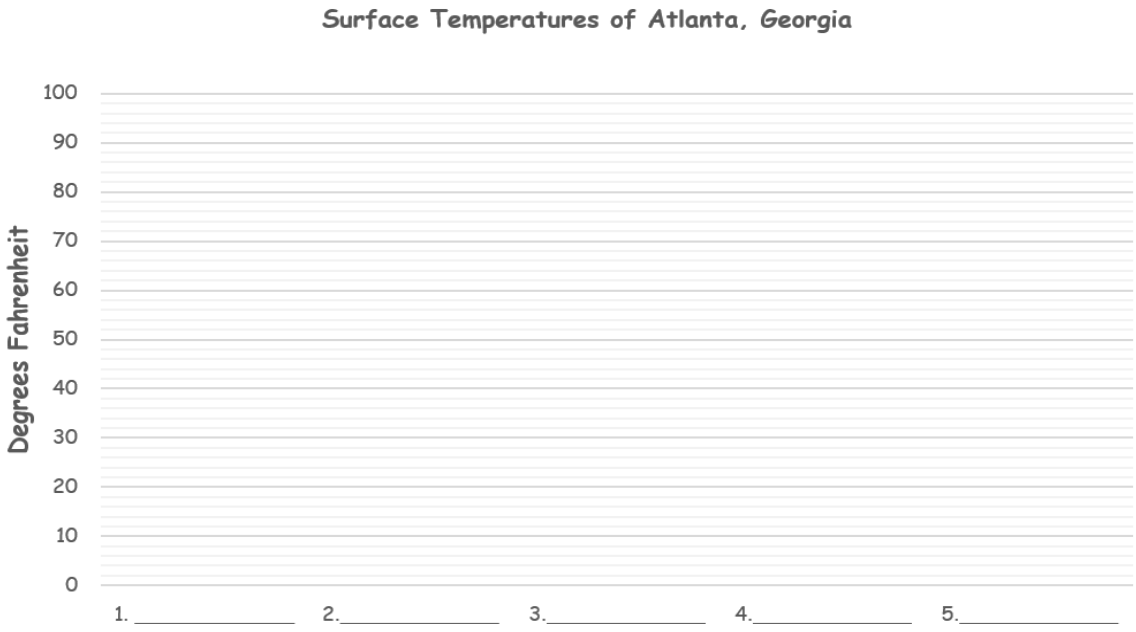
B.1 Fill in the following chart with three different surface types that you identify in the image of Atlanta, Georgia. Next, fill in the surface temperature of the material.

Item (object or organism)	Artificial or Natural?	Temperature
1.		
2.		
3.		
4.		
5.		

B.2 What patterns do you see?

B.3 What do these patterns mean?

B.4 On the bar chart template, fill in numbers 1 – 5 with the different surfaces you found in Atlanta, Georgia. Next, create the bar graph of surface temperatures.

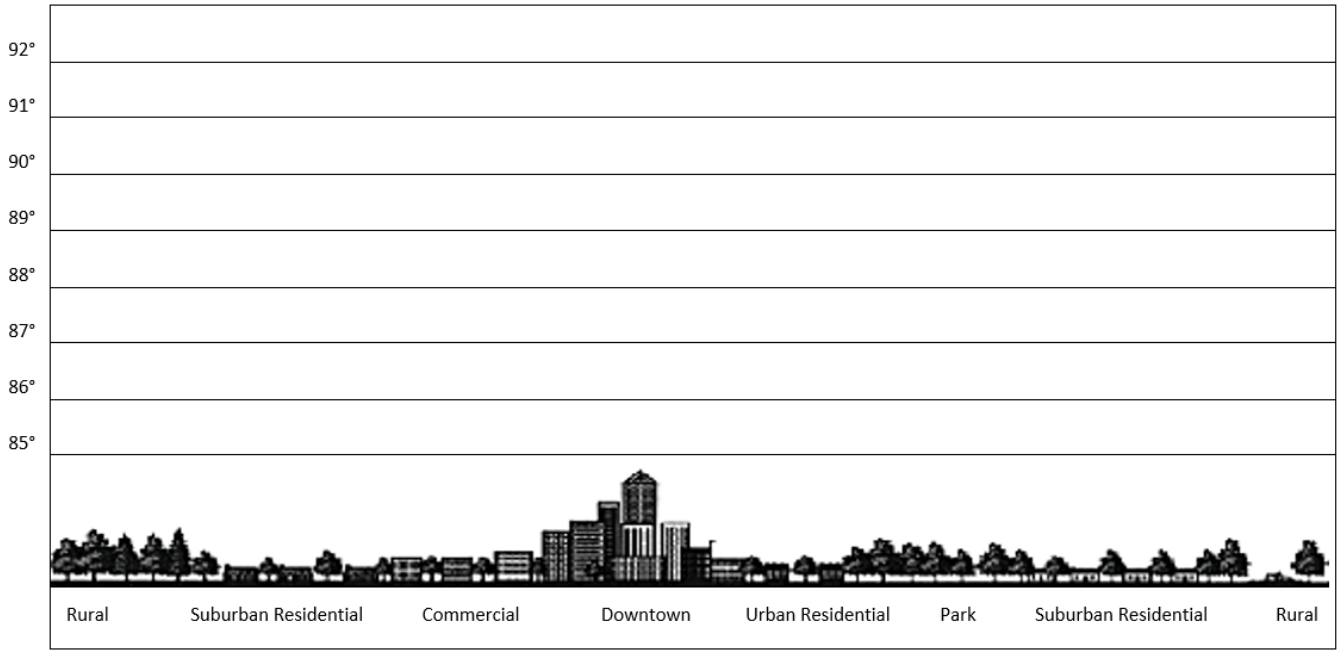


B.5 How does your bar graph support your earlier claim about the relationship between human activities or construction and surface temperature?

B.6 Shown below is a data table of the surface temperatures of sections of a city. Use the data table to plot the temperature values above their corresponding city district on the profile image. Then, connect the values you plotted on the profile image with lines to create a line plot.

City District	Temperature (Degrees Fahrenheit)
Rural	85°
Suburban Residential	87°
Commercial	88.5°
Downtown	92°
Urban Residential	89°
Park	86°

Urban Heat Island Profile



B.7 In a city, where are the highest surface temperatures? The lowest?

B.8 What section of the city do you live in? Describe the surface temperature of your neighborhood by comparing it with other districts of your city.

B.9 How does your line graph support your earlier claim about the relationship between human activities or construction and surface temperature?

B.10 Using the table provided, fill in whether the relationship is proportional or inverse. For each of the three relationships, provide the evidence you used to determine whether they were proportional or inverse. Use specific examples, such as the differences between materials, in your reasoning.

Relationship	Relationship Type (Proportional or Inverse)	Evidence
Developed Land and Vegetation		
Developed Land and Surface Temperature		
Vegetation and Surface Temperature		

B.11 How do these relationships support your earlier claim about the relationship about human activities or construction and surface temperature?

B.12 What patterns or relationship do you notice between population density and locations of urban heat islands?

B.13 Do you think population density influences the difference in temperature between urban heat islands and their surrounding areas? Why or why not? Use evidence to support your answer.

B.14 What do you see? Identify any trends and differences you see in the graph. Pay special attention to the trends in surface and air temperature at each time of day as well as the difference in surface temperature between the day and night.

B.15 What do these trends and differences mean?

B.16 Write a complete paragraph caption for this graph. Start with a topic sentence that describes the whole graph. In the body of the paragraph, include the trends and differences you found in questions 11 and 12.

B.17 What is something you would like to know about this graph? Come up with a research question you would like to know the answer to.

B.18 Atlanta, Georgia is located at exactly 84.39 W. What is happening at this point on the line graph

B.19 Why do you see changes in the line graph before and after the location of Atlanta, Georgia? Use evidence to support your reasoning. Refer to previous images within this lesson to help you answer this question.

Part C: Explain

C.1 What type of energy do we receive from the sun?

C.2 What percentage of the energy from the sun gets absorbed into the land and ocean rather than blocked by the atmosphere?

C.3 Which surfaces are more reflective, deserts or rainforests?

C.4 In what form is the majority of energy released from the Earth's Surface in?

C.5 Why does the air above hot pavement appear to shimmer?

C.6 How does evaporation cool the Earth's surface?

C.7 What is the albedo of the grass? About how much solar radiation is absorbed at its surface?

C.8 What is the albedo of the asphalt? About how much solar radiation is absorbed at its surface?

C.9 If the grass is replaced by a new parking lot made of asphalt, predict what will happen to the surface temperature on a sunny day. Will the surface of the new parking lot be warmer or cooler than the old grass surface?

C.10 Does snow reflect or absorb more light at its surface?

C.11 What will happen to the plant if there is not enough water in the environment for transpiration to take place?

C.12 What causes the increase in temperature in the city center?

C.13 What human actions have led to an increase in temperature of cities?

C.14 What is significant about the temperatures near farms and forests?

C.15 Why is there a difference in temperature between rural and urban areas?

Part D: Elaborate

D.1 What is the percentage of San Diego County that has changed? (Listed under '**General**' tab)

D.2 Between 1996 and 2010, did development increase or decrease? By how much?

D.3 Between 1996 and 2010, did forested areas increase or decrease? By how much?

D.4 Repeat steps 1-4 for a coastal county of your choice. Look for the same results that you found in questions 1 - 3. How does the county you chose compare to San Diego County?

D.5 How has the population of urban areas changed over time? How has the population of rural areas changed over time?

D.6 Based on this information, what changes to the urban heat island effect do you expect to happen? Use evidence to support your reasoning.

D. 7 Describe three different ways in which the world could lessen the effects of Urban Heat Islands in the future. Think of ways we could change building materials or better plan the expansion of cities. Use evidence from earlier parts of this lesson to support your reasoning.

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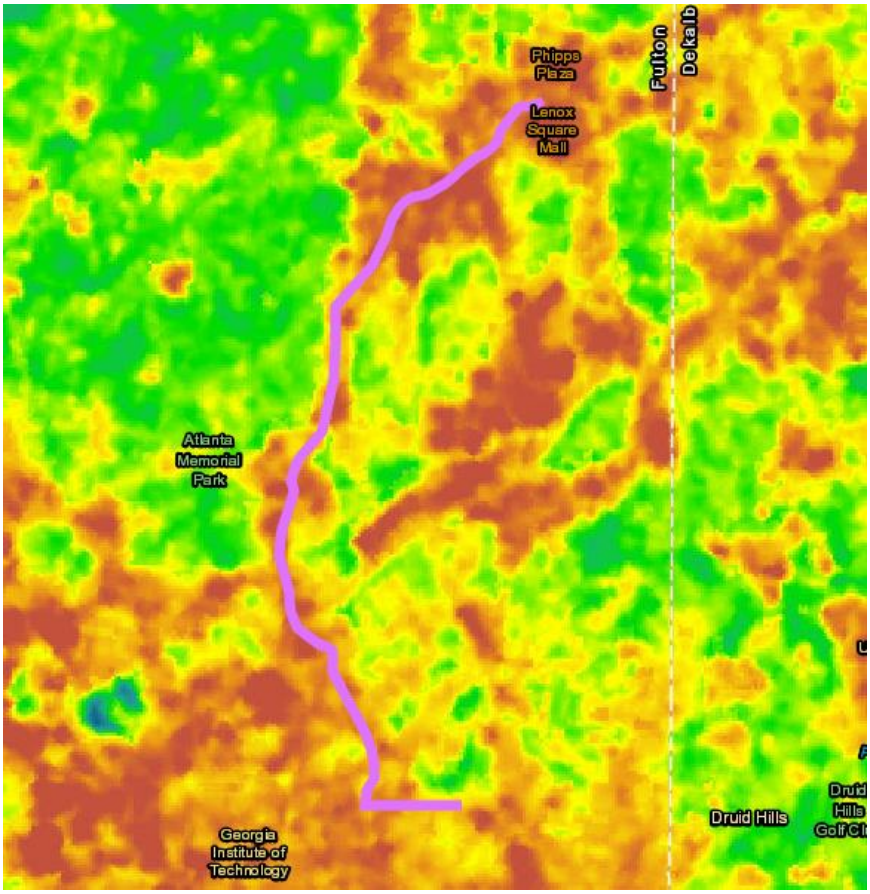
D.8 Fill in the chart with evidence and scientific reasoning that supports a claim for the impact urban growth will have on the Urban Heat Island Effect. Refer to the Explain tab and examples of data provided in the lesson.

State your claim: What effect will urban growth have on the Urban Heat Island Effect?	
Provide Evidence: How does data provided in this lesson support your claim?	
Scientific Reasoning: What information from the Explain tab provides support for your claim?	

Part E: Evaluate

E.1 On your hard copy of the map, circle where you think the best place to view the marathon from is.



E.2 Why did you choose this place as the best to view the race from? What process makes these areas cooler than the surrounding areas?

E.3 Design an Experiment

Material to be placed on rooftops:

What evidence do you have to claim that this material will cool off parts of the city?

Design of the experiment: (What will you measure? How will you measure it?)

How will you measure the effectiveness of your experiment? What is your control?

E.4 Which rooftop color has the greatest difference in temperature from the surrounding air temperature?

E.5 Which rooftop color shows the least difference in temperature from the surrounding air temperature?

E.6 Think back to your experiment from the previous slide. Based on this graph, would you change the material you chose for your experiment? Why or why not?