**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?
   1. 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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**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.

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

**Track:** Half of a length of pipe insulation

**Risers**: Books or other items that are flat and can be stacked

**Target:** One stack of 20 pennies

**Ball/Marble**

* 1. Stack 3-4 textbooks on top of each other.
  2. 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.
  3. Set 1 stack of 20 pennies on the table at the end of the pipe insulation.
  4. Release a marble or other ball from the top of the pipe insulation. Record the number of pennies knocked over.
  5. Release a marble or other ball from the middle of the pipe insulation. Record the number of pennies knocked over.

1. 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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**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.  Macintosh HD:Users:laurenstoll:Downloads:s8m2l1image8.jpgThis 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. |

1. **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?** |  |

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**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.

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**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.

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**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?

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