In partnership with

UNIVERSITY OF CAMBRIDGE

SPACE TO EARTH CHALLENGE

Space, Sports, Sun and Safety

KS 2/3 Project 1 - Exposure to UV Radiation

Some sunshine is good for our bodies, and helps us produce vitamin D. However, the Sun's radiation can also be dangerous. One way the Sun affects us here on Earth is through the ultraviolet (UV) light it emits, which we cannot see. The UV from the Sun gives us a suntan but it also causes sunburn, which can sometimes lead to skin cancer. It is not just direct sunlight which causes sunburn. UV light reflected off water, sand, concrete and snow can also cause problems. UV reflects off most sports training grounds and is a potential problem for athletes. To ski or snowboard, you would be high up in the mountains, where the UV light is stronger than at sea level. The snow also reflects UV light onto your face, so extra protection is needed, even when it is cloudy. Strong sunlight and UV radiation can damage eyes causing sunburn (snow blindness), degeneration in sight and cataracts.

When we are out in the Sun we need to use a very good sunscreen to block the UV radiation, and to keep us safe. In project 1, we explore this using beads that change colour in UV light, by creating experiments to test which suncreams are best. In project 2, we explore the variation in the sunlight in different parts of the world, and how this correlates with indigenous skin colour and skin problems. In project 3, we explore how to protect our eyes and faces from too much sunlight. Some material is common to all three projects.

OBJECTIVES

- To learn that sunlight extends beyond the visible into the ultraviolet (UV).
- To learn that the UV radiation from the Sun can be dangerous.
- To explore ways we can protect ourselves from too much direct sunlight.

RESOURCES

- Beads which change colour in response to UV light
- 3-4 different sunscreens (a range of SPF levels)
- Clear plastic bags
- Cotton buds
- UV light source (the Sun or UV lamp)
- Stop watch
- Materials which fluoresce (eg toothpaste, washing powder, highlight pens)
- Shoe box

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FACT FILE

There are several ranges of UV radiation, including UV-A (315-400nm) and UV-B (280-315nm). The latter is the most harmful to us on Earth since it penetrates further through the Earth's atmosphere. Sunscreens should provide protection against both UV-A and UV-B (it should say on the labels). Too much exposure to UV radiation can cause skin problems, sunburn, or in extreme cases, skin cancer (eg melanoma). Sweating can increase the risk of sunburn. Glass gives us some protection against UV radiation.

UV radiation is a particular hazard to astronauts. If exposed to direct sunlight, their skin would be burnt in a matter of seconds. In the copola (area with windows) on the ISS, the astronauts are protected by the material the windows are made of, but they still need to wear sunglasses to protect their eyes against the bright visible sunlight.

UV beads (sometimes called 'Energy Beads') respond to UV light by changing their molecular composition, so that they then appear different colours. When the UV light no longer falls on them, they change back to white. They can be switched back and forth many times (about 50,000). They are a very good way of detecting UV radiation, and can be used in experiments or for decoration (book marks, bracelets).

Sunscreens are labeled with a Sun Protection Factor (SPF) number. This number applies to UV-B screening. If you are a pale-skinned person using SPF15, you can spend 15 times longer in the Sun before getting sunburnt than you would without any sun screen. However, be careful as sunscreens can be wash off by sweat or when in the sea. We are protected from the Sun by clothing, but some materials are better than others.

Some materials (eg toothpaste, washing powder, highlight pens) fluoresce in UV radiation. These can be used in various activities.

Some animals can see UV light. Kestrals can see the urine trails of small mammals (mice etc). This helps them to track down their prey.

ACTIVITY

The aim of this activity is to encourage the students to come up with their own investigation. There are many ways they can do this. We recommend placing the beads into plastic bags, and checking that they change colour under UV light (either in sunshine or with a UV lamp). The students can sort the beads into different colours, to see if this makes any difference. The beads return back to white when there is no UV radiation.

The students can try thinly smearing the outside of a bag with sunscreen (imagining that the bag is their skin). We suggest providing cotton wool balls or buds for this. Try several different bags, with sunscreens of different strengths (SPF levels). The students can also investigate how much protection from UV radiation is provided by different materials.

The students could:

- explore how long it takes for different beads to change colour.
- make a colour chart, as the beads get deeper in colour with more exposure to the UV light.
- explore which suncreams give the best protection from the UV light, also try other skin creams, such as baby oil or facecream.

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- explore whether different colour beads react in the same way or take the same amount of time to change colour.
- find out if glass or plastic blocks UV light.
- find out if different fabrics (cloth, paper, plastic) protect us from UV radiation.

Other ideas and questions to explore

- Make a sun hat, with some UV beads around the rim.
- Make a bookmark about space with UV beads.
- Find out how easy it is to wash sunscreen off.
- Put a UV light in a shoe box with a peep hole, then place some objects inside to see if they fluoresce. Also write an 'invisible' message with a yellow highlighter pen and then place it in the shoebox to read it. 'Spy pens' can also be used.
- Find out if clouds protect us from UV radiation. (Note: only partially)
- Find out if windows protect us from UV radiation. (Note: most glass does)
- Which athletes (swimmers, runners, skiers, cyclists etc) are most at risk from UV radiation? (Note: runners, with exposed skin and training in the middle of the day)
- What about astronauts, are they at risk? (Note: astronauts are protected from the UV inside the ISS, but not on Extra Vehicular Activities (EVAs). They also need to wear sunglasses to protect their eyes from the strong visible sunlight).
- Find out about the daily UV index (see link below to the Met Office)

SAFETY

The UV beads will change colour outside, even if it is cloudy. However, you may wish to use UV LED torches, or black lights, if you do not have easy access to an outside space. These should be used with care, do not point into eyes, and always follow the manufacturer's recommendations.

NEVER LOOK DIRECTLY AT THE SUN

WEB LINKS

UV colour change beads are easy to source, one suggested provider is

- **http://www.stevespanglerscience.com**

Met Office, UV index

- **http://www.metoffice.gov.uk/health/public/uvindex#?tab=map**

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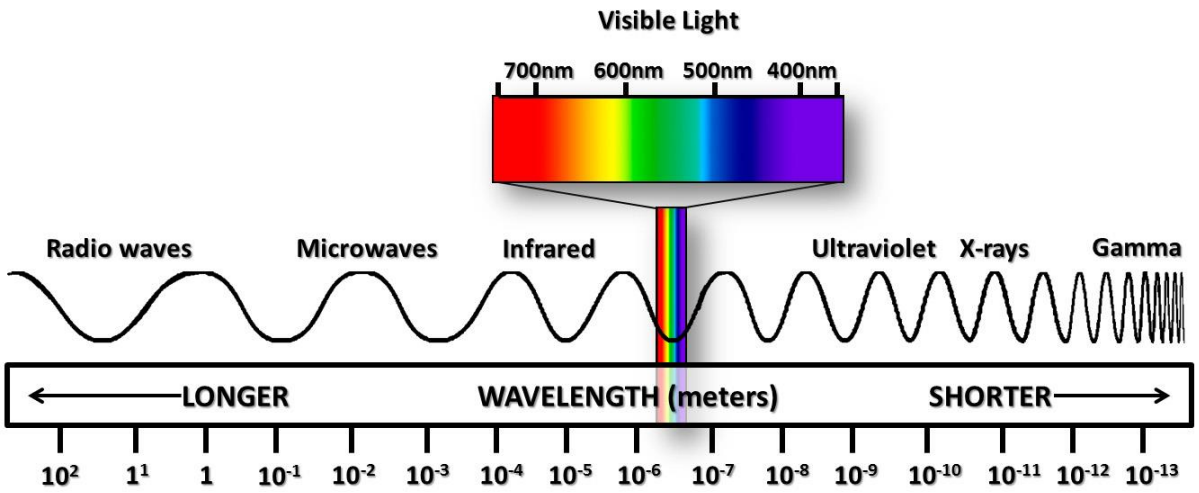
World Health Organization: skin colour/skin cancer

- http://www.who.int/uv/faq/skincancer/en/index1.html

Sun protection and triathletes

- http://triathlon.competitor.com/2013/06/training/6-things-triathletes-should-know-about-sun-protection_77983/6

IMAGE GALLERY



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Bookmarks using UV Beads

Beads outdoors © Cambridge University