Alignment of Superhydrophobicity Module to the Next Generation Science Standards

The Next Generation Science Standards (NGSS) were published in April 2013. They consist of statements that convey 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.

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Since the Superhydrophobicity Module was created prior to the release of these standards one would expect that it aligns most readily to the individual statements that articulate the practices, DCIs, and crosscutting concepts.

Our analysis revealed support for the performance expectation found in Table 1.

TABLE 1: ALIGNMENT TO SPECIFIC PERFORMANCE EXPECTATIONS	ALIGNMENT RATING
HS-PS2-6 Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.	

Table 2 clarifies the nature of the alignments by Practice, DCI, and Crosscutting Concept for the Performance Expectation above:

TABLE 1. ALIGNED PRACTICES, DISCIPLINARY CORE IDEAS, AND CROSSCUTTING CONCEPTS		
PRACTICES	***DCI***	***CROSSCUTTING CONCEPT***
HS. Obtaining, evaluating, and communicating information Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple	*HS.PS2.B: Types of interactions:* Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects.	*HS. Structure and Function:* 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

TABLE 1. ALIGNED PRACTICES, DISCIPLINARY CORE IDEAS, AND CROSSCUTTING CONCEPTS		
formats (including orally, graphically, textually, and mathematically).		components to reveal its function and/or solve a problem.
Where is this Practice found in the lesson plan? The Power Point slides include communicating scientific information using inequality equations for different situations, and the Discussion Questions include orally or textually communicating scientific information.	***Where is this DCI found in the lesson plan?*** This DCI is found in the teacher Background Information and the Power Point presentation.	***Where is this Crosscutting Concept found in the lesson plan?*** This is implied in the Power Point slides during the discussion of the forces acting on droplets.
How well is this Practice aligned? Strong alignment.	***How well is this DCI aligned?*** Strong alignment.	***How well is this Cross Cutting Concept aligned?*** Weak alignment, as students are not explicitly helped to understand this concept, and are not assessed on their understanding.

Alignment of Superhydrophobicity 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, and activity instructions.
How well is this standard aligned? Partial alignment. Familiarity with some scientific vocabulary is prerequisite (e.g., atomic structure, electron density), while some other conceptual vocabulary (e.g., hydrophobic, superhydrophobic) 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.

TABLE 3. ALIGNED COMMON CORE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY
Where is this standard found in the module?
Students read and follow multi-step procedure when completing the activities; students analyze the specific results through discussion questions.
How well is this standard aligned?
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).
Where is this standard found in the module?
Students must understand a variety of graphics that are used within the background information and PowerPoint slides.
How well is this standard aligned?
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.

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

TABLE 4. ALIGNED COMMON CORE STANDARDS FOR MATHEMATICS
STANDARD
HS.N-VM.1 (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., **v**, |**v**|, ||**v**||, v).
Where are these Standards found in the lesson plan?
All three standards are addressed in the Power Point. Students are asked to read and to use force diagrams, and to create inequality equations for different situations.
How well are these Standards aligned?

Strong alignment in the Power Point.

STANDARD

HS.N-VM.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors.

Where are these Standards found in the lesson plan?

All three standards are addressed in the Power Point. Students are asked to read and to use force diagrams, and to create inequality equations for different situations.

How well are these Standards aligned?

Strong alignment in the Power Point.

STANDARD

HS.A-CED.1 Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*

Where are these Standards found in the lesson plan?

All three standards are addressed in the Power Point. Students are asked to read and to use force diagrams, and to create inequality equations for different situations.

How well are these Standards aligned?

Strong alignment in the Power Point.