

UNIT 1

Setting Things in Motion



How do our bodies produce and use the energy needed to move objects?

SCALE

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6th Grade Science Unit 1: Setting Things in Motion

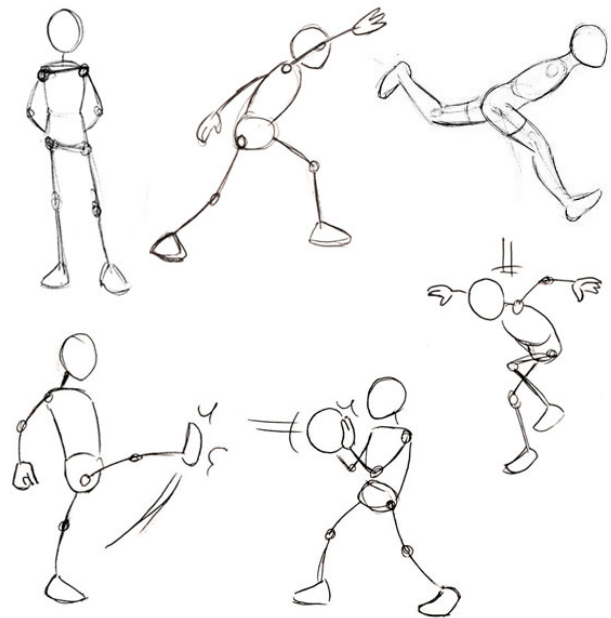
Culminating Project

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

Challenge

Most of you have experienced being able to make objects move—in a variety of different ways! In the Lift-Off Task, you saw how humans could make a ball move in a game of kickball. But what makes this ball move? What is happening in our bodies that might make this movement possible?

Making objects move is such an everyday action that we rarely think twice about it! Your task is to pick an activity that involves an object in motion and explain to people who do this activity how their bodies actually make the movement of the object possible. At the end of the unit, your group will create a video or presentation that demonstrates the activity. Throughout the presentation, you will pause to describe the role of the human body in making the motion happen. As individuals, you will then create a brochure to give more detail on the science involved in your body putting an object in motion.



<https://design.tutsplus.com/articles/human-anatomy-fundamentals-balance-and-movement--vector-20936>

Group Project Criteria for Success

Your activity presentation/video should include:

- A physical demonstration of the activity
- An explanation of where the energy comes from that moves the object
 - And a recommendation for how you could change the movement of that object (e.g. make it go faster/slower or farther/faster)
- A description of the body's nervous system pathway that results in the object's motion
- An explanation of how different body systems interact to make the activity possible
- Quality Presentation Structure
 - Pauses throughout the physical demonstration to explain the science behind what is happening
 - Is organized logically
 - Is interesting to the audience

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Individual Project Criteria for Success

The brochure should include:

- A diagram and description of the physical activity and object in motion
- An argument for why the motion of the object can vary: What is the relationship between kinetic energy and energy transfer? How do you know when the kinetic energy of the object changes?
 - Support the argument with relevant evidence
- A description or labeled diagram of the nervous system pathway that causes your object to move
 - Cite the sources you used to predict that this is the nervous system pathway used in your activity
- An argument for how subsystems of the body interact to make the activity possible. Include:
 - A description of each subsystem's function
 - An explanation and/or diagram showing how the subsystems interact
- An explanation of where the energy to move the object actually comes from in the human body. To support your explanation, include a model that shows:
 - Different cell parts (e.g. nucleus, cell membrane, and mitochondria) and their specific functions
 - How the function of the whole cell depends on relationships between these cell parts

**6th Grade Science Unit 1: Setting Things in Motion
Culminating Project**

Brochure Peer Review Feedback

Complete after you have a full first draft of your brochure.

Brochure Owner’s Name	
Brochure Reviewer’s Name	

Review the following sections of the Brochure:

- A diagram and description of the physical activity and object in motion
 - Positive Comment:

 - Constructive Comment:

- An argument for why the motion of the object can vary: What is the relationship between kinetic energy and energy transfer? How do you know when the kinetic energy of the object changes?
 - Support the argument with relevant evidence

 - Positive Comment:

 - Constructive Comment:

6th Grade Science Unit 1: Setting Things in Motion

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- A description or labeled diagram of the nervous system pathway that causes your object to move
 - Cite the sources you used to predict that this is the nervous system pathway used in your activity
 - Positive Comment:

 - Constructive Comment:

- An argument for how subsystems of the body interact to make the activity possible. Include:
 - A description of each subsystem's function
 - An explanation and/or diagram showing how the subsystems interact
 - Positive Comment:

 - Constructive Comment:

- An explanation of where the energy to move the object actually comes from in the human body. To support your explanation, include a model that shows:
 - Different cell parts (e.g. nucleus, cell membrane, and mitochondria) and their specific functions
 - How the function of the whole cell depends on relationships between these cell parts
 - Positive Comment:

 - Constructive Comment:

**6th Grade Science Unit 1: Setting Things in Motion
3-Dimensional Individual Project Rubric**

Overview: The following rubrics can be used to assess the individual project: a brochure on the science involved in the body putting an object in motion. Each rubric is aligned to one section of the *Individual Project Criteria for Success*, located on your Culminating Project Student Instructions. Use these rubrics to see if you are doing your best work on your individual project.

Rubric 1: Student uses evidence of observable features to argue that a change in the kinetic energy of their object means more or less energy was transferred to the object.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student constructs an inaccurate or irrelevant argument about the kinetic energy and energy transfer of their object.	Student accurately argues that a change in the kinetic energy of their object means more or less energy was transferred to the object.	Student uses evidence of an observable feature to accurately argue that a change in the kinetic energy of their object means more or less energy was transferred to the object.	Student uses evidence of multiple observable features to accurately argue that a change in the kinetic energy of their object means more or less energy was transferred to the object.

Rubric 2: Student describes the nervous system pathway that causes their object to move, citing information gathered and synthesized from multiple sources.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student inaccurately describes the nervous system pathway that causes their object to move.	Student partially describes the nervous system pathway that causes their object to move, using information gathered from at least one source.	Student completely describes the nervous system pathway that causes their object to move, using information gathered and synthesized from multiple sources.	Student completely describes the nervous system pathway that causes their object to move, citing information gathered and synthesized from multiple sources.

Rubric 3: Student uses evidence to argue how multiple body subsystems with specific functions interact to make their activity possible.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Student uses evidence to inaccurately argue how multiple body subsystems with specific functions work to make their activity possible.	Student uses evidence to partially argue how multiple body subsystems with specific functions work to make their activity possible.	Student uses evidence to partially argue how multiple body subsystems with specific functions interact to make their activity possible.	Student uses evidence to completely argue how multiple body subsystems with specific functions interact to make their activity possible.

**6th Grade Science Unit 1: Setting Things in Motion
3-Dimensional Individual Project Rubric**

Rubric 4: Student develops a model to describe the specific functions of main cell parts.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
<p>Student develops a model to inaccurately describe the specific functions of main cell parts.</p> <p>OR</p> <p>Student partially describes the specific functions of some cell parts, but no model is present.</p>	<p>Student develops a model to partially or completely describe the specific functions of some main cell parts.</p> <p>OR</p> <p>Student completely describes the specific functions of all cell parts, but no model is present.</p>	<p>Student develops a model to partially describe the specific functions of all main cell parts.</p>	<p>Student develops a model to completely describe the specific functions of all main cell parts.</p>

Rubric 5: Student develops a model to describe how the function of the cell depends on relationships among its parts.

Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
<p>Student develops a model to inaccurately describe how the function of the cell depends on relationships among its parts.</p>	<p>Student develops a model to generally describe how the function of the cell depends on relationships among its parts.</p> <p>OR</p> <p>Student partially or completely describes how the function of the cell depends on relationships among its parts, but no model is present.</p>	<p>Student develops a model to partially describe how the function of the cell depends on relationships among its parts.</p>	<p>Student develops a model to completely describe how the function of the cell depends on relationships among its parts.</p>

**6th Grade Science Unit 1: Setting Things in Motion
Project Organizer**



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

You will be teaching people how their bodies make the movement of objects possible in a specific activity. After each task, you will return to the table below to organize what you learn as you go through the unit. By the end of the five tasks, you will have all this information to use for your culminating project. For each activity, be sure to include answers to **ALL** the questions provided.

<p>Lift-Off Task: Objects in Motion</p>	<p>Brainstorm a list of activities that involve humans putting an object in motion. Circle ones that you are interested in using for your project.</p>
<p>Task 1: Energy in Motion</p>	<p>Your presentation will involve demonstrating an activity and explaining the science behind an object’s motion. <u>As a group</u>, first decide on an activity that puts an object in motion to focus on for your culminating project. Then <u>individually</u>,</p> <ul style="list-style-type: none"> <input type="checkbox"/> Describe how an object moves in your group’s chosen activity. <input type="checkbox"/> Explain what you would need to change the motion of the object (e.g., make it go faster/slower or farther/closer). Describe how this changes the object’s kinetic energy. <ul style="list-style-type: none"> ○ Cite evidence from your argument or investigations to support your explanation.

**6th Grade Science Unit 1: Setting Things in Motion
Project Organizer**



<p>Task 2: Sense and Respond</p>	<p>Your presentation and brochure will include showing how the body’s nervous system allows it to move objects in your chosen activity.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Describe the nervous system pathway involved in your chosen activity. You may draw a flowchart, like you did in this task, or describe the pathway in a numbered list or paragraph.
<p>Task 3: Interacting Subsystems</p>	<p>In this task, you learned that there are other subsystems of the body at work, besides just the nervous system.</p> <ul style="list-style-type: none"> <input type="checkbox"/> In a paragraph, flowchart, or diagram, explain how different subsystems of the body work together to do your chosen activity.

**6th Grade Science Unit 1: Setting Things in Motion
Project Organizer**

<p>Task 4: Got Cells?</p>	<p>In the last task, you described the different subsystems of the body that are involved in your activity.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Research and identify the types of cells that make up the body systems you identified. <input type="checkbox"/> Why do you think these different types of cells look so different? <input type="checkbox"/> Even though they appear different, why are they all called cells?
<p>Task 5: Parts of a Whole</p>	<p>We know from Task 1 that your activity requires energy to move an object.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Now that you have learned about cells and their parts, describe where this energy comes from. <input type="checkbox"/> Pick one body system involved in your activity and do research to fill out the flowchart below. This will show how energy from your body is able to move your object! <div style="text-align: center; margin-top: 20px;"> <p>_____ ⇒ _____ ⇒ _____ ⇒</p> <p style="margin-left: 50px;">Cell Part Type of Cell Type of Tissue</p> <p>_____ ⇒ _____ ⇒ _____</p> <p style="margin-left: 50px;">Organ Body System Interacts with Other Body Systems To Make Your Object Move!</p> </div>

6th Grade Science Unit 1: Setting Things in Motion

Lift-Off Task: Objects in Motion

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



<https://www.wikihow.com/Be-an-Awesome-Kickball-Player>

Every day, we make objects move without thinking twice about how it works! As a class,

- Go outside and observe different classmates kicking a kickball. What do you notice?

Part A: If you wanted to know more about what is happening when humans kick a kickball, what questions would you ask? Individually record any questions you would need to ask to get a better understanding of our bodies making objects move.

6th Grade Science Unit 1: Setting Things in Motion**Lift-Off Task: Objects in Motion**

Part B: As a group,

- Discuss what questions each member wrote on his or her list.
- On a large piece of poster paper:
 - Write the phrase “Humans Kicking a Kickball” in the middle of your poster and draw a circle around it.
 - Around the circle, record the questions that were similar across your group members.
 - Draw lines to link together questions that relate to each other.
 - Draft possible answers to the questions, using your prior knowledge. Connect these to the questions on your poster.
- Post your group poster on the wall.
- Walk around and look at each groups’ ideas.

Part C: As a whole class,

- Construct a class concept map with the phenomenon in the middle: “Humans Kicking a Kickball”.
 - Decide which key questions you want to have on the concept map.
 - Draw lines with arrows between two key questions to show that there is a relationship.
 - Make as many connections as you can between the questions on the concept map.
- It’s important for everyone to share their ideas and it’s okay if you don’t agree.
- You will revise and add new questions and information to this concept map as you learn more about moving objects and the human body.

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

Connecting to the Culminating Project

You have been asked to teach people how their bodies make the movement of objects possible in a specific activity. Brainstorm a list of activities that involve humans putting an object in motion. Circle ones that you are interested in using for your project.

This should be completed individually in your Project Organizer.

6th Grade Science Unit 1: Setting Things in Motion**Lift-Off Task: Objects in Motion**

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

Reflection

Individually reflect on the Lift-Off Task, using the questions provided:

1. 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: think about the questions your peers asked that you did not initially write down. How are their questions different from the ones you originally asked?

2. 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.
 - **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.

3. 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?

6th Grade Science Unit 1: Setting Things in Motion

Task 1: Energy in Motion

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

Engage

In the Lift-Off task, you explored an example of our bodies putting an object in motion—kicking a kickball. But what is the science behind the motion of an object, like a kickball?



Let's start by investigating an action you have likely done before. In pairs,

1. Rub your hands together slowly. Record your observations of any sensations below.
2. Rub your hands together as fast as you can. Record your observations of any sensations below.
3. Now compare your observations from rubbing your hands slowly vs. quickly. How were your observations different?
 - a. How might the speed of your hand motion cause this difference?
4. What do you think would happen if you rubbed your hands together very quickly and then put an ice cube in between your hands? Why?

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Task 1: Energy in Motion



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

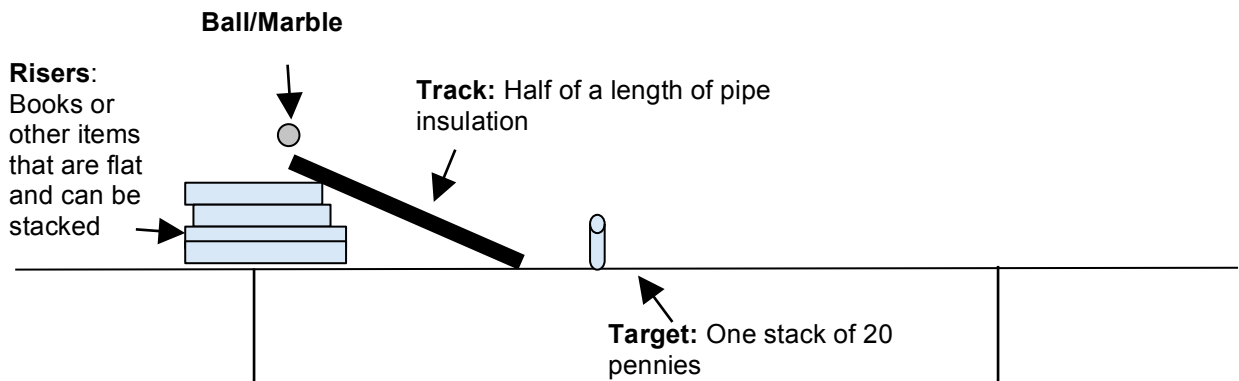
Explore

Energy and Matter: In the *Engage* investigation, you saw that a change in motion was associated with a change in another observable feature. Now let’s test this idea out by investigating a similar scenario: How does changing the position of a ball on a ramp affect the amount of stacked pennies it knocks over at the bottom of the ramp?

1. First, individually make a prediction to the experimental question:

I think that the _____ (higher/lower) the ball is on the ramp, the _____ (more/less) stacked pennies it will knock over at the bottom of the ramp.

2. With your group, set up and run the experiment using the following procedure:



- a. Stack 3-4 textbooks on top of each other.
- b. Place a piece of pipe insulation with one end resting on the edge of the stack of books and the other end resting on the table.
- c. Set 1 stack of 20 pennies on the table at the end of the pipe insulation.
- d. Release a marble or other ball from the top of the pipe insulation. Record the number of pennies knocked over.
- e. Release a marble or other ball from the middle of the pipe insulation. Record the number of pennies knocked over.

3. Record your data in the table below:

	Number of Pennies Knocked Over	Why do you think there was a change in the number of pennies knocked over?
Top of Ramp		
Middle of Ramp		

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Task 1: Energy in Motion

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

Explain

How can we make an argument for what is happening in our investigations? Why did our hands reach different temperatures when we rubbed them together at different speeds? Why did placing the ball at different positions on the ramp cause it to knock over different amounts of pennies at the bottom?

Individually,

1. **Energy and Matter:** Read and annotate the following article about energy to learn some of the scientific terms you can use in your argument.

The scientific concept of **energy** can help us understand why objects behave the way they do. If a **force** is applied to an object, this can cause the energy of that object to change. For example, when you push a table, you are applying a force. This changes the energy of the table, making it move.



This energy that an object has because of its motion is called **kinetic energy**. Kinetic energy can be **transferred** between objects or **transformed** into other kinds of energy. You can tell when kinetic energy changes because there are key observable features, such as **motion, temperature, or sound**. For example, when a bowling ball collides with bowling pins, some of the ball's kinetic energy is transferred to the pins and some to the surrounding air. This transfer of kinetic energy increases the amount of kinetic energy in the pins and the air. This is what makes the pins move and creates the loud sound you hear!

Sometimes you can predict an object's kinetic energy. If you put an object at a higher position, it will have more kinetic energy when it begins moving. This is called **potential energy**—or the stored energy an object has because of its position. For example, when you pick up a heavy book off the ground and raise it into the air, you are applying a force that increases the energy stored in the book—its potential energy. When you drop the book and let it fall, the potential energy is converted into kinetic energy. Thus the more potential energy (higher position) in an object, the more kinetic energy it will have.

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Task 1: Energy in Motion

2. **Engaging in Argument From Evidence:** Construct an argument to explain the role of energy in both the *Engage* and *Explore* investigations.
- Make sure to include the following scientific terms/ideas: transfer, transform, kinetic energy, potential energy, motion/move, and temperature.
 - Support your argument with data from the investigations.

Claim	
What evidence and scientific reasoning do you have to support your claim?	

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

Elaborate

Now that you understand the relationship between kinetic energy and energy transfer between objects, let's apply it to a real-life scenario: A car's wheel is spinning at a rapid speed while it is parked. The driver wants to know why there is so much smoke. How can you explain this to the driver? Discuss with a partner and respond below.

6th Grade Science Unit 1: Setting Things in Motion

Task 1: Energy in Motion

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

Evaluate: Connecting to the Culminating Project

You have been asked to teach people how their bodies make the movement of objects possible in a specific activity. Your presentation will involve demonstrating an activity and explaining the science behind an object's motion. As a group, first decide on an activity that puts an object in motion to focus on for your culminating project. Then individually,

- ✓ Describe how an object moves in your group's chosen activity.
- ✓ Explain what you would need to change the motion of the object (e.g., make it go faster/slower or farther/closer). Describe how this changes the object's kinetic energy.
 - Cite evidence from your argument or investigations to support your explanation.

This should be individually in your Project Organizer.

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

Reflection

Individually reflect on Task 1, using the questions provided:

1. At the beginning of this task, you were asked to make observations when you rubbed your hands together. This experiment showed one type of observable feature associated with kinetic energy. Based on what you learned throughout the task, what are all the different observable features associated with a change in kinetic energy?

2. In this task, we focused on the crosscutting concept of:
 - **Energy and Matter:** Energy may take different forms.Where do you see examples of **Energy and Matter** in this task?

6th Grade Science Unit 1: Setting Things in Motion**Task 1: Energy in Motion**

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3. Now that you have learned more about the science of moving objects, what questions do you still have?

6th Grade Science Unit 1: Setting Things in Motion

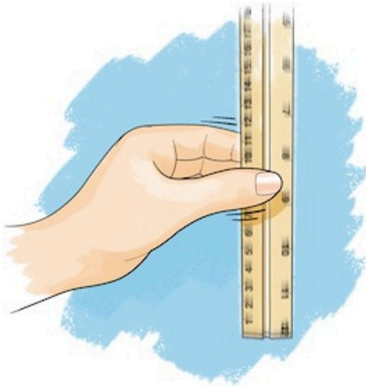
Task 2: Sense and Respond

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

Engage

In Task 1, you explored the energy involved in moving different objects, like a kickball. But how are you able to kick a kickball? How does your body move objects in these specific activities?

To help us think about how our bodies take action, let's try a simple game called "Catch the Ruler." Your goal is to catch the ruler with less than 7 cm left at the bottom. With a partner, follow the procedure below:



1. Partner 1: Hold the ruler vertically so that 0 cm is at the bottom and 30 cm is at the top.
2. Partner 2: Place your thumb and index finger at the bottom edge of the ruler.
3. Partner 1: Tell your partner you will release the ruler without telling them and it is their job to catch it as quickly as possible. Then release the ruler when you are ready.
4. Partner 2: Try to catch the ruler as quickly as possible. Note the cm where your fingers catch the ruler.
5. Repeat Steps 2-4 three times and then switch partners.

After the game, debrief the following questions:

1. Were you or your partner able to catch the ruler with less than 7 cm at the bottom of the ruler? If not, what was the average distance (in cm) that you and your partner were able to catch the ruler?

a. Hypothesize: Why do you think you got these results?

2. Describe the process you think your body goes through to be able to catch a ruler.


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Task 2: Sense and Respond

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

Explore

Obtaining, Evaluating, and Communicating Information: To help us understand the process our bodies go through to catch a ruler, we need to gather some more information. As a group, use the resources provided to learn more about a system in our body called the nervous system. Take notes in the table below.

Resource	Notes on the Nervous System
<p>Definition Cards</p>	<p>Label the diagram below with the nervous system terms and summaries of their definitions.</p> 

6th Grade Science Unit 1: Setting Things in Motion

Task 2: Sense and Respond



<p>Video</p>	<p>1. What are the three principal functions of the nervous system?</p> <div style="display: flex; align-items: center; justify-content: center; gap: 20px;"> <div style="border: 1px solid black; border-radius: 15px; width: 150px; height: 70px;"></div> <div style="color: #4a90e2; font-size: 2em;">→</div> <div style="border: 1px solid black; border-radius: 15px; width: 150px; height: 70px;"></div> <div style="color: #4a90e2; font-size: 2em;">→</div> <div style="border: 1px solid black; border-radius: 15px; width: 150px; height: 70px;"></div> </div> <p>2. Organization of the Nervous System</p> <p style="padding-left: 40px;">a. What two organs make up the central nervous system?</p> <p style="padding-left: 80px;">b. What two divisions of nerve cells make up the peripheral nervous system?</p> <p>3. Describe the steps in your nervous system pathway when you feel a spider on your leg. Underline terms that you think are important to the nervous system.</p>
<p>Relay Race Simulation</p>	<p>Create a numbered list or a flowchart to describe the nervous system pathway you modeled in the simulation.</p>

6th Grade Science Unit 1: Setting Things in Motion

Task 2: Sense and Respond

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

Explain

Now that you know more about the process our bodies go through to do different actions, let's return to the "Catch the Ruler" game from the *Engage*. Individually, respond to the following questions:

1. How did your nervous system allow you to catch the ruler? Draw a flowchart of the nervous system pathway using words, images, and arrows.
 - Use the *Nervous System Definition Cards* to help you decide what to include in your flowchart.

2. **Cause and Effect:** Now that you know more about the nervous system, why do you think no one was able to catch the ruler quickly enough to have less than 7 cm left at the bottom?

6th Grade Science Unit 1: Setting Things in Motion

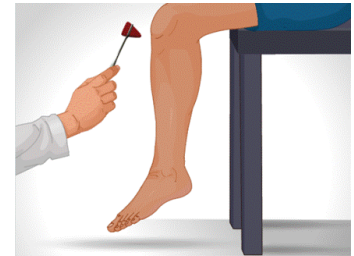
Task 2: Sense and Respond

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

Elaborate

To accomplish an action, like catching a ruler, your body senses an object and makes a decision to take action. What about when there isn't a conscious decision but an action happens anyway?

1. Try this out with an example you have likely experienced before. With a partner, follow the procedure below:
 - a. Have your partner sit on the table so their legs can swing freely.
 - b. With a reflex hammer or the side of your hand, firmly tap one leg just below the knee.
 - c. Record observations below:



2. **Cause and Effect:** How do you think this knee-jerk response was able to occur so quickly and without the person thinking about it?
 - a. What step/component do you think is missing from this pathway that was present in the “Catch the Ruler” pathway?
 - b. Draw a flowchart of the knee-jerk nervous system pathway using words, images, and arrows.
 - Use the *Nervous System Definition Cards* to help you decide what to include in your flowchart.

- c. *Think about it:* Why do you think our bodies have developed a reflex response to certain stimuli?

6th Grade Science Unit 1: Setting Things in Motion**Task 2: Sense and Respond**

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

Evaluate: Connecting to the Culminating Project

You have been asked to teach people how their bodies make the movement of objects possible in a specific activity. Your presentation and brochure will include showing how the body's nervous system allows it to move objects in your chosen activity.

- ✓ Describe the nervous system pathway involved in your chosen activity. You may draw a flowchart, like you did in this task, or describe the pathway in a numbered list or paragraph.

This should be individually in your Project Organizer.

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

Reflection

Individually reflect on Task 2, using the questions provided:

1. At the beginning of this task, you were asked to describe the process you thought your body was going through to catch a ruler. Look at the flowchart you drew in the *Explain* after learning more about the nervous system. How does your first description in the *Engage* differ from your later description in the *Explain*? What did you learn over the course of this task?

2. In this task, we focused on the crosscutting concept of:
 - **Cause and Effect:** Cause and effect relationships can be used to predict phenomena. Where do you see examples of **Cause and Effect** in this task?

6th Grade Science Unit 1: Setting Things in Motion**Task 2: Sense and Respond**

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3. Now that you have learned more about nervous system pathways, what questions do you still have?

6th Grade Science Unit 1: Setting Things in Motion

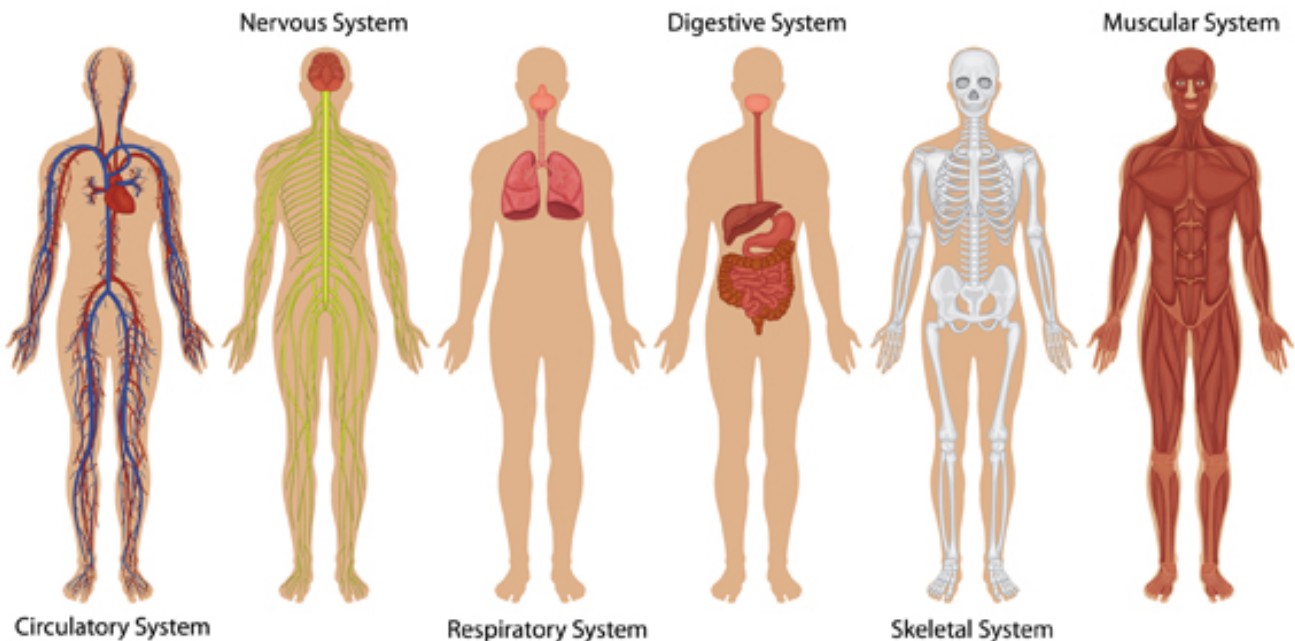
Task 3: Interacting Subsystems

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

Engage

In Task 2, you learned how the nervous system plays a key role in the body's ability to make objects move. But what other subsystems of the body are involved in various actions?

The picture below shows the main subsystems of the human body that we will be exploring in this task.



Your teacher will show pictures of different real-life activities. For each activity,

1. Discuss with your group which body systems you think are involved and record on a blank piece of paper.
2. Show your group's paper to the rest of the class at the same time as other groups.
3. Compare with other groups and discuss any differences as a class.

As a group, discuss:

1. Which body systems did the class think were involved in *most* of the activities?

2. Which body systems did the class think were involved in only a *few* of the activities?

6th Grade Science Unit 1: Setting Things in Motion

Task 3: Interacting Subsystems



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

Explore

Based on our prior knowledge, we have ideas about the subsystems of the body that are utilized in different activities, but how can we know? Let’s gather evidence of different body systems working together by conducting an experiment. With your group, follow the procedure below:

1. Assign roles within your group.
 - a. Exerciser/Heart Rate Monitor: _____
 - b. Respiratory Rate Monitor: _____
 - c. Timer: _____
 - d. Data Calculator/Recorder: _____

2. Measure the *Exerciser’s* heart rate and respiratory rate while they are sitting at rest.
 - a. *Exerciser:* To measure heart rate, press 2 fingers on your neck right underneath your chin to feel the number of heartbeats.
 - b. *Respiratory Rate Monitor:* To measure respiratory rate, observe the number of breaths as shown by the *Exerciser’s* chest rising.
 - c. *Timer:* Use a phone, watch, or timer to measure time (10 seconds for each round). Tell the *Exerciser* and *Respiratory Rate Monitor* when to start counting and when to stop counting.
 - d. *Recorder:* Record number of heartbeats and number of breaths. Then calculate heart rate (beats per minute) and respiratory rate (breaths per minute) by multiplying these numbers by 6. Record.

3. *Exerciser:* Do jumping jacks for 2 minutes (The *Timer* will tell you when to start and stop). *All Other Group Members:* Immediately after *Exerciser* finishes the jumping jacks, repeat the steps above to measure heart rate and respiratory rate after exercise.

4. Make sure all team members have recorded the data. Discuss and record any other observations your team noticed about the *Exerciser* before and after exercise.

	At Rest		After Exercise	
Heart Rate (Beats Per Minute)	_____ in 10 secs	x6 = _____ bpm	_____ in 10 secs	x6 = _____ bpm
Respiratory Rate (Breaths Per Minute)	_____ in 10 secs	x6 = _____ bpm	_____ in 10 secs	x6 = _____ bpm
Other Observations				

6th Grade Science Unit 1: Setting Things in Motion

Task 3: Interacting Subsystems



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

Explain

Engaging in Argument From Evidence: A student from another class is arguing that doing exercise requires only the respiratory system and circulatory system to work together. Individually, write an argument supporting or refuting this student’s claim. Use evidence from the experiment as well as the article provided by your teacher to support your argument.

<p>Claim:</p> <p>Do you agree or disagree with the student from the other class? Why?</p>	
<p>Evidence and Reasoning:</p> <p>What experimental data supports your claim?</p> <p>What other scientific information can you use to support your claim?</p>	

6th Grade Science Unit 1: Setting Things in Motion**Task 3: Interacting Subsystems**

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

Elaborate

Systems and System Models: In your argument, you wrote about the different body systems involved in doing exercise. With your group, make a poster model that shows all the subsystems at work during exercise and exactly how they interact to make exercise possible. Your poster should show a diagram or flowchart that includes:

- ✓ A labeled image of each subsystem that is used during exercise
- ✓ Key organs and tissues of each subsystem that is used during exercise (This will require research!)
- ✓ Arrows and captions between the subsystems to describe how they interact

You may use the space below to plan your poster:

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

Evaluate: Connecting to the Culminating Project

You have been asked to teach people how their bodies make the movement of objects possible in a specific activity. In this task, you learned that there are other subsystems of the body at work, besides just the nervous system.

- ✓ In a paragraph, flowchart, or diagram, explain how different subsystems of the body work together to do your chosen activity.

This should be individually in your Project Organizer.

6th Grade Science Unit 1: Setting Things in Motion

Task 3: Interacting Subsystems

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

Reflection

Individually reflect on Task 3, using the questions provided:

1. At the beginning of this task, you were asked to identify which body systems you thought were involved in different activities. Look back at your responses to the questions in the *Engage*. How has your understanding of the body systems involved in various activities changed over the course of this task?

2. In this task, we focused on the crosscutting concept of:
 - **Systems and System Models:** Systems may interact with other systems and may have sub-systems. Where do you see examples of **Systems and System Models** in this task?

3. Now that you have learned more about other subsystems of the body that are needed to do activities, what questions do you still have?

6th Grade Science Unit 1: Setting Things in Motion

Task 4: Got Cells?

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

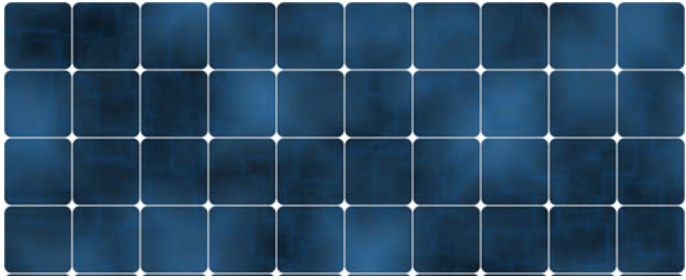
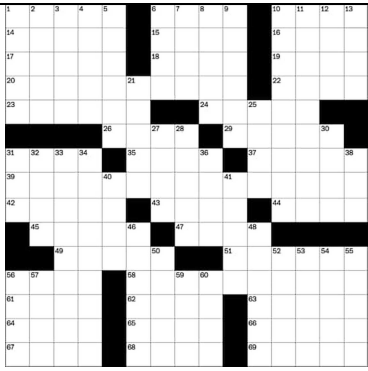
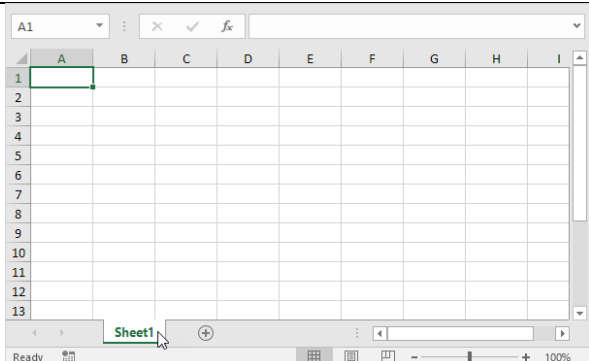

Engage

In the last two tasks, you explored all the different body systems that work together when we move objects. But where do our bodies actually make the energy that we transfer to these objects? In this task, we will begin to explore this question by first zooming in to look at these body systems up close.

Many of you have likely heard that we are made up of cells, but what is a cell?

1. First, individually record your own ideas to answer this question: What is a cell?

We often use the word, **cell**, to describe other everyday things, not just scientific things.

 <p style="text-align: center;">Solar Panel Cells</p>	 <p style="text-align: center;">Crossword Puzzle Cells</p>
 <p style="text-align: center;">Cells in an Excell Spreadsheet</p>	 <p style="text-align: center;">Open Cells in Foam Insulation</p>

2. Take a look at these non-scientific examples of cells above. With a partner,
 - a. Describe any similarities between the four non-scientific examples of cells.

6th Grade Science Unit 1: Setting Things in Motion

Task 4: Got Cells?



- b. Based on the similarities, write a group definition for **cell**.

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

Explore

Scale, Proportion, and Quantity: While the images above helped you figure out what a cell could look like, those objects were viewed at a macroscopic scale (with the naked eye). To see if objects are truly made up of cells in the scientific sense, we need to zoom in using a microscope. **Planning and Carrying Out Investigations:** With your group, visit the lab stations to analyze both macroscopic and microscopic images of various specimens and record your observations in the chart below:

Specimen	Macroscopic Observations: What does this specimen look like with the naked eye?	Microscopic Observations: What does this specimen look like under a microscope?	Do you think the specimen is made up of cells? Explain your reasoning.
Human Blood			
Human Skin			
Human Bone			

6th Grade Science Unit 1: Setting Things in Motion

Task 4: Got Cells?



Specimen	Observations: What does this specimen look like with the naked eye?	Observations: What does this specimen look like under a microscope?	Do you think the specimen is made up of cells? Explain your reasoning.
Cotton Thread			
Printed Paper			
Moss Leaf			
Cork Tree Bark			

6th Grade Science Unit 1: Setting Things in Motion

Task 4: Got Cells?

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

Explain

Scale, Proportion, and Quantity: All of the specimens you observed looked very different with the naked eye, but once you zoom in with the microscope, it tells a different story! With your group, compare and contrast the various specimens by filling out the chart below and discussing the conclusion question.

Grouping 1	Grouping 2
Which images were similar? List the specimens here:	Which images were different from the majority? List the specimens here:
Describe what these images have in common.	Describe how these images were different from the majority of other images.

Conclude: Look back at your two groupings above and use your own prior knowledge to draw conclusions.

- What do you know about the specimens in Grouping 1 vs. Grouping 2?

- Based on this knowledge and what you observed through the microscope, what types of specimens are made up of cells?

6th Grade Science Unit 1: Setting Things in Motion

Task 4: Got Cells?

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

Elaborate

Scale, Proportion, and Quantity: In the *Engage*, you saw non-scientific examples that use the word “cell” to describe objects able to be observed with the naked eye. Imagine you are researching beehives online and read the following statement: “Beehives are living things because I can see with my naked eye that they are made up of wax cells.” Now that you have investigated what types of things are made up of cells, critique this statement using the Critique, Correct, and Clarify technique below.



Prompt: Are beehives living things? How do you know?

In pairs:

1. Critique: Analyze the statement below. Identify the error(s), doing additional research if necessary. Share your ideas with a partner.

Beehives are living things because I can see with my naked eye that they are made up of wax cells.

2. Correct: Individually write an improved statement below.
3. Clarify: With a partner, discuss and describe how and why you corrected the statement.

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

Evaluate: Connecting to the Culminating Project

You have been asked to teach people how their bodies make the movement of objects possible in a specific activity. In the last task, you described the different subsystems of the body that are involved in your activity.

- ✓ Research and identify the types of cells that make up the body systems you identified.
- ✓ Why do you think these different types of cells look so different?
- ✓ Even though they appear different, why are they all called cells?

This should be individually in your Project Organizer.

6th Grade Science Unit 1: Setting Things in Motion**Task 4: Got Cells?**

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

Reflection

Individually reflect on Task 4, using the questions provided:

1. At the beginning of this task, you were looked at non-scientific examples of cells. What makes these examples of cells similar to the ones you saw in the rest of the task? What makes them different?

2. In this task, we focused on the crosscutting concept of:
 - **Scale, Proportion, and Quantity:** Phenomena that can be observed at one scale may not be observable at another scale.

Where do you see examples of **Scale, Proportion, and Quantity** in this task?

3. Now that you have learned more about the cells that make up all the subsystems of our body, what questions do you still have?

6th Grade Science Unit 1: Setting Things in Motion

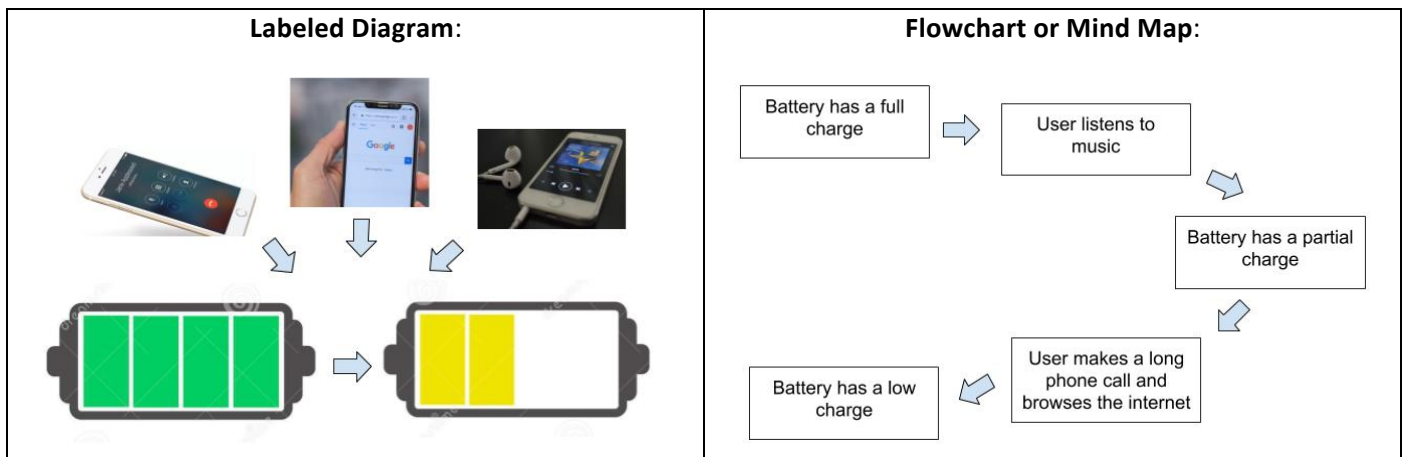
Task 5: Parts of a Whole

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

Engage

In Task 4, you zoomed in on various specimens to learn that all living things, like yourself, are made up of different types of cells! How do these cells allow us to do the things we like to do? How do they provide the energy our bodies need to move objects?

Because cells are so small, we will be using models to explore their parts and functions. But what exactly is a model? Let’s learn about models with a simple example: a smartphone battery draining in power during the day.



Analogy:

A draining smartphone battery is like a water jug that is slowly used throughout the day. Similar to the way a smartphone battery shows how much power is left, there are indicators on the jug to show how much water remains. Also, the power in a cell phone battery is used for different functions (internet, phone calls, music, etc.), just like the water in the jug is used for different functions (drinking, washing, etc.)

Discuss with a partner:

1. Based on the models shown, what do you think is the purpose of a model?

2. How are these three types of models different?

3. For this particular example, which type of model do you think is most helpful? Why?

6th Grade Science Unit 1: Setting Things in Motion

Task 5: Parts of a Whole

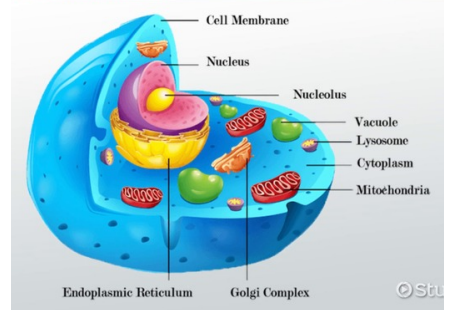


Unit Essential Question: *How do our bodies produce and use the energy needed to move objects?*

Explore

Using Models: To explore a cell’s function and parts, we will first use the type of model known as an analogy. Your group will receive a set of definition cards; each card defines a cell part or a substance that is used or created by a cell. In groups,

1. Cut out your *Cell Definition Cards*.
2. Read the analogy aloud.
3. Draw a picture of the factory, including all its parts.
4. Discuss which cell part or substance matches each part of the analogy.
5. Record your matches in the table below:



A Cell is like a _____

Cell Part or Substance		Part of the Analogy	Because...
The Mitochondria...	...is/are like...		
The Nucleus...			
The Cell Membrane...			
Sugar...			
Proteins...			

6th Grade Science Unit 1: Setting Things in Motion

Task 5: Parts of a Whole

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

Explain

Developing Models: While this analogy was helpful to show the functions of the entire cell and each of its parts, sometimes a visual model (like a diagram, mindmap, or flowchart) is better for showing the relationships between the different parts.

1. Individually, construct a visual model below to show how the different parts of a cell work together for the function of the whole cell. In your model, use and describe the key terms from the box below. Add any additional descriptions you need to make connections between all the different cell parts!

- Nucleus	- Sugar	- Energy
- Cell Membrane	- Proteins	- Instructions
- Mitochondria		

2. **Structure and Function:** At the bottom of your model, explain how each cell part contributes to the whole cell's function.

6th Grade Science Unit 1: Setting Things in Motion

Task 5: Parts of a Whole

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

Elaborate

Making models is challenging and new to many of us! We can use a method called *Stronger/Clearer* to further develop and improve the model you just made.

1. **Individual Think Time:** Take a minute to think about how you will explain your model to a first partner.
2. **Partner Discussions 1:** You will work in pairs with another student. One of you will be Student A and the other Student B. Student A will start first:
 - **Student A:** Without reading what you wrote down on your model, describe and support the thinking you used in your model.
 - **Student B:** Listen and ask clarifying questions. Ask questions to help Student A describe relationships in their model. For example, you might ask, “Why did you connect these two cell parts?” or “Do you think a connection is missing here?” or “Do you think you can add some more written description here?”
 - **Both Student A and Student B:** Write down any notes, thoughts, or questions that came up in this discussion.

Now switch roles and repeat the steps above.

3. **Partner Discussion 2:** Repeat the partnering process with another student. Remember to try to strengthen and clarify your model. Write down new notes, insights, and questions.

6th Grade Science Unit 1: Setting Things in Motion

Task 5: Parts of a Whole

4. **Partner Discussion 3:** Repeat the partnering process with another student. Remember to try to strengthen and clarify your model. Write down new notes, insights, and questions.

5. **Final Explanation:** After you have worked with partners to clarify your thinking, review your notes. Revise your model in the *Explain*.

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

Evaluate: Connecting to the Culminating Project

You have been asked to teach people how their bodies make the movement of objects possible in a specific activity. We know from Task 1 that your activity requires energy to move an object.

- ✓ Now that you have learned about cells and their parts, describe where this energy comes from.
- ✓ Pick one body system involved in your activity and do research to fill out the flowchart below. This will show how energy from your body is able to move your object!

This should be individually in your Project Organizer.

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

Reflection

Individually reflect on Task 5, using the questions provided:

1. At the beginning of this task, you examined different types of models you might use in science. Based on what you learned in this task, when do you think each type of model should be used (diagram vs. flowchart vs. analogy)?

6th Grade Science Unit 1: Setting Things in Motion

Task 5: Parts of a Whole

2. In this task, we focused on the crosscutting concept of:
- **Structure and Function:** Relationships between parts can be analyzed to determine how systems function.

Where do you see examples of **Structure and Function** in this task?

3. Now that you have learned more about how cells function, what questions do you still have?