**Stanford NGSS Integrated Curriculum: An Exploration of a Multidimensional World**

**Unit 1: Setting Things in Motion**

**Essential Question:** How do our bodies produce and use the energy needed to move objects?

**Total Number of Instructional Days:** 30.5

Connect to the Culminating Project using the Project Organizer

**Task 5:**

Parts of a Whole

**Group Culminating Project:**

Demonstrate and Analyze a Physical Activity

**Individual Culminating Project**

Create a Brochure Explaining All The Science Behind a Physical Activity

**Lift-Off Task:**

Objects in Motion

**Task 2:**

Sense and Respond

**Task 3:**

Interacting Subsystems

**Task 4:**

Got Cells?

**Task 1:**

Energy in Motion

**Unit 1 Pop-Out**

**Storyline for Unit 1**

Every day, students make objects move without thinking twice about how it works. They move food from plates to their mouths as they eat. They pull out chairs to sit down in their classrooms. They kick or throw balls around in the schoolyard at recess. In this unit, students will be exploring how their bodies are able to make objects move. They will consider how their bodies are able to produce energy and how it is transferred to objects.

In the Lift-Off Task, students start with the actual experience of kicking a kickball. By considering the phenomenon of humans moving a kickball, students can begin to generate questions about how our bodies make objects move. The questions they generate will guide them throughout the unit as they continue to make sense of this phenomenon, so they can apply it to their own choice of physical activity in their culminating project.

Before students delve into how the body is involved in actions like kicking a kickball, we first want them to understand the science behind the motion itself. In Task 1, students explore how the kinetic energy of an object changes when energy is transferred or transformed to or from the object. Through investigations, they will learn to identify changes in kinetic energy by noticing observable features, such as motion, temperature, and sound. By the end of this task, students will be able to explain what is needed to change the motion of the object in their chosen activity for their culminating project.

In Task 2, students transition away from the physics concepts involved to think about how their bodies are able to move objects. To begin to make this connection between their bodies and moving objects, students first explore the nervous system—specifically the pathway signals take in order for the body to sense and respond to its environment in the kinds of activities they are focusing on for their culminating projects. After synthesizing information on nervous system pathways, students will have a variety of new scientific terminology to describe what is happening in their culminating project activity.

In Task 3, students broaden their understanding of the human body to consider what other subsystems might also be at work. After gathering evidence from experiments and articles, students are able to refute the argument that only two body systems work together during exercise. By the end of this task, students will be able to show and describe how all body systems interact to do both exercise and their chosen activity for their culminating project.

So far in this unit, students have explored the energy involved in moving objects and the different body systems that interact to put objects in motion. However, they still have not completely connected these two concepts—Where do our bodies actually make the energy that we transfer to these objects? Students will explicitly dig into this question in Task 5 as they look at cell parts, but in order to do so, students first need to understand that the human body they have been examining is made up of cells. In Task 4, students zoom in to the microscopic scale and look at the human body up close; here, they discover that only living things are made up of cells. By the end of this task, students will be prepared to research the types of cells involved in their activity and explain why they look different, but are all still referred to as cells.

Task 5 continues their exploration of the microscopic scale by diving into the function of a cell as a whole and the ways in which parts of the cell contribute to the function. This provides the final link for students to think about why their bodies are able to put objects in motion in different activities. By developing and using different types of models, students discover that there is a specific part of the cell that produces energy for the cell, allowing it to function. This is the energy that students eventually see in the movement of objects in their chosen activity for their culminating project.

Once students have completed all tasks and their Project Organizers, they can begin work on their culminating project. Students have already picked an activity that involves an object in motion. In this culminating project, their job is to explain to people who do this activity how their bodies actually make the movement of the object possible. Each group will create a video or presentation that not only demonstrates the activity, but also pauses throughout to describe the role of the human body in making the motion happen. Individually, they will then create a brochure to give more detail on the science involved in the human body putting an object in motion.

**Three-Dimensional Breakdown of the Performance Expectations**

This unit was developed to align with, teach, and assess students’ understanding and skills related to these Performance Expectations. Below, we have mapped out the disciplinary core ideas, crosscutting concepts, and science and engineering practices addressed in this unit. Aspects of the dimensions that are not explicitly addressed in this unit are crossed out.

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| **Performance Expectations** | **Scientific and Engineering Practices** | **Disciplinary Core Ideas** | **Crosscutting Concepts** |
| **MS-PS3-5. 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.**[Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.] [*Assessment Boundary: Assessment does not include calculations of energy.*] | **Engaging in Argument From Evidence**   * Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon. | **PS3.B: Conservation of Energy and Energy Transfer**   * When the motion energy of an object changes, there is inevitably some other change in energy at the same time. | **Energy and Matter**   * Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). |
| **MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.**  [*Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.*] | **Obtaining, Evaluating, and Communicating Information**   * Gather, read, and synthesize information from multiple appropriate sources ~~and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.~~ | **LS1.D: Information Processing**  Each sense receptor responds to different inputs ~~(electromagnetic, mechanical, chemical)~~, transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. | **Cause and Effect**   * Cause and effect relationships may be used to predict phenomena in natural systems. |
| **MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.** [Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [*Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.*] | **Engaging in Argument From Evidence**   * Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. | **LS1.A: Structure and Function**   * In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. | **Systems and System Models**   * Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. |
| **MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.**[Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.] | **Planning and Carrying Out Investigations**   * Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. | **LS1.A: Structure and Function**   * All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). | **Scale, Proportion, and Quantity**   * Phenomena that can be observed at one scale may not be observable at another scale. |
| **MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.**[Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [*Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.*] | **Developing and Using Models**   * Develop and use a model to describe phenomena. | **LS1.A: Structure and Function**   * Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. | **Structure and Function**   * Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts; therefore complex natural structures/systems can be analyzed to determine how they function. |

**Connections to Common Core Math and ELA Standards:**

Over the course of this unit, students will gain knowledge and skills in science, as well as in math and English-Language Arts. Below we list the Common Core ELA and Math standards for middle school and 6th grade that are relevant to the curriculum tasks in this unit. Within the curriculum, there are opportunities to incorporate components of the following ELA and Math Standards:

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| **Middle School and 6th Grade Common Core ELA Standards** | | **Unit Task** |
| **Integration of Knowledge and Ideas** | CCSS.ELA-Literacy.RI.6.8: Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. | Task 3  Task 4 |
| **Key Ideas and Details** | CCSS.ELA-Literacy.RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts. | Task 1  Task 2  Task 3  Culminating Project |
| **Text Types and Purposes** | CCSS.ELA-Literacy.WHST.6-8.1: Write arguments focused on discipline-specific content. | Task 1  Task 3  Culminating Project |
| **Research to Build and Present Knowledge** | CCSS.ELA-Literacy.WHST.6-8.7: Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. | Task 4  Task 5 |
| CCSS.ELA-Literacy.WHST.6-8.8: Gather relevant information from multiple print and digital sources, using search terms effectively. | Culminating Project |
| **Presentation of Knowledge and Ideas** | CCSS.ELA-Literacy.SL.8.5: Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. | Task 5  Culminating Project |

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| **Middle School and 6th Grade Common Core Math Standards** | | **Unit Task** |
| **Mathematical Practice** | CCSS.MATH.MP.2: Reason abstractly and quantitatively. | Task 1  Task 2  Task 3 |
| **Ratios and Proportional Relationships** | CCSS.MATH. CONTENT.6.RP.A.1: Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. | Task 1  Culminating Project |

**Connections to English Language Development (ELD) Standards:**

We acknowledge that language development is a key component of disciplinary understanding and helps to support more rigorous and equitable outcomes for diverse students. This curriculum thus takes into account both the receptive and productive language demands of the culminating projects and strives to increase accessibility by including scaffolds for language development and pedagogical strategies throughout learning tasks. We aim to support language acquisition through the development of concept maps; utilizing sentence frames; implementing the Critique, Correct, Clarify technique; employing the Stronger Clearer strategy; and fostering large and small group discussions.

The California ELD Standards are comprised of two sections: the standards and a rubric. Outlined below are the standards from Section One that are met within this curriculum. For additional information, please refer to: https://www.pausd.org/sites/default/files/pdf-faqs/attachments/SS\_ELD\_6.pdf.

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| **6th Grade ELD Standards** | | |
| **Part I: Interacting in Meaningful Ways** | A: Collaborative | 1.Exchanging information and ideas with others through oral collaborative discussions on a range of social and academic topics |
| 2. Interacting with others in written English in various communicative forms (print, communicative technology, and multimedia) |
| 3. Offering and justifying options, negotiating with and persuading others in communicative exchanges |
| 4. Adapting language choices to various contexts (based on task, purpose, audience, and text type) |
| B: Interpretive | 5. Listening actively to spoken English in a range of social and academic contexts |
| 6. Reading closely literary and informational texts and viewing multimedia to determine how meaning is conveyed explicitly and implicitly through language |
| 7. Evaluating how well writers and speakers use language to support ideas and arguments with details or evidence depending on modality, text type, purpose, audience, topic, and content area |
| 8. Analyzing how writers and speakers use vocabulary and other language resources for specific purposes (to explain, persuade, entertain, etc.) depending on modality, text type, purpose, audience, topic, and content area |
| C: Productive | 9. Expressing information and ideas in formal oral presentations on academic topics |
| 10. Writing literary and informational texts to present, describe, and explain ideas and information, using appropriate technology |
| 11. Justifying own arguments and evaluating others’ arguments in writing |
| 12. Selecting and applying varied and precise vocabulary and other language resources to effectively convey ideas |
| **Part II: Learning About How English Works** | A: Structuring Cohesive Texts | 1. Understanding text structure |
| 2. Understanding cohesion |
| B: Expanding and Enriching Ideas | 3. Using verbs and verb phrases |
| 4. Using nouns and noun phrases |
| 5. Modifying to add details |
| C: Connecting and Condensing Ideas | 6. Connecting ideas |
| 7. Condensing ideas |

**Connections to Environmental Awareness:**

Over the course of this curriculum, students will explore content related to various environmental principles and concepts that examine the interactions and interdependence of human societies and natural systems. In accordance with the *Education and the Environment Initiative (EEI),* tasks throughout this curriculum explore many of *California’s Approved Environmental Principles and Concepts.*

Because this unit focuses on the human body and how it can move objects, it does not explicitly examine the interactions of *humans* and natural systems. In later units, we will outline the EEI principles relevant to the unit in this section of the unit overview.