

Alignment of Nanoparticles and Sunscreen Module to the Common Core State Standards in English Language Arts/Literacy and Mathematics

The Next Generation Science Standards (NGSS) were published in April 2013. They consist of statements that convey the performance expectations for students. Each performance expectation is a single statement that is built from three parts: science and engineering practices (Practices), disciplinary core ideas (DCI) and crosscutting concepts.

The background material, reading, and the slides from the module address the aspects of the NGSS shown in Table 1.

TABLE 1. ALIGNED PRACTICES, DISCIPLINARY CORE IDEAS, AND CROSSCUTTING CONCEPTS		
PRACTICE	DCI	CROSSCUTTING CONCEPT
<p><i>HS. Constructing explanations and designing solutions:</i> Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.</p>	<p><i>MS-PS4.B:Electromagnetic Radiation:</i> When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light.</p>	<p><i>HS. Structure and function:</i> Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.</p>
<p>Where is this Practice found in the lesson plan?</p> <p>The student activity asks students to evaluate the effectiveness of different types of sunscreen based on student-generated sources of evidence.</p>	<p>Where is this DCI found in the lesson plan?</p> <p>This DCI is found in the teacher's Background Information section and the Power Point presentation. It is also found in the Discussion Questions.</p>	<p>Where is this Crosscutting Concept found in the lesson plan?</p> <p>This is implied in the Power Point slides during the discussion of how the different types of sunscreens work.</p>
<p>How well is this Practice aligned?</p> <p>Weak alignment, due to issues of scope. The Practice</p>	<p>How well is this DCI aligned?</p> <p>Strong alignment.</p>	<p>How well is this Cross Cutting Concept aligned?</p> <p>Weak alignment, as students are not explicitly helped to</p>

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<p>specifies that students are evaluating <i>complex</i> real-world problems, and that they should be basing their evaluation on scientific knowledge, prioritized criteria, and tradeoff considerations. The lesson does not require students to evaluate the sunscreens to this depth.</p>		<p>understand this concept, and are not assessed on their understanding.</p>
<p>PRACTICE</p> <p><i>HS. Analyzing and interpreting data:</i> Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.</p>	<p>DCI</p> <p><i>HS-PS4.B:Electromagnetic Radiation:</i> Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features.</p>	<p>CROSSCUTTING CONCEPT</p> <p><i>HS. Influence of Science, Engineering, and Technology on Society and the Natural World:</i> New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology.</p>
<p>Where is this Practice found in the lesson plan?</p> <p>The student activity’s potential questions include questions which will require students to analyze data in order to determine which design solution (chemical or nanoparticle sunscreen) is optimal.</p>	<p>Where is this DCI found in the lesson plan?</p> <p>This DCI is found in the teacher’s Background Information section and the Power Point presentation. It is also found in the Discussion Questions.</p>	<p>Where is this Crosscutting Concept found in the lesson plan?</p> <p>This is implied in the Power Point slides during the discussion of how the different types of sunscreens work.</p>

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<i>How well is this Practice aligned?</i>	<i>How well is this DCI aligned?</i>	<i>How well is this Cross Cutting Concept aligned?</i>
Partial alignment, as it is not clear if students will be required to determine the optimal design solution.	Weak alignment, due to issue of scope. The DCI includes an understanding of the utility of the wave and particle models, which is not included in the lesson plan.	Weak alignment, as students are not explicitly helped to understand this concept, and are not assessed on their understanding.

Alignment of Nanoparticles and Sunscreen Module to the Common Core State Standards for English Language Arts/Literacy and Mathematics

The Common Core State Standards (CCSS) were published in June 2010. They articulate student skills for English language arts/literacy and mathematics. The content of the module addresses the concepts and skills shown in Tables 3 and 4.

For English language arts/literacy, the CCSS is organized around College and Career Anchor Standards (CCR) that articulate the over-arching skills that students need to be prepared for college and career. There are grade level versions of each Anchor Standard, as well as versions for science and social studies classrooms (literacy standards). Alignments in Table 3 were made to the Anchor Standards, unless a more specific version of the standard was a closer fit to the skills in the module. Additional alignments may be warranted, depending on the use of associated reading passages and videos that are provided as links in the module and whether students engage in peer discussions.

TABLE 3. ALIGNED COMMON CORE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY STANDARD

CCR.L.6: Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.

Where is this standard found in the module?

Scientific words and phrases are used throughout the module, including within the background information, PowerPoint slides, activity instructions, and discussion questions.

TABLE 3. ALIGNED COMMON CORE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY	
<i>How well is this standard aligned?</i>	
Partial alignment. Familiarity with some scientific vocabulary is prerequisite, while some other conceptual vocabulary (e.g., light absorption, light scattering) may be part of instruction. Students must use scientific (domain-specific) words and phrases to accurately respond to discussion questions.	
STANDARD	
RST.11–12.3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.	
<i>Where is this standard found in the module?</i>	
Students read and follow multi-step procedure when completing the activities; students analyze the specific results through discussion.	
<i>How well is this standard aligned?</i>	
Weak alignment. The ability to follow written procedures is prerequisite to the module and not part of direct instruction; students' analysis of results is not based on explanations in the text.	
STANDARD	
RST.6–8.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).	
<i>Where is this standard found in the module?</i>	
Students must understand a variety of graphics that used within the background information and PowerPoint slides.	
<i>How well is this standard aligned?</i>	
Weak alignment. The ability to connect graphic images with a description of phenomena is assumed (prerequisite) and not part of instruction or assessment in the module.	
STANDARD	
CCR.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.	
<i>Where is this Standard found in the module?</i>	
Instructions for students working in teams is provided within the Instructor Notes. Potential questions for the class or group discussion are provided after each part of the procedure. Discussion questions are also provided at the end of the lesson.	

TABLE 3. ALIGNED COMMON CORE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY

How well is this standard aligned?

Weak alignment. The ability to work in effectively in groups is prerequisite to this module, as strategies for individual roles and expectations with the team are not explicitly provided. Although discussion questions are given, there is no prescribed format or specific expectations for class discussion.

For mathematics, Table 4 shows alignments to standards found in the 8th through 12th grade levels.

TABLE 4. ALIGNED COMMON CORE STANDARDS FOR MATHEMATICS

None Found