

Name:

Date:

Class:

Protective Fashion! Student Worksheet – Answer Key

Pre-Activity

Introduction: When you head to the beach, it's natural to focus on looking stylish and staying cool. But have you ever considered how your beachwear can also shield you from the sun's harmful ultraviolet (UV) rays?

In this activity, you'll take on the role of a textile engineer, creating beachwear that combines style with sun protection. Your task is to design clothing that not only looks great but also keeps the wearer cool and safeguards them from UV radiation.

Pre-Activity Instructions: After listening to the teacher's introduction and watching the video "[Sun and Skin](#)," answer the following questions.

1. What is UV radiation?

UV radiation, or ultraviolet radiation, is a type of energy that comes from the sun and other sources, like tanning beds. It's a bit like the light we see with our eyes, but it's invisible because its wavelengths are shorter. You can think of UV radiation as being a bit like sunlight's "secret" rays. Even though we can't see UV rays, they can still harm our skin and eyes.

2. Why is UV radiation harmful to human skin?

UV radiation is harmful because it can damage the cells in your skin. When your skin gets too much UV radiation, it can cause a sunburn, which is a sign that your skin cells are hurt. Even more seriously, UV radiation can change the DNA in your skin cells, which is like the instructions for how your cells should work. If the DNA gets damaged, it can lead to skin cancer, which is when your skin cells start to grow uncontrollably. That's why it's important to protect your skin with sunscreen, wear protective clothing, and avoid too much direct sunlight, especially during the middle of the day when the sun's UV rays are strongest.

3. Besides wearing sunscreen, how can people take preventive measures against skin cancer at the beach?

Wearing clothing that blocks UV rays, like long-sleeve shirts and wide-brimmed hats, is a great way to shield your skin. You can also choose clothing made from special UV-blocking fabrics for extra protection. Seeking shade, especially during peak sun hours, can help reduce your exposure. Don't forget to wear UV-blocking sunglasses to protect your eyes, and be mindful of reflective surfaces like water and sand, which can bounce UV rays back onto your skin. Finally, checking the UV Index can help you plan your outdoor activities when the risk is lower.

4. What problem are we going to try to solve?

How can we make beach clothes that are cool and yet protective from UV radiation.

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Activity Procedure

Control Experiment

1. In your group's box, draw a large person-shape on the photoluminescent paper with a dark marker. Try to fill as much of the paper as possible.
2. Label this page "Control."
3. While the UV flashlight is still off, measure 6 inches from the end of the flashlight to the photoluminescent paper.
4. Use your UV flashlight and shine the light on the paper for 2 minutes. (Use your phone as a timer.)
5. When the 2 minutes is over, observe how much UV light ends up on the person-shape.
6. Each group member should record their observations in the table below.
7. Describe any other changes to the paper related to color, reflection, etc. in the table below.

Color Change Observations	Other Observations
Data will vary.	Data will vary.

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Fabric Experiments

Instructions: Do the following for each fabric type.

1. In your group's box, draw a large person-shape (like the person-shape drawn in the control experiment) on the photoluminescent paper with a dark marker.
2. Label this page with the fabric type.
3. Cut the fabric to the dimensions and shape of your large person-shape.
4. Weigh the mass of the fabric on the scale (in grams) and record it in the data table.
5. Place the fabric on top of your person-shape.
6. While the UV flashlight is still off, measure 6 inches from the end of the flashlight to the photoluminescent paper.
7. Use your UV flashlight and shine the light on the paper for 2 minutes. (Use your phone as a timer.)
8. When the 2 minutes is over, observe how much UV light ends up on the person-shape.
9. Remove the fabric from the person-shape and observe the penetration of UV light from a flashlight on the person-shape.
10. Record your observations in the data table.
11. Describe any other changes to the paper related to color, reflection, etc. in the data table.

Data Table

Fabric Type	Mass of Fabric (g)	Observed color changes	Other observed changes
Cotton	Data will vary.	Data will vary.	Data will vary.
White satin/silk	Data will vary.	Data will vary.	Data will vary.
Denim	Data will vary.	Data will vary.	Data will vary.
Corduroy	Data will vary.	Data will vary.	Data will vary.

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Data Analysis

Based on the data you collected above, answer the following questions:

1. Which fabric type would be the coolest fabric to wear to the beach? Why?

Data may vary, but cotton OR satin/silk is the coolest fabric to wear to the beach because their mass was lowest out of all the fabrics.

2. Which fabric type would be the best at protecting from UV radiation? Why?

Data may vary, but denim OR corduroy would be the best protection from UV radiation of the four fabrics because the UV flashlight penetration on these fabrics left the photoluminescent paper the most unchanged.

3. Which fabric type would be the coolest and best UV radiation protection? Why?

Data may vary, but many students conclude that cotton OR satin/silk would be the coolest fabric and provide the best UV radiation protection because their mass was lowest out of all the fabrics but these fabrics still protected the photoluminescent paper from UV radiation to a degree.

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Design

Instructions: Based on the data collected, design three beach outfits that only cover the top layer of the person-shape on your photoluminescent paper. These outfits may be designed to your liking, but you must be mindful of protection and comfort. Sketch your three designs below. Make sure to label the fabrics/materials you would like to use in each design.

Design #1

Designs will vary.

Design #2

Designs will vary.

Design #3

Designs will vary.

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Test

Instructions: Do the following for each of your beach outfit designs.

1. In your group's box, draw a large person-shape (like the person-shape drawn in the control experiment) on the photoluminescent paper with a dark marker.
2. Label this page with the design number.
3. Cut the fabric to the dimensions and shape of each design sketch.
4. Weigh the mass of the fabric on the scale (in grams) and record it in the data table.
5. Place the fabric on top of your person-shape.
6. While the UV flashlight is still off, measure 6 inches from the end of the flashlight to the photoluminescent paper.
7. Use your UV flashlight and shine the light on the paper for 2 minutes. (Use your phone as a timer.)
8. When the 2 minutes is over, observe how much UV light ends up on the person-shape.
9. Remove the fabric from the person-shape and observe the penetration of UV light from a flashlight on the person-shape.
10. Record your observations in the data table.
11. Describe any other changes to the paper related to color, reflection, etc. in the data table.

Data Table

Design	Mass of Fabric (g)	Observed color changes	Other observed changes
Design #1	Data will vary.	Data will vary.	Data will vary.
Design #2	Data will vary.	Data will vary.	Data will vary.
Design #3	Data will vary.	Data will vary.	Data will vary.

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Improvements

Based on the data you collected above, answer the following questions:

1. Which of your designs would be the coolest to wear to the beach? Why?

Answers will vary.

2. Which of your designs would have the best protection from UV radiation? Why?

Answers will vary.

3. Which of your designs would be the coolest AND have the best UV radiation protection? Why?

Answers will vary.

4. What improvements would you make to your design? Why?

Answers will vary.

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Reflection

Answer the following questions:

1. How did the different fabrics you tested compare in terms of their ability to block UV radiation? What surprised you about the results?

Potential answer: The different fabrics showed varying levels of UV protection. For example, denim likely blocked the most UV radiation because it's thick and tightly woven, while cotton and satin/silk might have let more UV rays through because they are lighter and thinner. What surprised me was that the thickness of the fabric wasn't the only factor—color and material composition also played a role.

2. What challenges did you face when trying to balance style, comfort, and UV protection in your beachwear designs? How did you overcome them?

Potential answer: One challenge was finding a fabric that was both stylish and provided strong UV protection. For example, denim offers great protection but might be too hot and heavy for the beach. To overcome this, I looked for lighter fabrics with tight weaves or added layers of fabric that were breathable but still blocked UV rays.

3. If you had to choose one fabric to use for all beachwear based on your experiments, which would it be, and why?

Potential answer: Based on the experiments, I would choose a lightweight, tightly woven fabric like polyester with UV-blocking properties. This type of fabric can provide good protection while remaining cool and comfortable in hot weather, making it ideal for beachwear.

4. How did your understanding of UV radiation influence your design choices? Do you think these choices would change if you were designing for a different environment (e.g., hiking in the mountains)?

Potential answer: Understanding that UV radiation can cause skin damage and increase the risk of skin cancer made me prioritize fabrics that offer maximum UV protection. For beachwear, I focused on lightweight, UV-blocking fabrics. If I were designing for hiking in the mountains, where temperatures can vary, I might choose fabrics that offer both UV protection and warmth, like layering lighter UV-protective fabrics under a breathable but insulating outer layer.

5. After completing this activity, what advice would you give to someone choosing beachwear to protect themselves from UV radiation?

Potential answer: I would advise choosing clothing made from tightly woven, UV-blocking fabrics, like polyester or nylon blends, and opting for darker colors, which can absorb more UV rays. It's also important to cover as much skin as possible with long sleeves and wide-brimmed hats. And, don't forget to wear sunglasses that block UV rays to protect your eyes.