

Experiences

ACTIVITY SHEET: HOW ARE LIGHT AND HEAT RELATED?

Aim:

To explore how different surfaces absorb sunlight and transfer that heat to objects placed on them.

You will need:



4 identical metal spoons



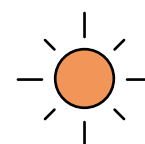
Black paper



White paper



Aluminium foil



A sunny
outdoor space



What to do:

- 1) Place the black paper, white paper, and aluminium foil side by side in a spot that will remain in direct sunlight for at least 20 minutes. Make sure that they do not fly or move and the sun falls evenly on them.
- 2) Place one identical metal spoon in the centre of each surface.
- 3) If possible, place a fourth spoon on the bare ground nearby.
- 4) If you have extra spoons and papers, place the same setup in the shade. If not, you could simply move your sun-warmed setup into the shade after you are done (do the spoons stay at different temperatures, or do they all eventually feel the same?).



- 5) Predict which spoon will feel the warmest and which will be the coolest. Write down your reasons in the table in the **Observe and record** section.
- 6) Leave the setup undisturbed in the Sun for 15–20 minutes.
- 7) Use the back of your finger to carefully touch each spoon. Then touch the paper or foil underneath it. Compare their degrees of hotness. Rank the spoons in the table from 1 (hottest) to 4 (coolest).

Observe and record:

| |  Predict |  Observe | Was your observation different from your prediction? |
|-------------------------|---|---|--|
| Spoon on black paper | | | |
| Spoon on white paper | | | |
| Spoon on aluminium foil | | | |
| Spoon on ground | | | |

Think about:

- Why did the spoons in the shade feel different from those in the Sun? What does this tell you about the relationship between sunlight and heat?
- Why did the spoon on the black paper get hotter than the one on the white paper or foil? What is the black paper doing with the light that the others are not?
- Was the spoon on the black paper hotter than the one on the bare ground? What does this tell you about how the surface underneath an object affects its heating?
- Did the spoon heat the paper, or did the paper heat the spoon? How can you tell? (**Hint:** Which one felt hotter when you touched them?) How does the heat move from the surface into the object resting on it?

Discuss:

- Q1. Based on your observations, which surface absorbed the most sunlight and which reflected the most? How does a surface's ability to reflect light change its temperature?
- Q2. How does warmth from the Sun reach the spoons through millions of kilometres of empty space without any physical contact?
- Q3. Why do people in hot climates often paint their houses white or wear light-coloured clothes? Can you use your results with the black and white paper to explain this?



Contributed by:

Vipin Varghese is a temporary physics teacher at Government Higher Secondary School, Kizakkupuram, Pathanamthitta district, Kerala. He can be contacted at: vipinv_1@yahoo.com.

David Blair is an Emeritus Professor at the University of Western Australia and Director of the Einstein-First project, which promotes the teaching of modern physics concepts in schools. He can be contacted at: david.blair@uwa.edu.au.

