Detecting Ultraviolet Light

TEACHER WORKSHEET
Year Levels 5-9

OBJECTIVES

1. Understand that ultraviolet light is part of the sun's electromagnetic spectrum
2. Recognise that ultraviolet light has shorter wavelengths than visible light
3. Explain the concept of fluorescence and that UV causes fluorescence in some substances such as tonic water

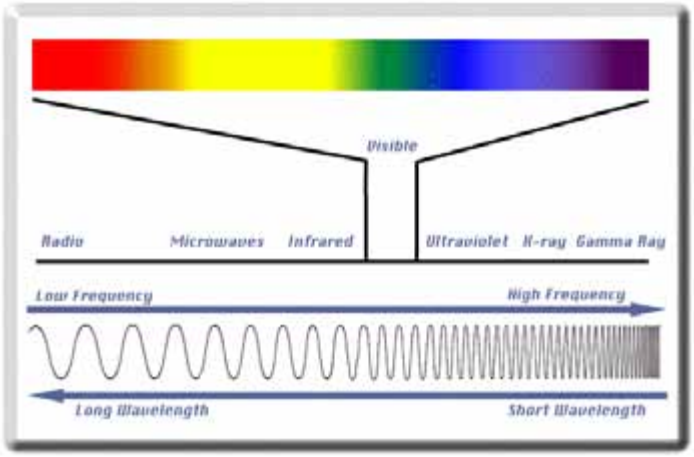
BACKGROUND INFORMATION

The energy from the sun includes not only visible light but also wavelengths longer (infrared) and shorter (ultraviolet) than visible light. The wavelengths of visible light increase from violet to red across the spectrum. Those wavelengths that are shorter than violet are called ultraviolet (UV). The amount of ultraviolet radiation reaching the earth's surface at a particular point depends on the distance it travels through the atmosphere. During the morning the sun is lower on the horizon and therefore UV light travels through more of the earth's atmosphere. At noon the rays travel their shortest distance through the atmosphere as the sun is directly overhead.

This activity is a simple method for demonstrating UV light presence. When a photon of UV energy is absorbed, it is reemitted by the quinine in tonic water as a photon of visible light. This process is called fluorescence. The extent of fluorescence that occurs is related to the amount of UV light resulting from the angle of the sun (time of day and season of the year).

WHAT YOU NEED

- 2x Beakers or clear, plastic cups
- Tap water
- Tonic water
- Pen and labels
- Black card 18cm x 25cm
- Sunlight
- Blacklight if available
- Sunscreen
- Overhead transparency film



WHAT TO DO

1. Label the beakers *tap water* and *tonic water*.
2. Fill one beaker almost to the top with tap water
3. Fill the other beaker almost to the top with tonic water.
4. Whilst indoors, place the black card behind both beakers and shine the black light onto both beakers and observe the changes.
5. Take the beakers and black card outside. Hold the black card behind the beakers and look across the surface of the tonic water and tap water through the sides of the glasses. You should see a blue tint across the surface of the tonic water.
6. Smear some sunscreen onto the overhead transparency film and cover the top of the tonic water with it. Observe any changes.

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QUESTIONS

1. How would the position of the sun affect your results? *The results will be best when the sun is in the middle of the sky.*
2. What happened when you held the OHT film over the top of the beaker with tonic water? *The blue disappears as the sunscreen filters the UV light.*

REAL WORLD APPLICATIONS OF ULTRAVIOLET LIGHT

Fluorescent plastics are being developed at QUT, Faculty of Science to help protect plastic materials by trapping any damaging free radicals and also acting as an early detection of plastic degradation. This technology is being used in detecting cracks in aircraft wings. More information at http://www.sciencealert.com.au/features/20082602-16949.html

Ultraviolet disinfection water system used UV light to eliminate water borne pathogens (germs, viruses and moulds). UV-C light has the ability to destroy pathogens by inactivating their DNA and thus their ability to reproduce.

CURRICULUM

Essential Learnings: Energy and Change Years 5-9
-Energy can be transferred from one object to another.
-Different forms of energy used within the community have different sources.
-Energy can be transferred and transformed.
-Transfer of energy can vary according to the medium in which it travels.

RESOURCES

1. Henkle, T. 2008. *Mr Henkles Home Science page*. http://earth-oceans.com/images/spectrum.gif. Access 22/08/08.
2. University Cooperation for Atmospheric Research. 2008. *Detecting ultraviolet light using tonic water*. www.ucar.edu/learn/1_5_2_23t.htm. Accessed 22/08/08.
3. Gadgil, A.J. and Leslie, J.S. 1995. *To Drink Without Risk: The use of ultraviolet light to disinfect drinking water in developing countries*. http://solarcooking.org/ultraviolet1.htm. Accessed 30/08/08.