Nanoparticles in sunscreen challenge

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Acknowledgements

This resource was originally developed by Nottingham Trent University to support outreach work delivered as part of the Chemistry for All project.

To find out more about the project, and get more resources to help widen participation, visit our Outreach resources hub: rsc.li/3CJX7M3.

Guidance notes

The activities should take approximately four to five hours to complete in full. This resource was initially created for 14–16 year-old learners but can be adapted when teaching nanoparticles to other age groups.

Download the PowerPoint presentation, technician notes and student workbook that accompany this resource at rsc.li/3cd4lcy.

Read our health & safety guidance, available from rsc.li/3lAmFA0, and carry out a risk assessment before running any live practical. Be aware of any allergies before carrying out the activities.

The safety equipment suggested is in line with CLEAPSS requirements. For non-hazardous substances, wearing lab coats can help protect clothes. The safety rules might be different where you live so it is worth checking local and school guidance.

The challenge links to chemistry specification statements about the nature and application of nanoparticles and includes a sequence of practical activities using sunscreen as the context for learning about nanoparticles.

As an extension to this challenge, learners could research other applications of nanotechnologies and their potential risks.

Learning objectives

- Describe the use of nanoparticles for a specified purpose.
- Evaluate methods for testing the effectiveness of sunscreens.

Activities overview

Use **slides 3–23** to introduce nanoparticles and their use in sunscreens.

Career links

Nanotoxicologist

Use **slide 8** to introduce learners to Vicki, a nanotoxicologist. She examines how the nanoparticles present in sunscreens and other everyday products interact with our body to make sure they are safe to use. Watch her video job profile at: rsc.li/3Z6btiW.

Development chemist

Link the need for honest and effective labelling of sunscreens to the development chemist role on **slide 18**. Mariam makes custom inks used to print labels for food, medicines and household goods, including sunscreens. Watch her video job profile at: rsc.li/3ls8V13.

Activity 1: preparing your sunscreen

In Activity 1, learners work in pairs to prepare their own sunscreen. **Slide 26** of the PowerPoint introduces the task and full instructions are provided in the student workbook.

Career link

Pharmaceutical associate researcher

While the learners are waiting for their homemade sunscreen mixture to cool, encourage them to consider careers that may involve the skills they have been using to prepare their own sunscreen. Use **slide 27** to link the skills they have used and tasks they have completed to those involved in the role of pharmaceutical associate researcher, also available from: rsc.li/3LIA7TR.

Activity 2: estimating an SPF value for your sunscreen

Slide 29 introduces Activity 2. Learners will use four different methods to measure the sun protection factor (SPF) values of four sunscreens with known SPF values and a control. They then use these results to estimate the SPF value for their homemade sunscreen prepared in Activity 1.

Career link

Senior scientist

Slide 30 highlights the chemistry career of a senior scientist for household goods. Phillip leads a small team of researchers testing household goods such as toothpaste, shampoo and sunscreen and looking for new ways to improve their performance. Find out more at: rsc.li/3kfmiRF.

Activity 3: presenting your findings

In Activity 3, learners produce a poster, guided by five questions, about the use of nanoparticles and their sunscreen activities. **Slide 32** introduces the task to the learners and includes the questions they should answer while producing their poster.

You could use peer review to judge the completed posters using the question: 'How well does the poster answer the questions?'

Suggested answers

Answers are also shown on **slides 33–34** of the PowerPoint.

1. Particles that are 1–100 nm in size, of the order of a few hundred atoms.
2. The nanoparticles in some sunscreens are clusters of particles of white chemicals such as titanium oxide or zinc oxide.
3. The higher the SPF value, the less UV light it allows through.
   The relationship is not linear: higher SPF values have a decreasing effect as the SPF value increases.
4. Nanoparticles prevent UV light getting to your skin by scattering or absorbing the light.
5. Learners could show diagrams of the different methods and annotate these. They could compare the accuracy of judging 'glow' by eye with using a light meter. They could also discuss the methods that measure the glow of a liquid compared with direct measurement of UV light passing from a source through the slide.