Concept 2: Heat and UV from the sun: What's the difference?

LEARNING INTENTIONS

Students will:

- consolidate and understand that the sun gives off energy that we can see (visible light), heat that we can feel, as well as an invisible energy that we cannot see or feel, ultraviolet (UV) radiation
- observe the effects of UV radiation
- understand that too much sun can hurt their skin
- consolidate that there is a difference between UV and heat
- understand that too much exposure to UV radiation can cause sunburn, skin damage and possibly skin cancer later in life
- develop an understanding of how to protect their bodies from the harmful effects of sunlight
- explore/demonstrate the effects of UV radiation on reactive objects
- understand the need to minimise and/or avoid exposure to the sun when it is at its strongest or peak times of the day
- understand the need to protect their skin when the UV Index is 3 or above.

OVERVIEW

Lesson 1: Prism Spectrum - Why can you get sunburn on cool days?

Lesson 2: UV Reactive Detection Beads (2 parts)

Lesson 3: SunSmart Global UV App
Activity sheet: SunSmart UV diary

Lesson 4: My Day Across the UV Index
Activity sheet: My Day Across the UV Index

Lesson 5: Light Protection

USEFUL LINKS

MyUV.com.au
SunSmart Global UV app
Bureau of Meteorology
ARPANSA
How to read the daily UV forecast

Lesson 1: Prism spectrum - Why can you get sunburn on cool days?

Background

A refracting triangular prism is made from clear material like glass or plastic. When a beam of light is passed through it in a certain way, the light is refracted or split into different wavelengths.

This reveals the colours of the spectrum and raises some interesting questions.

This lesson is designed to:

- introduce the concept refraction and reflection
- illustrate that heat and UV are different
- introduce the Latin words infra and ultra
- demonstrate the visible spectrum.

Developing an awareness of these concepts, helps student understand why you can get sunburn on cool days.

Key messages

- Visible spectrum (ROYGBIV).
- Skin damage is caused by ultraviolet (UV) radiation, not temperature. A cool or overcast day can have similar UV levels to a warm, sunny day.
- UV and heat are different, they are not the same thing.
- When the UV Index is 3 or above, sun protection is required.
- Best sun protection practices are using a combination of Slip, Slop, Slap, Seek and Slide.

Resources

- A prism – these can be purchased online at Mad About Science or visit the SciTech shop
- A white screen. This can be a sheet of paper or card (or a white wall or projector screen etc)
- A variety of torches – some LED and some incandescent is best
- A sheet of thin card
- Scissors
- A darkish room helps this lesson greatly

Instructions

1. The prism works best when a narrow beam of light is passed through it. You can use a piece of card to achieve this.
2. Cut a short 2mm wide slit in the card.
3. Fold card so that it stands on the table.
4. Turn torch on and place it behind the slit in the card.
5. Move the torch closer to or further away from the card until you achieve a beam of light with parallel sides coming from the slit.
6. Place your prism into the beam of light. Experiment with the position of the prism until you see the beam of light bend ~ 90 degrees.
7. Place your screen in the path of the beam that is coming out of the prism. You should see a spectrum on the screen. If you are using a wall or projector screen, you will need to move the prism and beam of light until you see the spectrum.
8. Using your prism, ask students to experiment with the positions of the prism, the torch and the screen to achieve a good spectrum. The spectrum is brightest when the screen is close to the prism and fainter as the prism and screen distance become further apart.

What's going on?

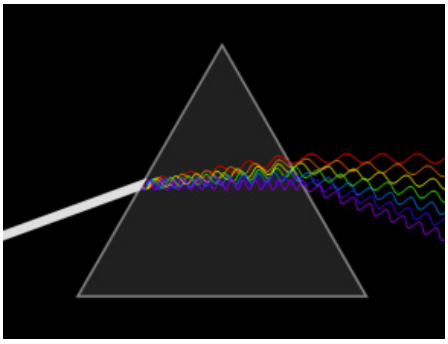
Light travels at different speeds in different media. When light enters the prism, it slows down. This speed change causes the light to be bent (refracted) and to travel through the prism at a different angle. The degree of bending of the light's path depends on the angle that the incident beam of light makes with the surface of the prism and on the refractive index of the prism (the refractive index of a material describes the degree to which the material bends light). Since different wavelengths – or colours – of light refract at different angles, the prism causes each colour in the white light to be refracted differently and to leave the prism at a different angle, creating an effect like a rainbow. With care and precision, students should be able to produce a full spectrum from red though to violet. This represents the full range of wavelengths that can be seen by the human eye. But there is MUCH more light energy here that cannot be seen.

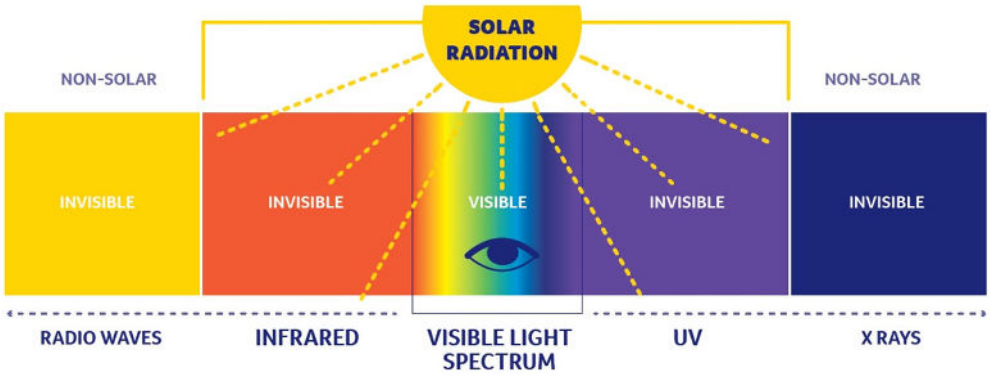
Ultraviolet radiation

Just beyond the red is the infrared. The word 'infra' is a Latin word, and it means 'beneath or below'. This is the part of the spectrum that we feel as heat. Infrared light can be seen with night vision goggles and some cameras. Infrared light was discovered by William Herschell.

At the other side of the visible spectrum just past the violet light is ultraviolet. (Ultra is Latin for 'above or beyond'). Ultraviolet light is the part of the light that causes sunburn and skin damage.

You cannot feel it. This demonstration shows us that heat radiation, infrared (IR) radiation and sunburning radiation, ultraviolet (UV) radiation are separate.





Key questions

- Do you put sunscreen or wear a hat on when it is cold outside? Why or Why not?
- What do you see and feel from the sun?
- What do you notice when the light shines onto the prism?
- Is there more to light than we can see at first?
- Why can you get sunburn on cool days?
- Why do rainbows happen?

Lesson 2: UV Reactive Detection Beads

Background

The UV Reactive Detection Beads activity is a great opportunity for students to observe the effects of UV radiation. The stronger the UV radiation present, the quicker the colour change of the beads and the deeper the colour. Once indoors and away from the sun's UV, the beads change back to off-white. There are 3 parts to this activity, part 1 explores the concept of UV radiation using the UV beads and part 2 is an experiment, testing how the UV beads respond in different conditions. Then in part 3, students create a UV bead wrist band that they can take outdoors to see the effects of UV radiation.

Key messages

- UV is invisible, you cannot see or feel it. If the UV Index is 3 or above, it can cause sunburn and skin damage
- When the UV Index is 3 or above, sun protection is required.
- UV and heat are different. We do not only need to use sun protection when it is hot.
- UV radiation can bounce and reflect off surfaces, so it is important to use a combination of sun protection.
- The UV Index is an open-ended numerical scale that measures the amount of UV radiation reaching the earth's surface.
- A daily time period shows the strength of UV levels and peaks normally at solar noon on a clear sky day. Solar noon is the point at which the sun is directly overhead.

Resources

- Source UV detection beads (purchase online - Mad About Science)
- Variety of light sources (lamp, UV torch, etc.)
- Canisters, small containers, or empty cans
- White and black cloth or card
- Broad-brimmed or bucket hats
- Water
- Plastic wrap
- Sunscreen with an SPF50 or SPF50+
- Long pipe cleaners

Part 1- Exploring

Instructions

1. Have the students move around the room, looking at the colour of their beads, placed under different sources of light. Note that fluorescent lighting will not change the colour of the beads.
2. As the students move towards the window, they should notice that their beads will begin to change colour.
3. Take students outside if possible; it does not have to be a bright sunny day. Ensure that appropriate sun protective measures are taken for students and staff.
4. Class discussion: prompt students with the following questions to help them develop an explanation for the changes they are seeing in the UV beads.

Part 2 – Experimenting

Instructions

1. Find an area in full sunlight.
2. Arrange the students into groups of 3-4 and distribute materials.
3. Have each group of students put three UV beads in each film canister/container/petri dish (lids are not required unless used to secure beads whilst moving outside. Remove lids once outside).

Process

Students will place different coverings on top of the canisters to determine the effect of the light restriction for this experiment. This activity can be done in small groups or completed as a whole class.

1. Discuss the experiment with students and hypothesise what they think will happen.
2. Instruct students to test the following nine scenarios (if it is difficult to do all 9 tests at the one time, break the experiment into a couple of separate sessions). If you do not have a canister, tin cans or other small containers will also work. Place some UV beads into 9 canisters.
    - Canister 1. (control) Set it on a desk or the ground with nothing over it.
    - Canister 2. Lay a white piece of cloth over it.
    - Canister 3. Lay a black piece of cloth over it.
    - Canister 4. Put sunglasses over this canister.
    - Canister 5. Put a broad-brimmed hat over this canister.
    - Canister 6. Fill this canister with water. String the beads on a paper clip so that they will sink.
    - Canister 7. Cover this canister with plastic wrap.
    - Canister 8. Cover this canister with plastic wrap and then apply a coat of sunscreen SPF50 or SPF50+ to the plastic with a paintbrush or sponge.
    - Canister 9. Repeat the instructions for the previous canister using a SPF50 or SPF50+ sunscreen.
3. Observe each canister and discuss findings.

Key questions

- Which canister with UV beads had the darkest colour? Why do you think this happened?
- Which canister with UV beads colour did not change colour or was the lightest? Why do you think this happened?
- What does the canister with sunscreen tell us?

Part 3 - Creating

Instructions

1. To make a UV wrist band, provide each student with a pipe cleaner and UV bead. More UV beads can be used if possible.
2. Thread the UV beads onto the pipe cleaner.
3. Shape the pipe cleaner into a circle shape and twist the ends together to join.

Variation

The reactive UV beads can be transferred into an Art or Design and Technology project where students design and make a bracelet, other jewelery, or key ring to show where there is UV.
UV radiation cannot be seen or felt, and the piece of jewelery or key ring will be a reminder to use sun protection.

When completing activities and lessons outdoors when the UV Index is 3 or above, please remember to be SunSmart!

Lesson 3: SunSmart Global UV App

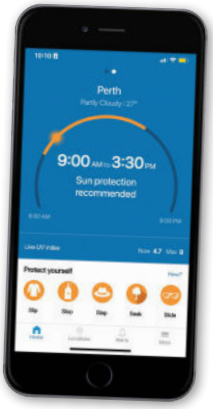
Background

This activity is designed to consolidate student's understanding about the difference between UV and heat. It introduces the SunSmart Global UV app and the useful information it provides to support students' decision making around healthy lifestyle choices. By recording the UV Index and weather forecast over 2 weeks (10 days), it differentiates temperature and the UV Index and provides an opportunity to compare the results: temperature vs UV rating.

The free SunSmart Global UV app tells you when sun protection is recommended for your location using live UV data from ARPANSA.

Key messages

- We often check the weather forecast, but it is also important to check the daily UV Index to protect our skin from UV radiation.
- Checking the UV Index forecast helps us determine when the UV Index is 3 or above and sun protection is required.
- UV radiation is invisible, you cannot see or feel it.
- UV and heat are different. We do not only need to use sun protection when it is hot.
- UV radiation can bounce and reflect off surfaces, so it is important to use a combination of sun protection.
- When UV levels are at their peak, minimise time outdoors during these times.



Resources

- MyUV website
- Free SunSmart Global UV app, displayed on school device or interactive board
- Activity sheet: SunSmart Daily UV Record

Instructions

1. Display SunSmart Global UV app or students access app on their own device.
2. Explore and discuss how the SunSmart Global UV app works, its functions and key questions.
3. Distribute SunSmart Daily UV Record activity sheet.
4. Using the SunSmart Global UV app , students record the UV reading at each day, at the same time for two weeks.
5. Class discussion, summarise activity, findings and key questions.

Extension

- Repeat the activity again at a different time of the year such as winter and summer. Compare the results.
- Add the SunSmart widget to your school website.

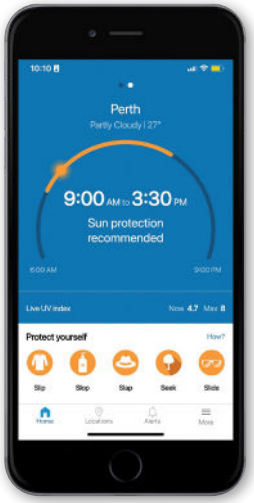
Key questions

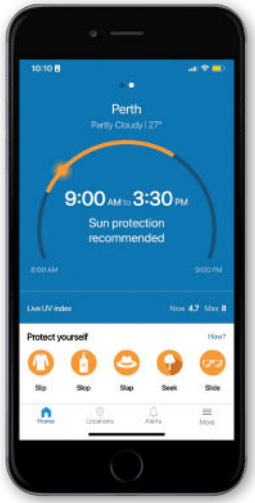
- What is UV radiation?
- What are some ways we can protect our skin?
- Why is it important to protect our skin?
- What does the UV Index tell us?
- How can we incorporate and use the free SunSmart Global UV app in our daily routines?
- What did you notice over two weeks of recording the UV Index?
- What was the weather like on these days? Was it clear skies or cloudy?

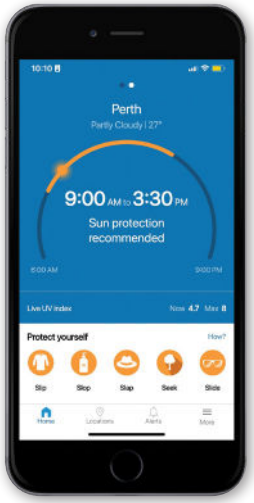
SunSmart Daily UV Record

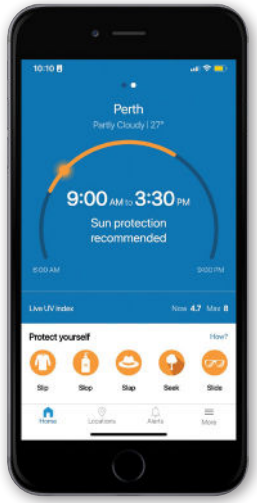
Week 1: _____

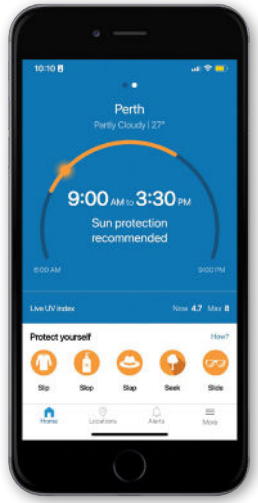
Date: _____





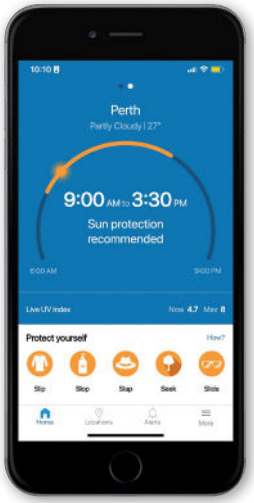


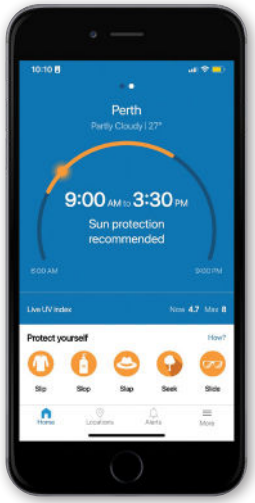


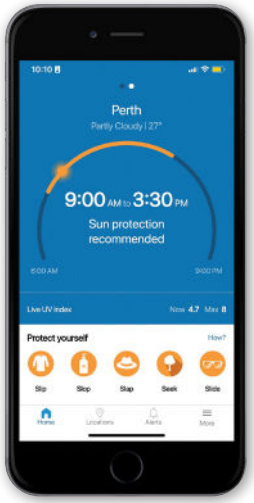


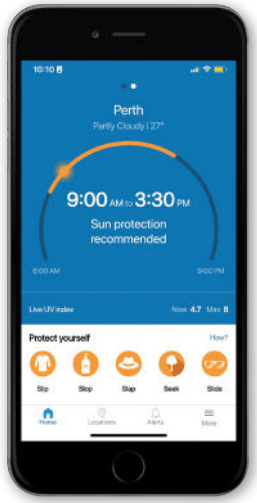
Week 2: _____

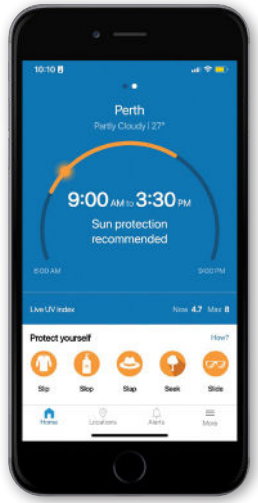
Date: _____











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Lesson 4: My Day Across the UV Index

Background

The story 'Today's Sun' by Gregg Dreise demonstrates the journey of the sun from sun rise to sunset. It describes the strength of the sun similar to that of the UV Index throughout the day. Students can complete a think pair share of the things they do throughout the day and map these events along the UV Index scale. A read out loud version of the story is available online.

Key messages

- We often check the weather forecast, but it is important to check the daily UV Index to protect our skin.
- When the UV Index is 3 or above, sun protection is required.
- UV radiation is invisible, you cannot see it or feel it.
- UV and heat are different. We do not only need to use sun protection when it is hot.
- The UV Index is an open-ended numerical scale that measures the amount of UV radiation reaching the earth's surface.
- When UV levels are at their peak, minimise time outdoors during these times.

Resources

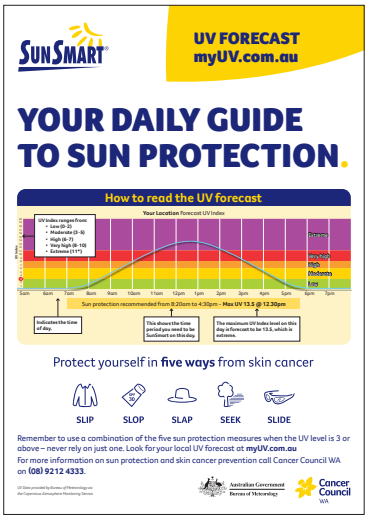
- Today's Sun by Gregg Dreise
- How to read the daily UV forecast
- Activity sheet: My Day Across the UV Index

Instructions

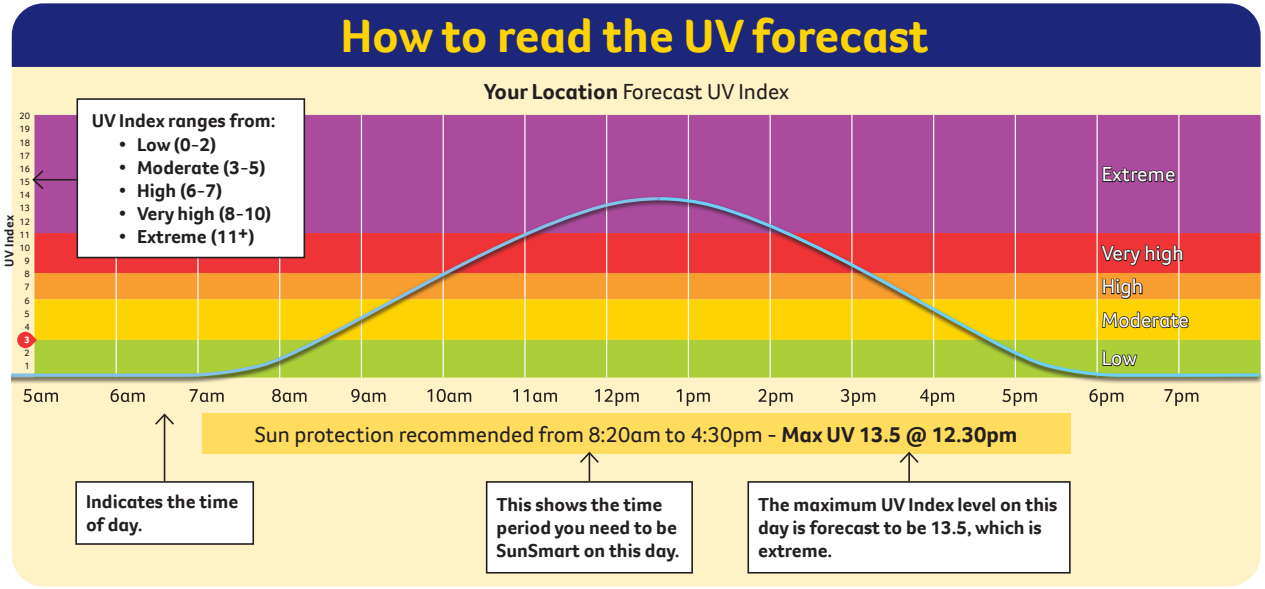
1. Read the story and discuss the movement of the sun throughout the day. Ask some key questions.
2. Provide students with My Day Across the UV Index activity sheet. Colour or black and white version.
3. Black and white version: colour in the UV Index chart. 1-3 in green, 3-6 yellow, 6-8 orange, 8-11 red and 11 up to 20 in purple.
4. Look at the How to Read the UV Index Poster, interpret and discuss each section carefully.
5. Refer to story, plot and link the daily activities in story to the UV chart across the day.
6. Complete a think, pair, share of some of the activities students do across the day and draw in the spaces provided on the My Day Across the UV Index activity sheet.
7. Discuss how the UV Index impacts on our day-to-day activities and ask key questions about how to protect ourselves from UV radiation when the UV Index is 3 and above.

Key questions

- What time of the day is the sun the strongest?
- What do you think the UV Index was in the morning?
- What do you think the UV Index was in the evening?
- Do you think it is a good idea to go out in the sun in the middle of day?
- What does the UV Index tell us?
- When is it the best time of the day to play outside?
- If you are outside in the middle of the day, what do you need to do?



My Day Across the UV Index



Draw something you do across the day

7-10am	11-2pm	3-6pm

Draw the 5 ways to protect yourself from the sun

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Lesson 5: Light Protection

Background

The Light Protection lesson is designed to build on previously taught knowledge that UV radiation is invisible and cannot be seen or felt. By completing this activity, students will look closely at the type of fabrics that are used in sun protective clothing and which are best to protect the skin from UV radiation. UPF (ultraviolet protection factor) rating is based on how much UV radiation is transmitted through a fabric. It is an indicator of the protective ability of the fabric. The higher the UPF the greater protection offered, with a recommended value of UPF 50+. Fabrics that let a lot of light through offer limited protection from UV. Generally, the less light that can pass through, the better the fabric.

Key messages

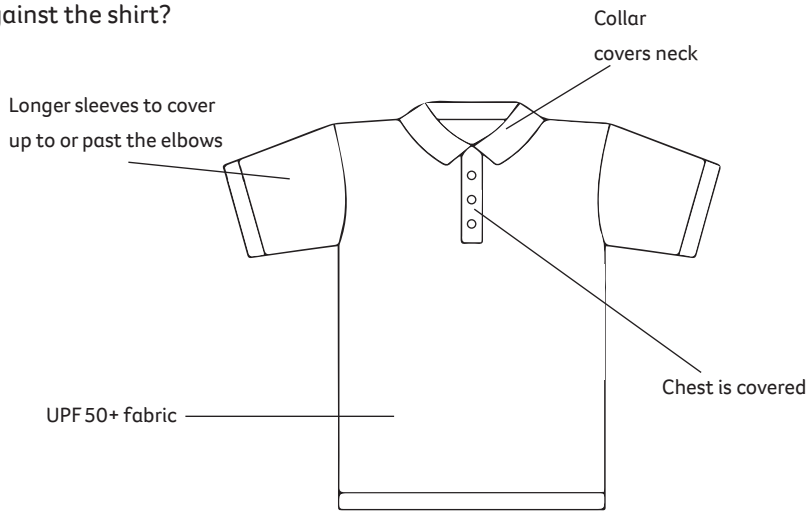
- There are many materials with different weaves of fabric. The different weaves of fabric allow light to filter through. If light can filter through, so does the UV radiation.
- Covering the skin with clothing is the best form of sun protection. Clothing that covers the neck (collars), arms and chest are recommended.

Resources

- Range of shirts or fabrics
- Rash shirt with UPF 50+
- Torch

Instructions

1. Ask students to bring a shirt into class for this activity.
2. Explore and discuss the different shirts. Decide which one covers most of their skin.
3. Encourage them to hold a shirt up to the light. Explain that if you can see through it, the sun can get through it.
4. Using the samples of shirts or fabrics, place a torch against the fabric to compare how much light permeates the fabrics and rank them from most SunSmart to least.
5. Compare it to the UPF 50+ rash shirt.
6. Have students explain why their shirt is SunSmart or not.
7. In workbooks, draw a SunSmart shirt and label all the components of what makes it SunSmart.

Key questions

- What are the best fabrics to protect yourself from UV radiation? Why?
- What did you notice when you place the torch up against the shirt?
- What do you look for in a SunSmart shirt?