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

**Introduction**

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 like these move. They will consider how their bodies are able to produce energy and use it in a way that transfers it to objects. To begin this thought process, 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.

**Alignment Table**

Because the Lift-Off tasks focus on student-generated questions, we do not identify specific Disciplinary Core Ideas or Science and Engineering Practices in this table.

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| **Crosscutting Concepts (\*depending upon student-generated questions)**   * Cause and Effect   + Cause and effect relationships may be used to predict phenomena in natural systems. * Scale, Proportion, and Quantity   + Phenomena that can be observed at one scale may not be observable at another scale. * Systems and System Models   + Systems may interact with other systems; they may have sub-systems and be a part of a larger complex system. * Energy and Matter   + Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). * 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. |
| **Equity and Groupwork**   * Share and listen to broad and diverse student contributions. * Make connections between each other’s ideas. * Work together to co-construct a concept map. |
| **Language**   * Use connector words to link ideas. * Generate and write questions about the phenomenon. * Organize key questions in a concept map. |

**Learning Goals**

This learning task introduces students to the phenomenon of humans kicking a kickball and begins generating questions that will guide them through the unit. More specifically, the purpose is to:

* Individually generate a list of questions about humans kicking a kickball, using observations from the outdoor activity.
* Make connections between related questions.
* Generate possible answers to questions, using prior knowledge.
* Apply prior experiences of various physical activities to make a list of activities that involve putting an object in motion.

**Content Background for Teachers**

In this task, students experience the act of kicking a kickball. By making observations from the perspective of the kicker and the outside observer, they will likely generate questions both about the kickball’s motion and the inner-workings of the human body that are involved in the kickball’s motion. As students gather more knowledge throughout the unit, they will find that the movement of the kickball is made possible because of energy transferred from the human body to the kickball. This energy is manufactured in body cells using the food that they eat and other essential molecules consumed. For more information on scientific concepts related to moving objects and body systems, reference this section in subsequent tasks.

In this task, students create a concept map, which is a graphical tool that helps to organize and represent knowledge and questions, and is a successful academic language instruction tool. In this task, students will likely add only basic terms relating to motion of objects and the human body. As students learn more about the body system processes that allow movement of objects, they will add more complex questions and ideas to this concept map. If your students have not had previous experience making concept maps, please see the instructions in Part B below for strategies on teaching this skill.

**Academic Vocabulary**

* Energy
* Move/Motion
* Body

\*Additional academic vocabulary will vary by class

**Time Needed (Based on 45-Minute Periods)**

2 Days

* Introduction, Part A and Part B: 1 period
* Class Concept Map, Project Overview, and Project Organizer: 1 period

**Materials**

* Unit 1, Lift-Off Task Student Version
* Kickball(s)

Part B

* Poster paper and markers
* Post-Its (Optional)

Part C

* Class Poster Paper and markers
* \*See Instructions below for other optional materials to use for the class concept map

Connecting to the Culminating Project

* Culminating Project Handout
* Project Organizer Handout

**Instructions**

1. Introduce students to the unit by reading or projecting the Unit Essential Question aloud.
2. To help students think about the essential question, take students outside to take turns kicking a kickball. Ask them to observe what they notice as they kick the kickball and as they watch others kick the kickball. You may want them to record these observations on a separate piece of paper or in a Science Notebook, so they can refer back to them as they generate questions in the next section of this task.

**Part A**

1. In this section of the task, students will generate questions to help them make sense of the phenomenon—kicking a kickball. Using these self-generated questions throughout the unit will help them get a better understanding of how their bodies make objects move.
2. Have students complete this section individually in their student guide.

* For students who need more support, encourage them to think back to their experience of kicking a kickball or watching others kick the kickball, and consider any questions they have.
* Here is a list of some potential questions students might generate: “Why does the kickball move? Why does the ball sometimes go farther? What happens in our bodies to make this possible? Besides muscles in our legs, what else is needed to kick a ball? Where does the energy come from? How does our body decide what action to do?”

**Part B:**

1. In this part of the task, students create a concept map as a group.

* Remind students to refer to the directions on their student guide to help them make their concept map. First, students should compare each member’s list of questions and record/connect key questions on a piece of poster paper. They will then draft possible answers to the questions, using prior knowledge.
* Remind students that there are no right or wrong questions or predictions, so students feel encouraged to contribute any and all questions and ideas they think of.
* Because this is a collaborative task, it is recommended that you remind students of group work norms and assign group roles, such as Resource Manager, Facilitator, Recorder, and Harmonizer (See “How to Use this Curriculum” for more details).

1. Students will post their posters on a wall and then walk around and look at each group’s ideas. One suggestion for gallery walks is for students to interact with the posters in some way. For example, students are required to initial or leave post-its on three questions that they are also excited about on other posters.

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| Macintosh HD:Users:laurenstoll:Downloads:Sample Concept Map (1).jpg**How to Concept Map**  For students who have not had a lot of experience making concept maps, we have detailed a strategy below for introducing concept mapping using more familiar content. An example is also provided, but this will vary depending on what your students come up with as you make your own model.   1. Write the phenomenon in the middle of the poster, in this case “Humans breathe harder when they exercise.” 2. Ask students to share questions they might ask to make sense of this phenomenon and make a list of these questions on the board. 3. Model the process of reviewing the list and finding similarities amongst the questions.    * Place these key questions on the concept map poster, modeling how to put similar questions near each other on the poster. Circle these to signify that these are questions, not content knowledge. 4. Ask students to look at the key questions and see if any of the questions are connected: Would answering one question lead to one of the other questions? Model making these connections by drawing arrows between the circles. 5. In this Lift-Off task, students will only be drafting possible answers to the questions, not actually gathering and recording learned concepts. However, throughout the unit, they will be adding content they have learned. Model this by recording a student’s prior knowledge to one of the questions, using boxes to signify that these are pieces of content knowledge rather than questions.    * Use connector words to identify the relationships between the content boxes (See image above for an example). 6. Optional: To emphasize crosscutting concepts using a concept map, make a key of different colors for the crosscutting concepts emphasized in this unit. Identify questions that clearly show evidence of the different crosscutting concepts and circle them with the corresponding colors. Explain to students how you made that choice by pointing out the language that hints at that crosscutting concept. \*Note: not all boxes and circles will necessarily have a crosscutting concept. |

**Part C**

1. Construct a whole-class concept map that begins to help students make sense of the phenomenon of humans kicking a kickball.

* Start with the phenomenon in the middle.
* Then ask students to share out the questions that were most common across all the posters in the classroom. As you record questions on the poster, organize them based on connections you see. Draw circles around each question (as you add to the concept map throughout the unit, you’ll also be adding concepts learned, which can be written in boxes to distinguish them from the questions).
* Ask students to identify any connections they see between the questions and record these as lines between the questions.
  + Recommended: Give pairs of students think time to come up with 1-2 connections to add to the class concept map and call on pairs using equity sticks. This encourages more equitable participation in this class-wide activity.
* The purpose of this concept map is to facilitate generation of student questions, promote language development, and support understanding of the science content throughout the unit. Allowing students to ask their own questions and use their own words to make meaning of the concepts will not only help them make deep connections about science content but will also help their oral and written language development.
* This whole class concept map will be revisited at the end of each task, asking students questions like: Are there any new questions you have about the phenomenon? Are there any connections you want to add or change? What is your reason for that addition/revision? Are there more connections we can make between the questions/ideas already on the map? Do you want to add any new ideas/concepts to the map?

1. Because this concept map will be added to and revised throughout the unit, here are some practical options for implementation.

* If you have access to white board paper, we encourage you to use these for class posters since it will allow you and your students to make revisions throughout the unit.
* Another option is to use smaller pieces of paper for each class and project using a document camera; this will save space as opposed to doing large class posters.
* We highly recommend students keep their own version of this concept map in their notebooks, adding questions and concepts as they go through the unit.

1. Once the draft concept map is complete, introduce students to the crosscutting concepts for this unit. We recommend posting posters of each crosscutting concept in your classroom (See beginning of teacher guide for templates).

* The crosscutting concepts for this unit are: Cause and Effect; Scale, Proportion, and Quantity; Systems and System Models; Energy and Matter; and Structure and Function. Assign a color for each crosscutting concept that can be used throughout the unit.
* Have students analyze the class concept map for as many examples of the crosscutting concepts as they can find. Depending on the questions they have, they may be able to find an example of each of the crosscutting concepts or perhaps just some.
* We recommend modeling this process by picking a question, identifying the crosscutting concept, and tracing the circle in the corresponding color. Explain the key words that helped you identify the crosscutting concept in this question. Some identifying words that students might look for are:
  + **Cause and Effect:** These could be phrases such as, “that results in,” “that causes,” “that explains why,” “is due to,” etc.
  + **Scale, Proportion, and Quantity**: These could be phrases such as, “is proportional to”, “compared to”, “has a ratio of”, “is bigger/smaller than”, “is longer/shorter than”, etc.
  + **Systems and Systems Models**: These could be phrases such as, “is a part of” “connects to,” “interacts with,” “is made up of,” “works together with,” etc.
  + **Energy and Matter**: These could be phrases such as, “energy is transferred/flows,” “is conserved,” “is important for,” “is needed,” etc.
  + **Structure and Function**: These could be phrases such as, “its shape affects its function by,” “structure causes it to,” “functions this way because of,” etc.

**Connecting to the Culminating Project**

1. Hand out the Culminating Project Task Card and read the Challenge and Group Project Criteria for Success aloud as a class.
   * Take questions for clarification.
   * Optional: You may want to explain the different format options available for their group project (e.g., live presentation with props and posters, video using basic recording of presentation, whiteboard video using Sparkol VideoScribe, video using Powtoons, etc.)
2. Pass out their Project Organizer and explain that they will complete a section of this after each task in class. Students should independently complete the Lift-Off Task section of the Project Organizer in class. Revisions can be done for homework, depending upon student’s needs and/or class scheduling.
   * Students have been tasked to teach people how their bodies make the movement of objects possible in a specific activity. The student prompt is as follows: Brainstorm a list of activities that involve humans putting an object in motion. Circle ones that you are interested in using for your project.

**Reflection**

1. At the end of the task, ask students to reflect on what they have learned over the course of this task by answering the following three questions in their student guide:
   * At the beginning of this task, you made a list of all the questions you have about humans kicking a kickball. Look back at your list: after learning from your peers, how can you add to your list? What kinds of things did you initially leave out? Use the class concept map to help you.
   * In this unit, we will be focusing on five crosscutting concepts: **Cause and Effect**: Cause and effect relationships may be used to predict phenomena; **Scale, Proportion, and Quantity**: Phenomena that can be observed at one scale may not be observable at another scale; **Systems and System Models**:Systems may interact with other systems and may have sub-systems; **Energy and Matter**: Energy may take different forms; and **Structure and Function:** Relationships between parts can be analyzed to determine how systems function. Looking at your class concept map, give one example of how a crosscutting concept came up in today’s task.
   * Now that you understand what project you’ll be working on over the course of this unit, what else do you need to know? What additional questions do you have?
2. There are no right answers but encourage students to look back at their initial lists and their class concept map. They should not change their initial responses, but rather use this reflection space to add to their questions and ideas based on what they have learned through this task. By generating more of their own questions, students continue to engage in sense-making of the phenomenon and the gathering of knowledge and skills for their final project.