Strengthening Delaware’s Education System

Enhancing Science Education with the Next Generation Science Standards

Public comment on the adoption of the standards accepted until September 5, 2013

Send written comments to: Susan Haberstroh, Associate Secretary Education Supports & Innovative Practices, 401 Federal Street, Dover, DE 19901
Building on the Past, Preparing for the Future, Leading to the NGSS

1990s

1990s-2009

1/2010 - 7/2011

Phase I

Phase II

For States, By States

7/2011 – March 2013
Why Change to the NGSS?

- Modest improvement in NAEP scores does not reflect the goals of Delaware science.
- Changes in science and in the understanding of how students learn have occurred over the past few decades.
- Emphasis on *Science and Engineering Practices* lacking in the current standards.
- Standards are performance expectations constructed by combining the *Practices*, *Cross-Cutting Concepts*, and *Core Ideas*.
- Standards provide for internationally benchmarked science education.
- Standards increase equity and opportunities for all students.
Delaware
A Lead State in the Development of the NGSS
MS-PS-CR Chemical Reactions

Views: Black and white / Practices and Core Ideas / Practices and Crosscutting Concepts / PDF

Students who demonstrate understanding can:

a. Develop representations how atoms regroup during chemical reactions to account for the conservation of mass. [Assessment Boundary: Representations should not involve bonding energy or valence electrons. Balancing equations are also not employed here]

b. Generate and revise explanations from the comparison of the physical and chemical properties of reacting substances to the properties of new substances produced through chemical reactions to show that new properties have emerged. [Assessment Boundary: Comparison and analysis should not involve statistical techniques]

c. Construct explanations linking evidence to claims that when combining simpler molecules (e.g., \( \text{H}_2\text{O} \) and \( \text{CO}_2 \)) into complex molecules (e.g., \( \text{C}_6\text{H}_12\text{O}_6 \) in photosynthesis) or breaking down complex molecules to simpler molecules, energy can be stored or released. [Assessment Boundary: Further details of the photosynthesis process are not addressed]

d. Develop a model to represent the movement of matter and energy in the cycling of carbon (e.g. carbon in the atmosphere and carbon in living things). [Assessment Boundary: Further details of the photosynthesis process are not addressed]

The standard above was developed using the following elements from the NRC document *A Framework for K-12 Science Education.*

<table>
<thead>
<tr>
<th>Science and Engineering Practices</th>
<th>Disciplinary Core Ideas</th>
<th>Crosscutting Concepts</th>
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</thead>
<tbody>
<tr>
<td><strong>Developing and Using Models</strong></td>
<td><strong>PS1.B: Chemical Reactions</strong></td>
<td><strong>Patterns</strong></td>
</tr>
<tr>
<td>Use and construct models to predict, explain, and/or collect data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs. (a)</td>
<td>- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (a) (b)</td>
<td>- Macroscopic patterns are related to the nature of microscopic data and atomic-level structure. Patterns in rates of change and other numerical relationships can provide information about natural and human-designed systems. Patterns can be used to identify cause and effect relationships. Graphs and charts can be used to identify patterns in data. (b)</td>
</tr>
<tr>
<td>Test models to determine mechanisms at unobservable scales. (c)</td>
<td>- The total number of each type of atom is conserved, and thus the mass does not change. (c)</td>
<td>- Rationale for a comparing properties is a search for patterns; finding a change in pattern indicates a new substance. (c)</td>
</tr>
<tr>
<td><strong>Constructing Explanations and Designing Solutions</strong></td>
<td><strong>PS3.B: Energy in Chemical Processes and Everyday Life</strong></td>
<td><strong>Energy and Matter</strong></td>
</tr>
<tr>
<td>Generate and revise causal explanations from data (e.g., observations, sources of reliable information) and relate these explanations to current knowledge. (b)</td>
<td>- Some chemical reactions release energy, others store energy. (c)</td>
<td>- Matter is conserved because atoms are conserved in physical and chemical processes. Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (d)</td>
</tr>
<tr>
<td>Apply scientific reasoning to link evidence to claims and show why the data is adequate for the explanation or conclusion. (c)</td>
<td>- The chemical reaction by which plants produce complex food molecules (e.g., sugar) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (c)(d)</td>
<td>- Energy may take different forms (e.g., energy in fields, thermal energy, energy of motion). The transfer of energy can be tracked as energy flows through a designed or natural system. (c)</td>
</tr>
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<td><strong>Disciplinary Core Ideas</strong></td>
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A well-established DE Science Coalition exists, consisting of key stakeholder groups including all public school districts and the majority of the state’s charter schools. The membership meets monthly.

A state-wide professional development program is currently in place. Institutions of higher education are key partners in this program.
For More Information, Visit the NGSS Website
http://www.nextgenscience.org
Breakout Sessions

The BIG Picture - 1

Instructional Shifts - 2

Assessment - 3

DE Labor Landscape - 4
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