



Sample GEMS Club Activity

Topic: UV Power

Goals: Understand and measure UV rays and use UV rays to transform objects into art using the sun's power

Challenge One: supplies needed:

- UV beads—60 per girl (buy from Amazon or Steve Spangler)
- Snack-size plastic bags—Ziploc—6 per girl
- 4 different strengths of sunscreen—1 big bottle of each strength is plenty—if you can't find 4 different strengths, use old sunscreen vs. new but be sure to mark the bottles
- 1 white t-shirt cut into 16 small squares
- Permanent marker
- Q-tips to smear the sunscreen on the bags
- A few large tubs to carry the bags out into the sun.
- Colored pencils
- A day with no rain

Vocabulary:

- Ultra-violet
- Molecules
- Spectrum
- Wavelengths
- Radiation

Challenge 1—the Power of Ultra-Violet Light

Background: Ultra-violet energy beads are indicators of the presence of UV light. They are normally opaque or a pale green, but change to bright colors upon exposure to UV light. Using energy beads, you will be able to uncover an invisible form of light energy called ultra-violet light. None of the energy in the ultra-violet region of the light spectrum is visible to the naked eye. Just as there are many different colors of wavelengths in the visible spectrum (red, yellow, green, blue...), so are there many wavelengths of ultra-violet light.



When you expose bare skin to sunlight or solar radiation, your skin will either burn or tan (which doctors warn is **not** healthy for your body). UV radiation wavelengths are short enough to break chemical bonds in your skin tissue and, with prolonged exposure, your skin may wrinkle or skin cancer may appear. These responses by your skin are a signal that the cells under your skin are being assaulted by UV radiation.

<http://solar-center.stanford.edu/>

Preparation:

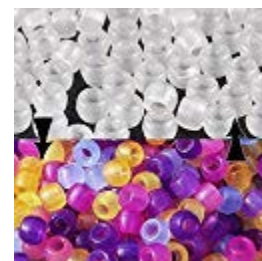
Make each girl a kit of 60 beads, 6 bags, a marker, a square of the T-shirt, and 4 Q-tips. Do not pass these out until you are ready to work. Have a kit ready to demonstrate.

Challenge One:

People are always telling you that you should cover up to protect yourself from the harmful rays of the sun, either by using sunscreen or by wearing long-sleeved clothing. But how do you know that is true? Maybe they just want you to look ugly or to sell sunscreen. How can you find out?

Preparing the experiment:

Show the girls the supplies and tell them that they are going to test how good sunscreen and clothing are at blocking the rays of the sun. Using the data sheet, have them predict what will happen when the packages of beads are covered in sunscreen and put out into the sun. Discuss and annotate the predictions, especially the ones about the shirt. Dim the lights in the room so they can work but not expose the beads to too much light.



Directions to the girls:

1. Mark each of 4 bags with the level of sunscreen—4, 15, 30, 45 etc. and your initials.
2. Mark one bag “zero” and your initials—this is your control.
3. Mark the last bag with the word “shirt” and your initials.
4. Count out 10 beads into each bag and zip them closed tightly.
5. Place the T-shirt piece into the “shirt” bag, and fold it over so that the beads remain under the shirt when you go outside. It is essential that beads are not exposed to sunlight directly.

6. On the remaining 4 bags, use a Q-tip to smear a large portion of sunscreen on the bag—about 2 inches by 3 inches. Be sure to match the level of the sunscreen SPF factor to the marked bag. Do not mix up the Q-tips. (WHY?)

Carrying out the experiment:

1. Place the bags into the tubs and, keeping them covered, take them out into the sun. Quickly and carefully, give each girl her bags and have her lay them in the sun, making sure the beads are inside the bag and under the sunscreen or shirt.
2. Set your timer or watch for 5 minutes, or 10 minutes on a cloudy day.
3. When the timer goes off, leave the beads in the bags, pick them up and get them back inside where the girls can observe the changes.
4. Have the girls complete the second part of the data sheet—recording with colored pencils the changes they have noticed.

Discussion:

- What happened? What were the changes you noticed, if any? Compare the changes to your predictions.
- What does the data tell you about sunscreen use? What does it tell you about clothing as protection? Was there a difference in reaction with different strengths of sunscreen?

Analysis/Conclusion:

- What is your conclusion about the value of sunscreen? Is it protecting skin from the sun? How can we protect ourselves and our friends?



Challenge 2—making the power of the sun work for you

“You go visit your grandmother, who lives in a very hot climate. You notice that when she takes a picture off the wall to show you some relatives, there is a square left on the wall where the picture has been hanging. What happened? How can you figure this out?”

Supplies needed:

- SunPrint Paper (buy from Amazon or Steve Spangler—3-4 sheets per girl)—if you have large sheets, cut them into smaller pieces
- Fun-shaped objects to make prints of—big paper clips, toys, leaves, etc.
- Small tubs of water
- Cardboard
- Thumbtacks
- Clear plastic wrap
- Towels/paper towels for drying
- Sunny area or very bright lights

Preparation:

Get the materials ready and have access to either a safe outdoor area with plenty of sun, and some shade (under an overhang, perhaps.) Place the tubs of water around the periphery of the area so that the girls can move around between the sun and the shade.

Making Predictions:

Using the attached data sheet, ask the girls to write down their predictions/rationale for what is happening to grandmother’s wall. Use these later to discuss the results of their experiments.

Challenge directions:

- In the shade, place one sheet of the Sun Print paper blue side up, and pin the corners to a piece of cardboard for stability.
- Place one or two objects you wish to "print" on top of the paper. If your objects are particularly lightweight, you can hold them in place with a piece of clear plastic wrap.
- Expose the paper to the sun for 2-4 minutes, until the Sun Print paper turns very pale blue.
- Remove the paper from the tray or cardboard and soak it in water for about one minute. Remove the paper from the water and let it dry flat. The image will sharpen as it dries.



Discussion:

Go back to the predictions. Were they accurate? What happened to the blue paper? Why do you think this happened? What do you think is happening to the walls in your grandmother's house?

Does this kind of event only happen with sunlight? What would happen if you tried it with regular lights?

Reflection:

What have you learned about the power of the sun? What do you remember about doing the experiments? What worked and what didn't? Use the reflection cards to help discussion.

More resources:

<https://www.wbdg.org/resources/sun-control-and-shading-devices> --Harnessing the power of the sun

<https://www.energymatters.com.au/education/solar-kids-teens/>

UV Power data sheet

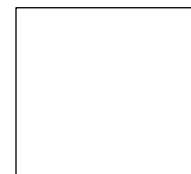
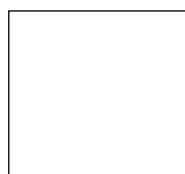
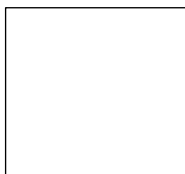
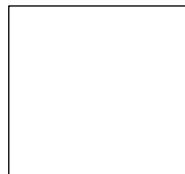
Your first challenge: People are always telling you that you should cover up to protect yourself from the harmful rays of the sun, either by using sunscreen or by wearing long-sleeved clothing. But how do you know that is true? Maybe they just want you to look ugly or to sell sunscreen. How can you find out?

Your supplies:

- UV beads—60
- 6 Snack-size plastic bags—Ziploc
- 4 different strengths of sunscreen
- 1 small square of a T-shirt
- Permanent marker
- Q-tips to smear the sunscreen on the bags

Given these supplies, how do you think that the sunscreens will affect the beads when you put them into bags? Write or draw your thoughts and predictions:

Draw each of the bags—what do the beads look like?





Your second challenge:

You go visit your grandmother, who lives in a very hot climate. You notice that when she takes a picture off the wall to show you some relatives, there is a square left on the wall where the picture has been hanging. What happened? How can you figure this out?

Your supplies:

- SunPrint Paper—3-4 sheets per girl
- Fun-shaped objects to make prints of—big paper clips, toys, leaves, etc.
- Small tubs of water
- Cardboard
- Thumbtacks
- Clear plastic wrap
- Towels/paper towels for drying

Prediction:

Draw or write what you think is happening to the wall and pictures.

After you have made your SunPrints, draw or write what happened and why. Make a suggestion to your grandmother.

