

Lesson Plan

Assessment	AFL, observations, peer assess.
Cross-curricular	Health, Phys.Ed., Technology

Big Ideas

- A wide range of technologies utilizes the properties of light and colour.
- The behaviour of light depends on the materials with which it interacts.

Learning Goals

- Learn what UV light is
- Practice making observations
- Learn how to brainstorm variables that might affect a scientific test
- Learn to make an experimental plan

Materials

UV sensitive beads
 String
 UV Beads Inquiry Part 1 (Rally Robin and Inquiry Plan)
 Smarter Science Level 3 posters
 (<https://smarterscience.youthscience.ca/>)

Safety Notes

UV radiation from the sun can cause sunburns.

Specific Expectations

A1.1 formulate scientific questions about observed relationships, ideas, problems, and/or issues, make predictions, and/or formulate hypotheses to focus inquiries or research

A1.2 select appropriate instruments and materials for particular inquiries

A1.4 apply knowledge and understanding of safe practices and procedures when planning investigations; ... safe operation of electrical equipment, ... with the aid of appropriate support materials.

A1.5 conduct inquiries, controlling some variables, adapting or extending procedures as required, and using standard equipment and materials safely, accurately, and effectively, to collect observations and data

A1.6 gather data from laboratory and other sources, and organize and record the data using appropriate formats, including tables, flow charts, graphs, and/or diagrams

A1.8 analyse and interpret qualitative and/or quantitative data to determine whether the evidence supports or refutes the initial prediction or hypothesis, identifying possible sources of error, bias, or uncertainty

E2.1 use appropriate terminology related to light and optics

E2.5 investigate how various objects or media reflect, transmit, or absorb light

E3.1 describe various types of light emissions and how they produce light

E3.2 identify and label the visible and invisible regions of the electromagnetic spectrum, and identify the colours that make up visible white light

Description

This is **lesson one** of two lessons on UV radiation. Students should have a basic understanding of the electromagnetic spectrum.

Introduction

- The day prior to starting this activity the teacher should give every student a length of string and 3-5 Ultraviolet sensitive beads.
 - The teacher will describe these beads only as 'Observation Beads' and give students the instruction to tie these beads on to their wrists and carefully observe any changes that they make over the next 24 hours.
 - Students should be encouraged to keep the beads on for all activities (homework, sleep, showering, chores, etc.) if possible. If/when students encounter ultraviolet radiation from sunlight the beads will begin to change colour.
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Action

- Before students arrive, the teacher will post or project the Smarter Science LVL 3 posters.
- Upon arriving in class students should be assigned to Inquiry Lab groups of 2-4 students.
- Within groups, students will be asked to get out their 'observation' beads and discuss the observations that they made the previous night through a process called Rally Robin.
 - Each group will use UV Beads Part 1 'RallyRobin' and students will take turns writing down an observation before 'rallying' the sheet to the next student in the group.
 - This proceeds until observations are exhausted (be sure to encourage both qualitative and quantitative observations).
- Students will take green sticky notes and write their observation one-per-note. They will bring them to poster 1 in the 'Steps to Inquiry' poster and stick them around the 'Event' graphic.
 - If a student sees an identical observation they will cover it with their own sticky note.
- The teacher will lead a brief discussion on these observations.
- The teacher will explain that the observations beads are, in fact, Ultraviolet detecting beads and they change colour when struck by UV radiation.
- The teacher will lead the students through the associated presentation about UV light (slides 1-7 of the 'UV Beads Visuals').
- Students will take blue sticky notes. The teacher will explain "Now that we know that these beads change colour when they get hit by ultraviolet radiation, we can use these beads as little detectors. What are some things that we could change that would affect how much these beads change colour?"
 - The teacher may prompt students to think about how we protect our own bodies from UV radiation.
 - As students come up with possible Independent Variables they will write them on the blue sticky notes and place the notes on page 2 of the 'Steps to Inquiry'
 - *Students may benefit from significant prompting in this step. Suggestions might include:

- Time of day
 - Kind of light source
 - Added sunscreen (further, differing SPFs of sunscreen)
 - Kind of cloth in front of bead
 - Thickness of glass in front of bead
 - Location
 - Which bead is used
 - Car window vs. school window
 - Amount of cloud cover
 - Age of sunscreen
 - Type of sunglasses
- Each group will be given a copy of page 3 of the Steps to Inquiry and it should be displayed/projected if possible. The teacher will lead a discussion using the following prompts and wait-time:
 - “How can we tell how much radiation is hitting the beads?” A: How dark they get.
 - “If we were to test a bunch of different light sources, how could we tell which one is giving off more UV light?” A: use the same bead, same amount of time, and compare darkness of colour
 - “How can we compare the colour on the same bead? Should we just remember it as best we can?”
 - Students may suggest various options. Likely ones are to take a photo on a cell phone or class ipad camera, or use pencil crayons/markers to record a representation of the colour.
- CHOOSING DEPENDENT VARIABLE: Depending on the students and their level of skill with inquiry, teachers may want to:
 - Choose a single dependent variable that all groups will measure.
 - Allow students to brainstorm and choose their own option (note: this makes it more difficult for groups to teach one another what they have learned).
- Dependent Variable Measuring Options may include:
 - Take photos on cell phones and directly compare bead darkness
 - Use pencil crayons or markers to draw a representation of bead darkness.
 - Use a Colour Gradient (see slide 8 or below), place bead on the gradient, and measure the distance from the white side in cm.
 - Colour gradients can be found by searching for (for example) “pink white gradient”.
- Students should write their chosen DV on a green sticky note and place it on their paper copy of page 3 of the Steps to Inquiry poster.
- LEARN WHAT A CONTROL GROUP IS: Show students slide 9
- CHOOSING INDEPENDENT VARIABLE and CONTROLLED VARIABLES: Students should look at the class-generated list of brainstormed variables.
- Using blue sticky notes they will write down ONE variable that they will change on purpose (their IV) and place it on their chart.

- They will write down on blue sticky notes at least 4 other variables that they will purposefully keep the same as controls and place these in the CV spots on their chart. Students will show this to their teacher and if approved they will be given their 'Inquiry Plan', UV Beads Part 1.
 - Groups will fill out UV Beads Part 1 'Inquiry Plan' as a group.
 - Do peer assessment of plan, and then hand it in for formative teacher feedback.
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Consolidation/Extension

- The group will fill out the inquiry plan then trade their plan with another group for peer assessment.
 - The other group will provide written feedback (one good thing, one thing to improve, and circle in pencil any confusing parts) and verbally describe this feedback.
- Groups will use the peer feedback to make improvements to their Inquiry Plan then submit to the teacher before leaving class for formative assessment comments (returned during the next period).