

## Alignment of Ring Polymer Module to the Next Generation Science Standards

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 components: science and engineering practices (Practices), disciplinary core ideas (DCI) and crosscutting concepts. Each lesson was evaluated to determine alignment to (1) Performance Expectations, and (2) alignment to the individual components.

Since the Ring Polymer 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
<i>HS-PS2-6</i> Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.	Partial (see Table 2 for explanation)

Table 2 clarifies the nature of the alignments by Practice, DCI, and Crosscutting Concept.

TABLE 2. ALIGNED PRACTICES, DISCIPLINARY CORE IDEAS, AND CROSSCUTTING CONCEPTS		
PRACTICE	DCI	CROSSCUTTING CONCEPT
<i>HS: Obtaining, Evaluating, and Communicating Information:</i> 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 formats (including orally, graphically, textually, and mathematically).	<i>HS-PS2.B: Types of interactions:</i> 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.	<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.

**TABLE 2. ALIGNED PRACTICES, DISCIPLINARY CORE IDEAS, AND CROSSCUTTING CONCEPTS**

<p><b><i>Where is this Practice found in the lesson plan?</i></b></p> <p>In the Questions, students are asked to communicate scientific information about polymers, including their molecular structure.</p>	<p><b><i>Where is this DCI found in the lesson plan?</i></b></p> <p>This DCI is found within the teacher Background, Power Point Slides, and the Activity.</p>	<p><b><i>Where is this Crosscutting Concept found in the lesson plan?</i></b></p> <p>This concept is found within the teacher Background, Power Point Slides, and the Activity.</p>
<p><b><i>How well is this Practice aligned?</i></b></p> <p>Weak alignment, due to scope. Students are only asked to communicate scientific information orally or textually (it is unclear which format is required), while the Practice specifies multiple formats.</p>	<p><b><i>How well is this DCI aligned?</i></b></p> <p>Strong alignment.</p>	<p><b><i>How well is this Cross Cutting Concept aligned?</i></b></p> <p>Partial alignment, due to scope and clarity. The lesson includes investigating structures by examining the properties of materials, but does not include examining different materials, or does not specify looking at the connections of components to reveal function or solve a problem.</p>

## **Alignment of Ring Polymer 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 questions.

***How well is this standard aligned?***

Partial alignment. Familiarity with some scientific vocabulary is prerequisite, while some other conceptual vocabulary (e.g., capillary action, thermoplastics, thermosetting plastics) may be part of instruction. Students must use scientific (domain-specific) words and phrases to accurately respond to 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.

***Where is this standard found in the module?***

Students read and follow a multi-step procedure when completing the activity; students analyze the specific results by answering 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, the procedure does not include many complex steps, and students' analysis of results is not based on explanations in a 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 PowerPoint slides.

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

***How well is this standard aligned?***

Weak alignment. The ability to connect graphic images with a description is assumed (prerequisite) and not part of instruction or assessment in the module.

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

**TABLE 4. ALIGNED COMMON CORE STANDARDS FOR MATHEMATICS**

**ALIGNMENT RATING**

*Note – these standards are aligned to content found in the “Optional” section of the lesson:*

MTH.HS.G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

Partial alignment.  
This content is found in the Calculations section of the Activity, which is labeled optional.

MTH.HS.G.MG.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).

Partial alignment.  
This content is found in the Calculations section of the Activity, which is labeled optional.