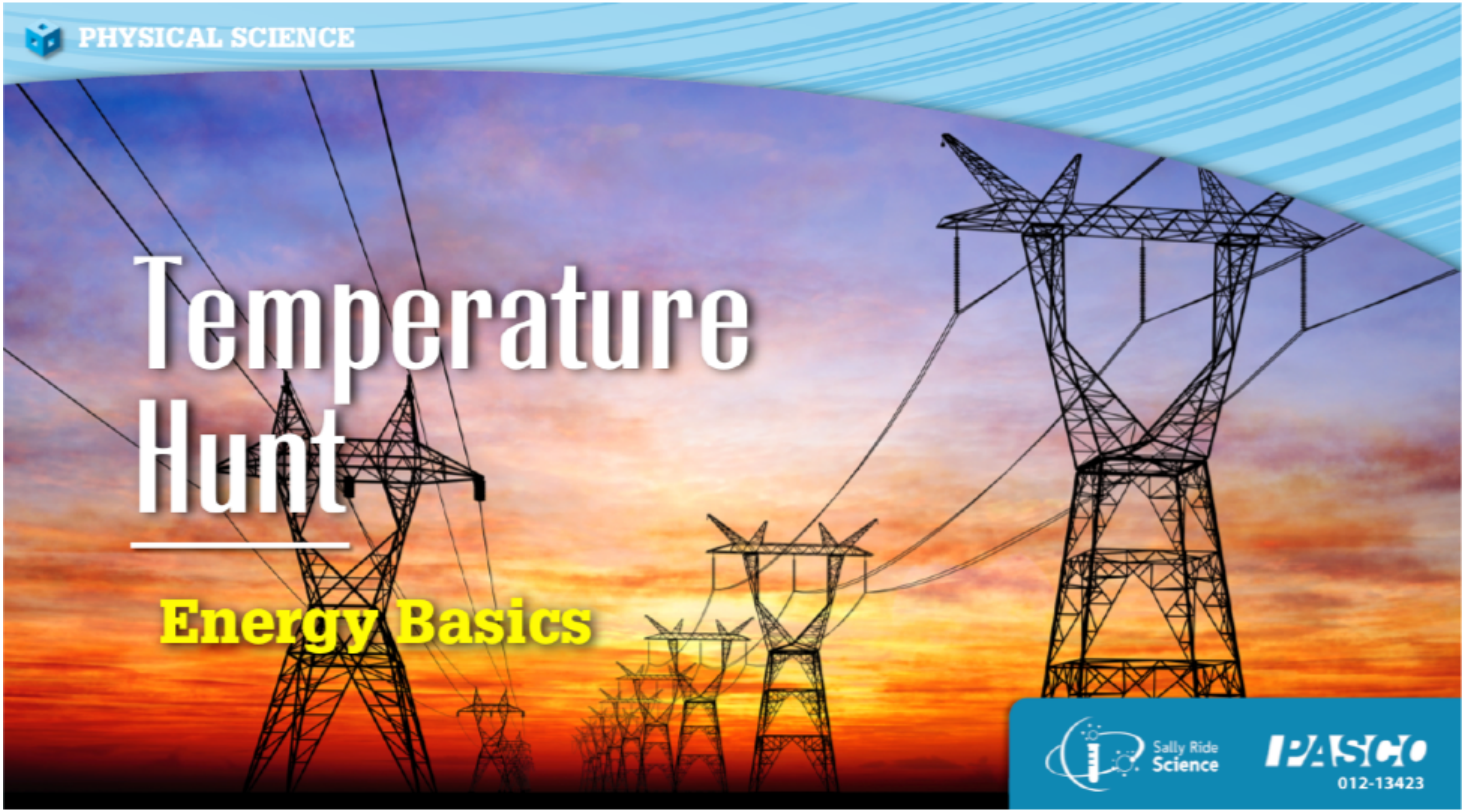
PHYSICAL SCIENCE

Temperature Hunt

Energy Basics



Sally Ride Science

PASCO

012-13423

Help System

Save, export, print, or submit your work.

Store your snapshots in the journal.

Take a screenshot when you see SNAPSHOT.

Browse the help system.

In Your World

O*h! Ah! Ee-ow!* It's like walking on hot coals as you quick-step across the sandy beach. You finally make it to the cool water. *Ahhh . . .* relief!

Sand can get really hot in the intense sunlight. So can a car hood, a bicycle seat, or a parking lot. But not everything warms the same. Put a plant on a sunlit windowsill. After a while, the plant, the soil, and the clay pot all have different temperatures. Which surfaces warm up most and least in the Sun, and why?

Introduction

Our Distant Source of Heat

The Sun is 150 million kilometers (93 million miles) away from us. Yet it's the source of almost all of the energy on Earth. The Sun is the ultimate source of the energy in all our food, from carrots to cheeseburgers. It provides our light, creates our winds, and even drives the water cycle that brings rain. And the Sun provides the heat that keeps our planet cozy, though maybe not the way you think.

Sunlight doesn't heat the air directly. Instead, it passes through the air and warms up the land, water, and other surfaces. These surfaces then radiate heat into the air. Gases in the air trap most of this heat and keep us toasty warm.

▼ **Your skin is one of the surfaces that the Sun warms directly.**

Introduction

An Absorbing Idea

What happens when sunlight strikes a surface – say, a sidewalk? The surface absorbs some of the energy. This means the Sun's energy makes molecules in the sidewalk jiggle faster. The faster the molecules jiggle, the more heat they generate, and the more heat they radiate into the air.

Not all surfaces absorb the same amount of sunlight. Some reflect more than they absorb. Light-colored materials, for example, reflect more sunlight than dark-colored materials. That means there is less energy to jiggle the molecules in the material and heat it up.

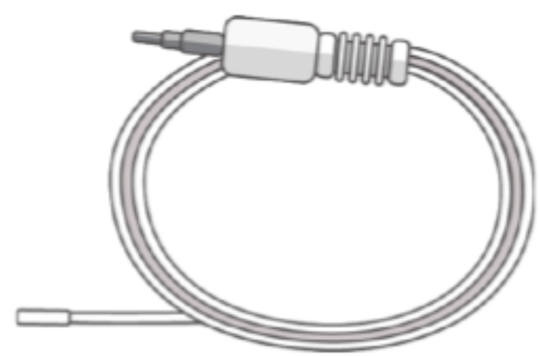
Now it's your turn – go on an outdoor temperature hunt to find out if some surfaces are warmer or cooler than others.

How would you expect these stones to feel on a sunny day?

Materials and Equipment

Each group needs these materials.

- Temperature sensor
- Safety goggles for each student



Safety

Add these rules to your regular classroom procedures.

- Wear safety goggles throughout the investigation
- Wash your hands after handling organic materials.
- Don't disturb ecosystems.

Handle living organisms with respect and care.

Investigation

You will use a temperature sensor to measure the temperature of different surfaces in your schoolyard. Do you think some surfaces will be warmer or cooler than others? If so, which do you think will be warmest? Which do you think will be coolest? Explain your predictions.

SNAPSHOT

I predict that different surfaces will/will not have different temperatures.

If surfaces have different temperatures, I think the warmest will be . . . because . . .

I think the coolest will be . . . because . . .

Investigation

1. Connect the temperature sensor.
2. Follow your teacher's instructions for going outdoors to the schoolyard.

Investigation

3. Choose four to six surfaces to test. Look for a variety of colors, textures, and materials. Make sure all of the surfaces are in direct sunlight.
4. Record each surface in the table on the next page.
5. The first row in the table has already been filled in. This is so you can record the air temperature in direct sunlight.

Surface to Test

Run 1

1	Air temperature in direct sunlight
2	
3	
4	
5	
6	
7	
8	
9	

Investigation

6. Begin recording temperature data.
7. Hold the temperature sensor in the air and wait for the reading to stabilize. When it has stabilized, keep the data point.
8. Turn to the next slide to see the temperature reading.

	Surface to Test	Temperature (°C)
	Run 1	--
1	Air temperature in direct sunlight	
2		
3		
4		
5		
6		
7		
8		
9		

Investigation

9. Go to the first surface you will measure. Place the tip of the temperature sensor on the surface.
10. Wait for the reading to stabilize. When it has stabilized, keep the data point.
11. Repeat the data collection for the other surfaces on your list.
12. Turn to the next slide to see your temperature data.

	Surface to Test	Temperature (°C)
	Run 1	--
1	Air temperature in direct sunlight	
2		
3		
4		
5		
6		
7		
8		
9		

13. Did you find variation in the surface temperatures around your schoolyard? If so, what were the minimum temperature and the maximum temperature you measured?

14. How do your results compare to your predictions? Suggest reasons for any differences.

SNAPSHOT

Temperatures around the schoolyard . . .

The minimum temperature was . . .

The maximum temperature was . . .

Compared to my predictions . . .

15. What was the range of temperatures you measured?

16. What is the mean, or average, of all the temperatures you measured? How does this value compare to the air temperature?

SNAPSHOT

The range of temperatures around the schoolyard was . . . °C.

The mean temperature is . . . °C.

Compared to the air temperature . . .

Interpretation

1. **Is the Sun's energy absorbed the same by all of the surfaces it shines on? Explain why you think this.**

SNAPSHOT

The Sun's energy . . .

I think this because . . .

Interpretation

2. How is the surface with the warmest temperature different from the surface with the coolest temperature?

SNAPSHOT

The surface with the warmest temperature . . . while the surface with the coolest temperature . . .

3. Which color shirt would keep your body coolest on a warm, sunny day?

a) White
b) Yellow
c) Red
d) Black

4. The Sun's energy is Earth's source of . . .

a) minerals and helium.
b) helium and heat.
c) minerals and energy.
d) light and heat.

SNAPSHOT

Write the letter of your answer:

Explain why you chose this answer.

Write the letter of your answer:

Explain why you chose this answer.

5. It's a hot, sunny day. You're outside barefoot helping plant flowers. Time to move from the front yard to the back. You have to walk across a green lawn, over a black asphalt driveway, and along a light-colored concrete walkway. Which surface do you think will feel most comfortable to your feet? Which will feel least comfortable? Why?

SNAPSHOT

The surface that will feel most comfortable is . . . because . . .

The surface that will feel least comfortable is . . . because . . .

Career Connection

Stan Atcitty, *Electrical Engineer, Sandia National Laboratories*

Wires carrying electrical energy crisscross the country in a giant network. Most homes get a steady supply of electricity from this grid. But what about people who live "off grid"? That's where Stan comes in. He's an expert on power systems for remote areas.

Stan grew up in the Navajo Nation in New Mexico. People there use solar energy to make their own electricity. Batteries store extra electricity for nights and cloudy days. Stan uses computer models to test these solar energy systems. He figures out how to get the best use out of a limited amount of energy.

Career Quest – List 10 devices you use that run on electricity. Which five might you turn off to conserve energy for a day?