

## Sunblock and UV light: demonstrators guide

### Aim

A fun demo to teach about UV light and the action/importance of sunscreen

### Equipment

- Security pens
- A source of long wavelength UV light (torch or 'black box')
- Sunblock (SPF 15 up)
- Body lotion without sunscreen, sunglasses with & without UV filters

### Activity

We all hate having to put sunblock on when it's hot and sunny, but it does work! This demo shows how sunblock blocks stops UV light reaching the skin.

1. Draw a picture, smiley face, message on hand with invisible security pen & shine the UV light on it (may help to turn lights down/off first) – the message will glow bright.
2. Turn the UV light off, cover half of the picture in sunscreen (or do another one on the other hand and cover this) then shine the UV light on it again – the part covered by the sunscreen will have 'disappeared' and will not be visible.
3. Do the same thing but with body lotion – the picture will still be visible.

Optional extras: Try holding sunglasses (UV filter and cheapo) between the light source and the picture.

### The Science

Ultraviolet, or UV, light has a higher frequency (and shorter wavelength) than visible light.

The security pen only reflects UV light, so the picture can only be seen when you shine a source UV light on it. But when you cover the picture in sunblock it disappears because it blocks the path of the UV light and stops it reaching the picture. This happens because sunblock contains organic compounds, inorganic particulates (such as zinc oxide and titanium dioxide) that absorb and scatter the UV light. Body lotion does not contain these chemicals, so it doesn't block the UV light.

This is important for health because the UV rays in sunlight can cause sunburn and skin cancer if you stay out in the sun too long (because it damages DNA and causes mutations). The amount of UV blocked by the sunscreen depends on the SPF – higher SPF, more UV blocked.

A similar result should be observed when sunglasses are used i.e. the sunglasses block the path of the UV so the picture is hidden. Again, this is to protect our eyes from the effects of UV rays in sunlight.

### Possible follow-ups

- Why is it called a security pen? Invisible ink –used to mark possessions so police can find owners. Also used to send secret messages.
- Other uses of UV-reflecting chemicals – washing powder tablets and white paper contain optical enhancers to make them appear ‘whiter than white’ in the light of the sun – see how brightly they glow when held under a UV light.
- Police put UV reflecting powder at crime scenes to find footprints, fingerprints, blood etc.
- If you scan the QR code on the poster or handout, it will take you to a video by Croda, which explains the chemistry behind making sun lotions.