
Deliberative Democracy: Sunscreen Ingredients

Alignment with Course Content

This module can be used to reinforce the concept of the interaction of light with matter.

Necessary Background Knowledge

- Absorption and emission of light
 - Quantization of light and matter
-

Policy Issue

Given our changing and more extreme climate conditions, you are being asked to recommend ideal formulation for ingredients for a sunscreen. Evaluating the active ingredients in the commercial products listed below, make a recommendation for appropriate active ingredient(s) that considers **efficacy, environmental impact, and toxicity**.

Neutrogena Ultra Sheer® Dry-Touch Sunscreen Broad Spectrum SPF 55 (Avobenzone, Oxybenzone, Homosalate, Octisalate, Octocrylene)

Shiseido Broad Spectrum SPF 50+ WetForce for Sensitive Skin & Children (Titanium Dioxide and Zinc Oxide)

Module Goals

Students should be able to:

- Search and utilize published scientific data to construct an argument
- Distinguish regions of the electromagnetic spectrum in terms of energy (or wavelength/frequency)
- Make an argument about how the choice of ingredients in a sunscreen affects its efficacy
- Describe possible limitations of research in peer reviewed articles i.e., concentrations used in toxicity studies
- Make an argument that considers the risks and benefits of chemicals under consideration

Deliberation Scaffolding

Students should consider:

- What region of the sun's electromagnetic spectrum should skin be protected from? Why?
- What are the active protectant molecules in sunscreen?
- Do all the active ingredients absorb the same wavelengths of light?
- What are the concentrations of these ingredients in sunscreen?
- What problems could these molecules cause if they enter the environment?

Instructor Notes

Implementation Suggestions

- Introduce the differences between a physical and chemical sunscreen.
- Introduce the topic of SPF

Articles

Media:

[2016- Stanford engineers develop a plastic clothing material that cools the skin](#)

Peer reviewed:

[2016 Radiative human body cooling by nanoporous polyethylene textile](#)

DOI: 10.1126/science.aaf5471

Recommended Supplemental Material:

This article gives UV absorption range for common sunscreen ingredients:

[http://tools.thermofisher.com/content/sfs/brochures/AN455_62980_Accela_Enviro\(1\).pdf](http://tools.thermofisher.com/content/sfs/brochures/AN455_62980_Accela_Enviro(1).pdf)

These two articles report on a scientific paper regarding coral damage and sunscreen ingredients. It would be valuable to show these examples of two media articles reporting on the same research in two different ways in order to show students what they may run into:

[Media-NPR-Chemicals in sunscreen are harming coral reefs, says new study-2015](#)

[Media-Mashable-No, your sunscreen isn't killing the world's coral reefs-2015](#)

Science in the Classroom exercises walk students through peer reviewed papers

[Science in the Classroom-Take heat](#)

[Science in the Classroom- Curiosity tells all about mars radiation environment](#)

Informative Articles Students Might Find

[Media-The Environmental Working Group website](#)

[Media-Key West Bans Sunscreen Containing Chemicals Believed to Harm Coral Reefs](#)

[Media-CNN article on EWG claims-2012](#)

[Media-Common sunscreen ingredient octocrylene might be harmful to coral](#)

[Peer Review-Metaanalysis of 64 exaggerated use studies with oxybenzone-2008](#)

[Peer Review-Current sunscreen controversies- 2011](#)

Media Paper (Multiple-Choice Assignment Ideas)

[2016- Stanford engineers develop a plastic clothing material that cools the skin](#)

Stanford engineers develop a plastic clothing material that cools the skin by Tom Abate, Stanford News

Example question topics:

- Why is the range of the electromagnetic spectrum important in the development of this new material?
- What range of the electromagnetic spectrum is of particular interest in this application?
- What were the important applicable characteristics of the materials already available?
- Identify chemistry concepts linked to this technology.

Peer Reviewed Paper (Multiple-Choice Assignment Ideas)

[2016 Radiative human body cooling by nanoporous polyethylene textile](#)

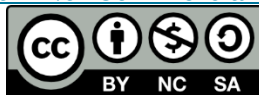
DOI: 10.1126/science.aaf5471

Radiative human body cooling by nanoporous polyethylene textile by Po-Chun Hsu, Alex Y. Song, Peter B. Catrysse, Chong Liu, Yucan Peny, Jin Xie, and Yi Cui.

Example question topics:

- Identifying gaps in research that the authors are addressing.
- What properties of materials give rise to certain characteristics?
- How does Figure 1B illustrate the desired properties of the ideal proposed material?
- What properties influence the transmittance of light through the material?
- Reflect on the difference between in-lab experiments and modeled experiments.

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Deliberative Democracy: Sunscreen Ingredients

Leader First & Last Name		Facilitator/Spokesperson First & Last Name	
Recorder First & Last Name		Devil's Advocate/Summarizer First & Last Name	

Question to scientists: Given our changing and more extreme climate conditions, you are being asked to recommend ideal formulation for ingredients for a sunscreen. Evaluating the active ingredients in the commercial products Neutrogena Ultra Sheer® Dry-Touch Sunscreen Broad Spectrum SPF 55 and Shiseido Broad Spectrum SPF 50+ WetForce for Sensitive Skin & Children, what is your recommendation for an appropriate active ingredient(s) that considers efficacy, environmental impact, and toxicity?

What do you need to know before you can make an informed recommendation?	Why does this missing piece of information matter? (include social and science rationales)	Who will find 2-3 articles about this concept (at least one per box must be peer-reviewed)?
A.		1. 2. 3.
B.		1. 2. 3.

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What do you need to know before you can make an informed recommendation?	Why does this missing piece of information matter? (include social and science rationales)	Who will find 2-3 articles about this concept (at least one per box must be peer-reviewed)?
C.		1. 2. 3.
D.		1. 2. 3.

Before doing background research, what is your group's initial stance?

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Evidence to support your science advisory statement:	Source title and journal (or media outlet) AND initials of who found the article	Which lecture topics or textbook chapters cover this material?
A.		
B.		

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Science Advisory Statement (**Deliberate consensus**):

End of Day 2. Thank you for investing your time and energy on this activity!