## Middle School Topic Model Course 1

**Narrative and Rationale:** This course model arranges the Performance Expectations (PEs) outlined in the first year of the California Integrated Middle School Model into four different bundles of PEs using a topical arrangement. The disciplinary core ideas of each standard were used in this model to arrange bundles that addressed the topics of human body systems, reproduction and growth, energy transfer and weather, and climates and human impacts. The Disciplinary Core Ideas (DCIs) in physical science focus on the transfer of energy in systems and the kinetic energy of objects. In the life sciences, the DCIs address the growth and development of organisms, cell structures, and processes. Finally, in the earth and space sciences, the DCIs emphasize the role of water in shaping the processes of the Earth. These DCIs build conceptually throughout the year.

In this model, students begin to develop proficiency in the middle school-level Science and Engineering Practices over the course of the year, and the level of sophistication at which they are able to engage in them increases over time. It is important to note that the Practices and Crosscutting Concepts described are intended as end-of-instructional unit expectations and not curricular designations. Additional Practices and Crosscutting Concepts should be used throughout instruction toward each bundle.

<table>
<thead>
<tr>
<th>Bundle 1: “How do the structures of organisms enable life’s functions?” ~6 weeks</th>
<th>Bundle 2: “How do organisms grow and reproduce?” ~6 weeks</th>
<th>Bundle 3: “How can we measure the flow of energy in a system?” ~6 weeks</th>
<th>Bundle 4: “What is contributing to the rise in global temperature?” ~6 weeks</th>
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<td><strong>MS-LS1-1.</strong> Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.</td>
<td><strong>MS-LS1-3.</strong> Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.¹</td>
<td><strong>MS-PS3-3.</strong> Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.*</td>
<td><strong>MS-ESS2-4.</strong> Develop a model to describe the cycling of water through Earth’s systems driven by energy from the sun and the force of gravity.</td>
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<td><strong>MS-LS1-2.</strong> Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.</td>
<td><strong>MS-LS1-4.</strong> Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.</td>
<td><strong>MS-PS3-4.</strong> Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.</td>
<td><strong>MS-ESS2-5.</strong> Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.</td>
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<td><strong>MS-LS1-3.</strong> Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.¹</td>
<td><strong>MS-LS1-5.</strong> Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.</td>
<td><strong>MS-PS3-5.</strong> Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.</td>
<td><strong>MS-ESS2-6.</strong> Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.</td>
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<td><strong>MS-LS1-8.</strong> Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.¹</td>
<td><strong>MS-ETS1-1.</strong> Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.</td>
<td><strong>MS-ETS1-3.</strong> Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.</td>
<td><strong>MS-ESS3-3.</strong> Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*</td>
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<td><strong>MS-ESS3-5.</strong> Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.</td>
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¹ DCIs are listed in the order they appear in the California Integrated Science Framework's disciplinary core ideas.
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1. The bundle only includes part of this PE; the PE is not fully assessable in a unit of instruction leading to this bundle.
The more precisely a design task’s criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions.

.models of all kinds are important for testing solutions. A solution needs to be tested, and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem.

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The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment.

When the motion energy of an object changes, there is inevitably some other change in energy at the same time.

ETS1.B as found in MS-ETS1-4

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Because these patterns are so complex, weather can only be predicted probabilistically.

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Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents.

Global movements of water and its changes in form are propelled by sunlight and gravity.

The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns.

The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents.

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The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.