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GREAT MINDS® SCIENCE

GRADE 4

MODULE 2

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Grade 4 Module 2

Energy

Draft

Science Logbook

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Name: _____ Date: _____

Lesson 1 Activity Guide

Notice and Wonder

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Use the table below to record what you notice and wonder.

I Notice ...	I Wonder ...

Reflection

Use the space below to copy and respond to the question shared by your teacher.

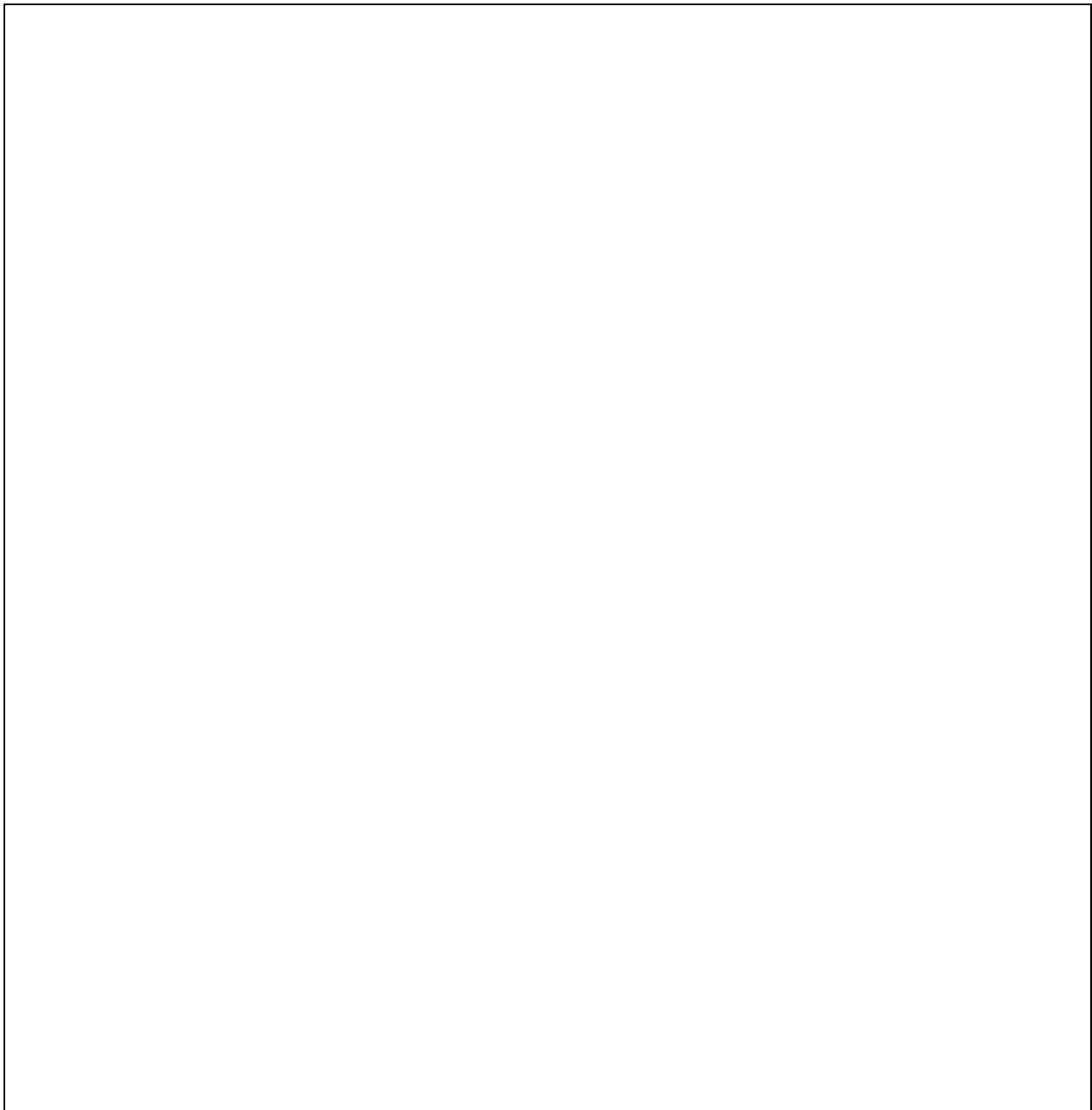
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Lesson 2 Activity Guide

Windmill Models

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Draw a model that represents your group's windmill. Include how the windmill use the wind to make something happen.



Compare your model with a partner from another group. Record similarities and differences between your models in the space below.

Similarities	Differences

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Lesson 3 Activity Guide

What Is Energy?

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Record your response to your teacher's question.

Record questions that you have about energy.

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Lesson 4 Activity Guide

Energy Stations

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Record observations to answer this question: What in the stations indicates (or shows) the presence of energy?

Station	Energy Observations
	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>

Station	Energy Observations
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Station	Energy Observations
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Lesson 6 Activity Guide

Investigate Moving Objects

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Phenomenon Question:

Make a prediction about the relationship between speed and energy.

My prediction:

Record the investigation plan and your observations.

Investigation Plan

Object 1 _____	Object 2 _____	Object 3 _____
Observations	Observations	Observations

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Lesson 7 Activity Guide

Investigate Speed and Energy

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Investigation Question:

Investigation Plan

Brainstorm an investigation plan that will provide evidence to answer the investigation question in the space below. Be sure to discuss why your plan is fair and reliable.

Data Table

Release Point on Ruler Ramp (centimeters from bottom)	Distance Ball Bearing Travels (meters)	Time for Ball Bearing to Roll (seconds)			
		Trial 1	Trial 2	Trial 3	Typical Time

Reflection Questions

What patterns do you notice in your data?

Which trials did not follow the pattern(s), if any? What could have caused differences in data?

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Final Reflection

Revisit your prediction from Lesson 6. How did today's experiment support or challenge your thinking?

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Lesson 8 Activity Guide

Investigate Collisions

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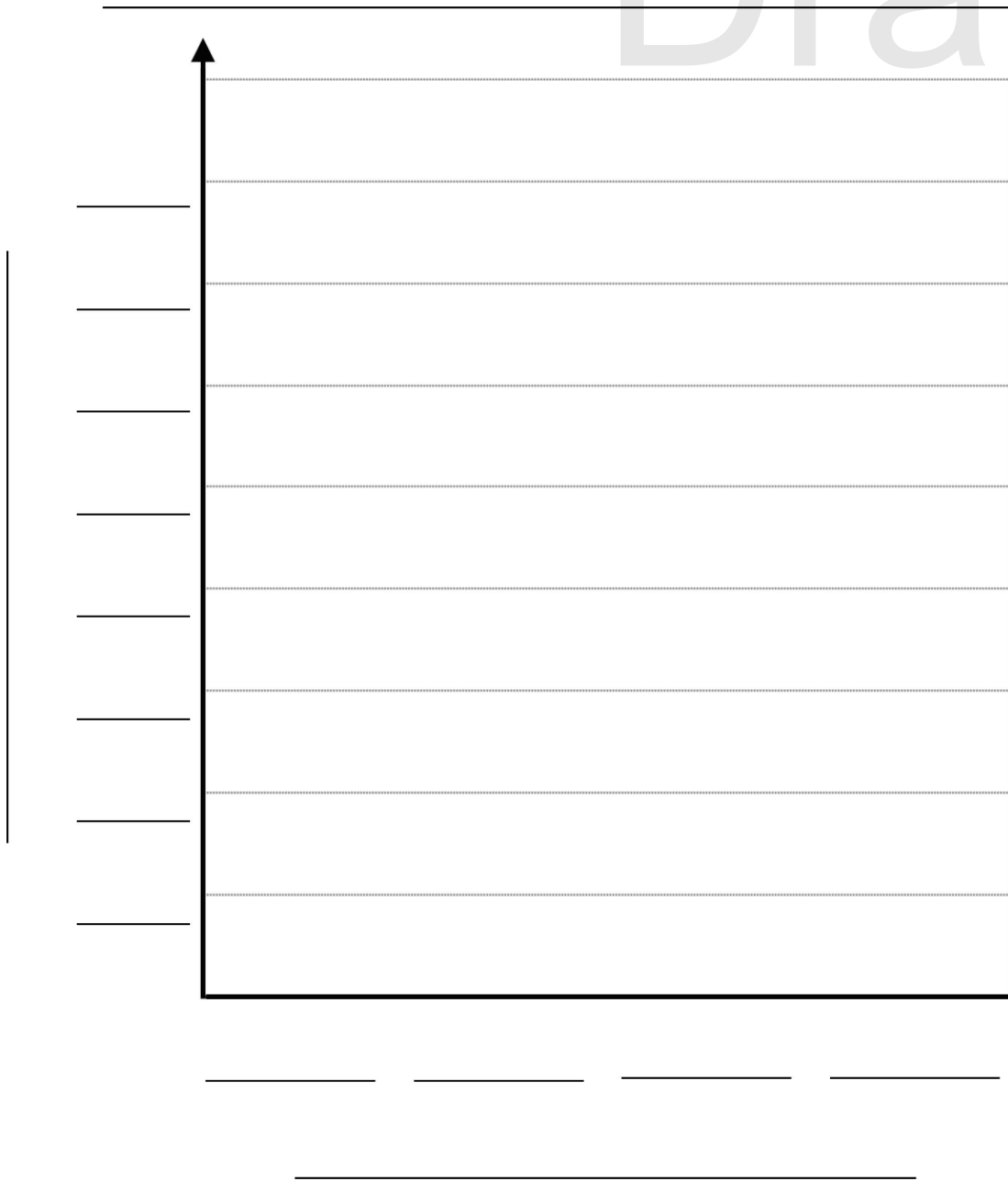
Investigation Question:

Data Table

Release Point on Ruler Ramp (centimeters from bottom)	_____ Ball Bearing Catch Travels (_____)			
	_____	_____	_____	_____

Analyze Data

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Lesson 9 Activity Guide A

Model Collisions

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The Phenomenon Question that we are trying to answer is _____

Which speed will your class mode?

Develop a model for each stage of the collision with your partner.

Before the Collision

During the Collision

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After the Collision

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Lesson 9 Activity Guide B

Conceptual Checkpoint

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Draw a model and explain a collision from a previous investigation in the space below.

What happened to energy during this collision?

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Lesson 10 Activity Guide

Energy Transformation Observations

As you visit each Energy Transformation Station, record observations about energy transformations. After you complete both stations for an indicator (light, sound, or heat) draw a model of one station to show how you think the energy transforms at the station. Be sure to identify where you observe energy.

Station 1a: Solar Cell	Station 1b: Radiometer
Observations	Observations
Transformation Model	

Station 2a: Balloon	Station 2b: Sound Cups
Observations	Observations
Transformation Model	

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Station 3a: Ice Melt	Station 3b: Air Temperature
Observations	Observations
Transformation Model	

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Constructing an Explanation

How did energy transform at the stations?

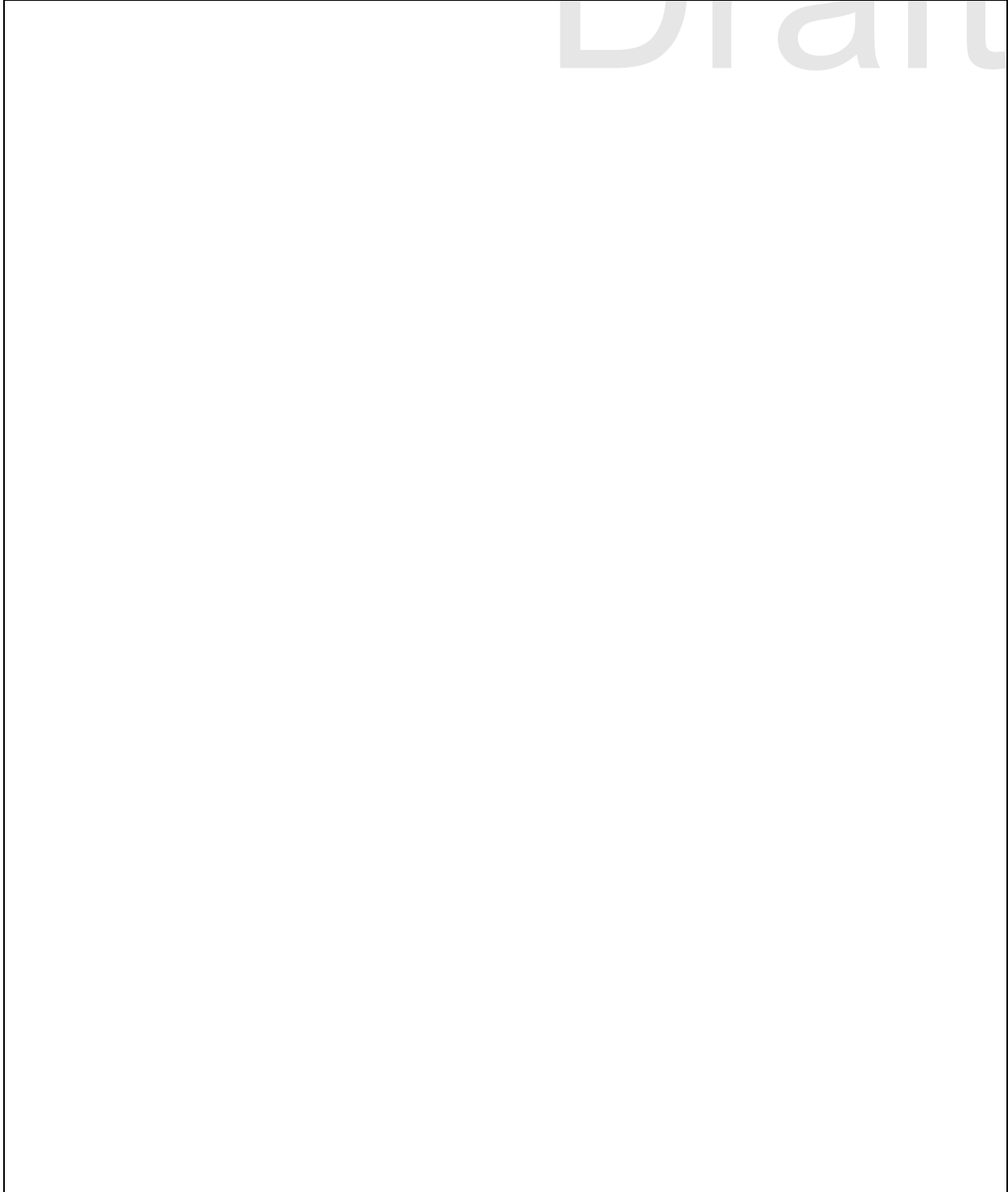
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What pattern(s) did you notice in those energy transformations?

How could our new knowledge of energy transformations help explain how the windmill turned wind into light?

Summary

In the space below, draw a model of Station 1a (the Solar Cell Station) that summarizes your knowledge of energy transfer and transformation.



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Lesson 12 Activity Guide

Building a Generator: Instructions

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Overview

To build your own generator, you will first need to create a tube frame to hold everything together. Then, you will glue magnets to a shaft so they can spin inside the frame. Finally, you will wrap the tube with wire and connect the generator to a light (an LED).

Instructions

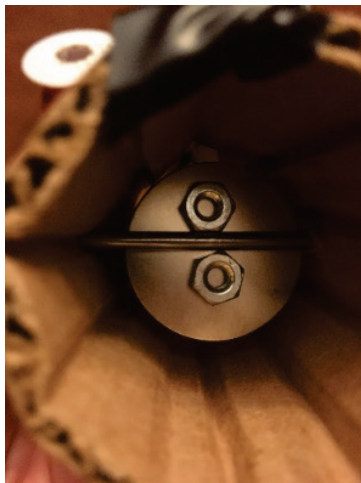
Step 1: (If your class is using toilet paper rolls, skip to Step 2.) Roll the cardboard into a tube shape (shown in the middle), then tape the edges of the tube together (shown on the right). Test the size of the tube by making sure the opening is wider than the diameter of one of the magnets.



Step 2: Carefully push a nail through the middle of the tube. Your teacher can help you with this. Make sure the nail goes all the way through the tube.

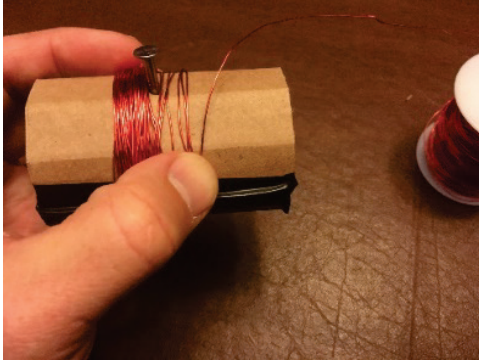


Step 3: Use a low-temperature glue gun to attach the flat side of one set of magnets to the nail. Your teacher can help you with this. Next, place a nut on each side of the nail (shown on the left). Glue the second set of magnets on the other side of the nail so that the nuts are between the two sets of magnets (shown on the right).



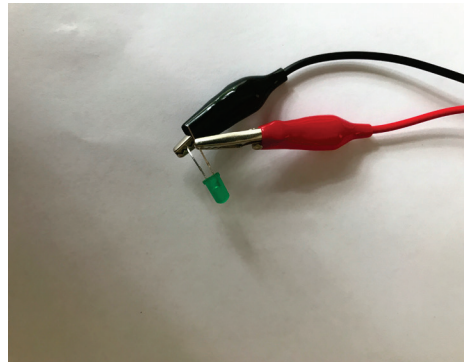
Step 4: Starting at the nail, measure 2 cm toward one end of the tube and make a dark mark with a pencil or pen. Repeat this step on the other side of the tube.

Step 5: Leaving about 10 cm of wire free at the end, wrap the copper wire around the center portion of the tube 200 times. As you wrap the wire, stay between the two marks made in Step 4. Leave another 10 cm of wire free at the other end, then use wire cutters to cut the wire. Your teacher can help you with this.



Step 6: Use sandpaper to remove 1 to 2 cm of the enamel (coating) from both ends of the wire. Be sure to remove the enamel completely or your generator may not work.

Step 7: Attach one end of an alligator clip to one of the wires on the LED. Attach the other end of the clip to one of the wires on your generator. Repeat this step for the remaining alligator clip and wires.



Step 8: Pinch the head of the nail and give it a quick spin. If your generator is set up correctly, the LED will glow. Experiment by spinning the nail at different speeds and observing what happens.

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Lesson 13 Activity Guide

Building a Generator: Group Roles

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Directions

Before building your generator, you will be given one or more roles by your teacher. The table below shows the tasks assigned to each role and the step where the task is needed. Use the step-by-step instructions in **Building a Generator: Instructions** to perform these tasks.

Group Roles

Role	Task
Tube Maker	Create the tube and resize it if necessary (Step 1).
Nail Keeper	Insert the nail properly and safely through the tube (Step 2). Spin the nail when the generator is ready to be tested (Step 8).
Magnet Keeper	Make sure the two magnet sets remain separated. Glue magnet sets on either side of the nail (Step 3).
Marker	Measure and mark the tube in the correct locations (Step 4).
Spool Holder	Hold the wire spool loosely so it can spin as wire is wrapped around the tube (Step 5).
Wire Wrapper	Wrap copper wire around the tube. Cut the wire (Step 5).
Sander	Remove the enamel from the ends of the wire with sandpaper (Step 6).
Connector	Connect the generator to the LED with alligator clips (Step 7).

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Lesson 14 Activity Guide

Generator Observations

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What happens when you try to make the LED light up? Record your observations.

What did you do to cause the LED to light up?

What caused the LED to produce different amounts of light? Did you observe a pattern? If so, what was it?

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What energy transfers and transformations did you observe in your generator investigation?

Energy Transfers	Energy Transformations

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Lesson 15 Activity Guide

Revised Model

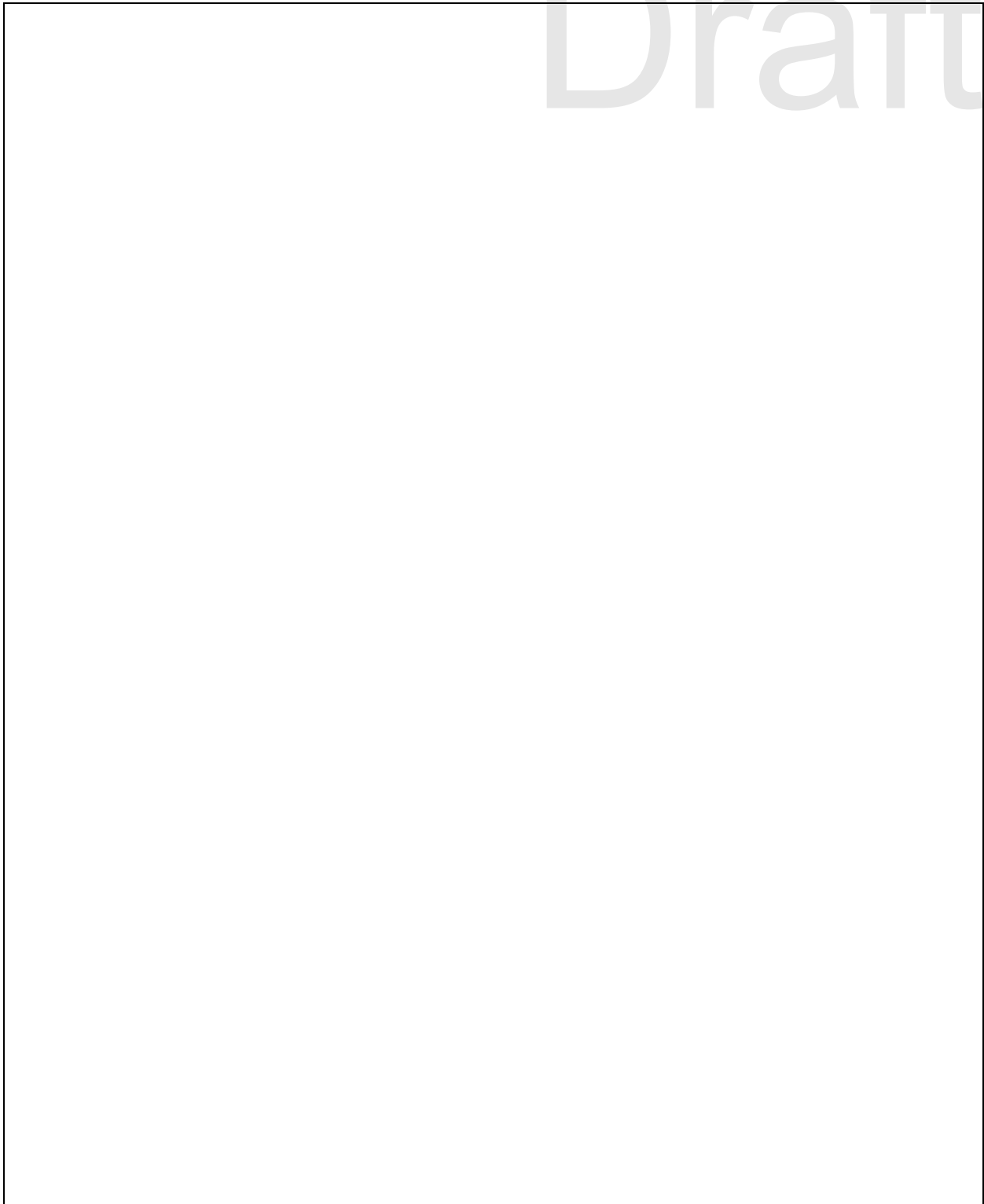
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Key Concepts Checklist

Record key concepts below as your class discusses.

Revised Windmill Model

Draw a new model to explain how the windmill changes wind into light.

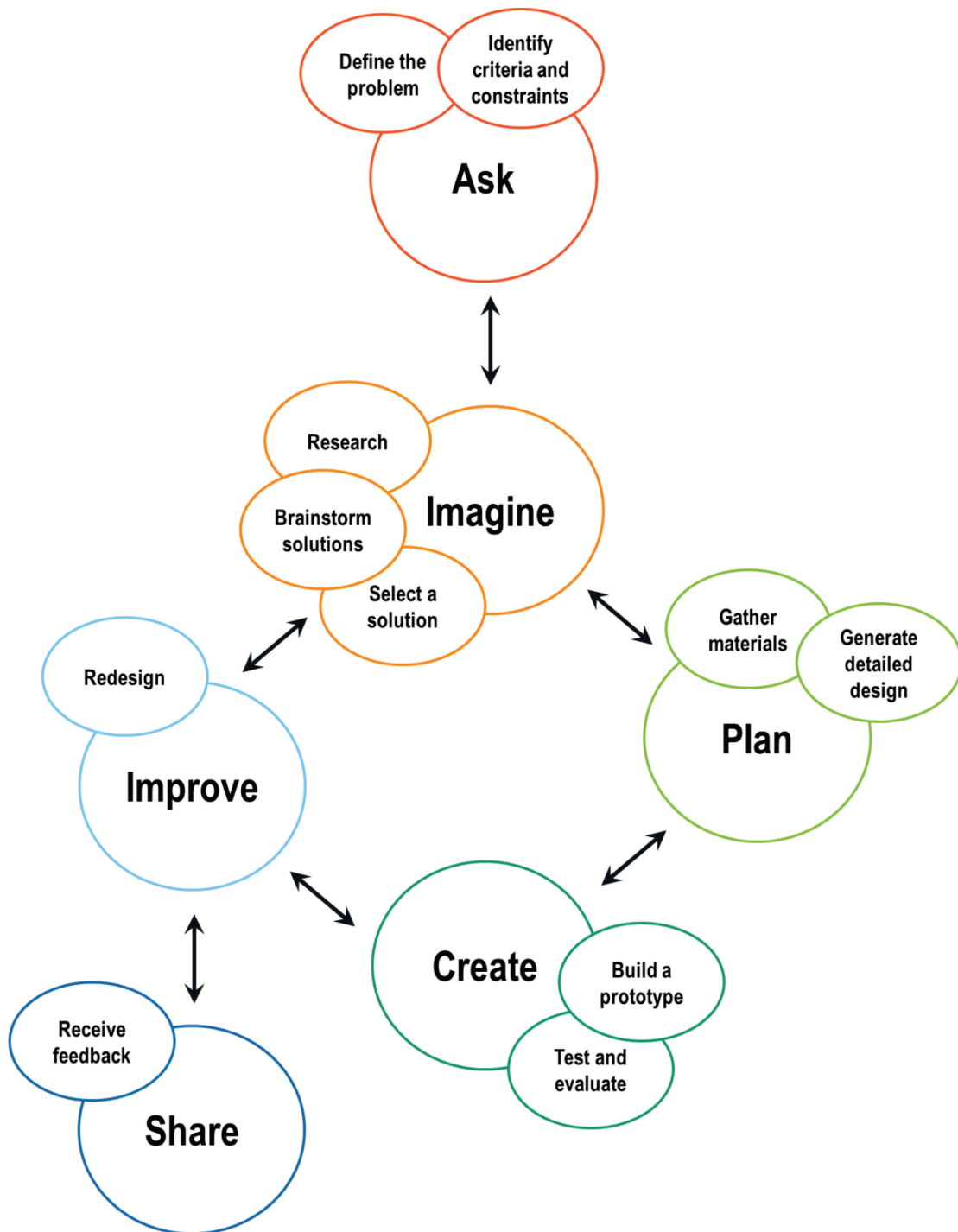


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Lesson 17 Activity Guide A

Engineering Design Process

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Lesson 17 Activity Guide B

Engineering Challenge

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Ask: Define the problem. Identify the criteria and constraints.

Problem: _____

Criteria	Constraints

Imagine: Research. Brainstorm solutions. Select a solution.

Brainstorm and record ideas with your group about how to build your device.

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Plan: Gather materials. Generate detailed design.

Work with your group to answer the following questions about the materials you will need.

What materials will you need to transform energy to produce light?

What materials will you need to transfer energy to the desired place?

What other materials will you need?

Create a diagram of your design. In the diagram, label all materials that you will need to build your windmill.



Create: Build a prototype. Test and evaluate.

Work with your group to build an initial version of your device (version 1). Test how it works and record your evaluation below.

What works well in the device?

What needs improvement?

Improve: Redesign.

Work with your group to plan improvements for another version of your device (version 2).

What will you change about your device? How do you predict those changes will affect the device's performance?

Build and test the next version of your device. As needed, keep planning improvements and testing updated versions. Draw more rows in the table to record notes for each version.

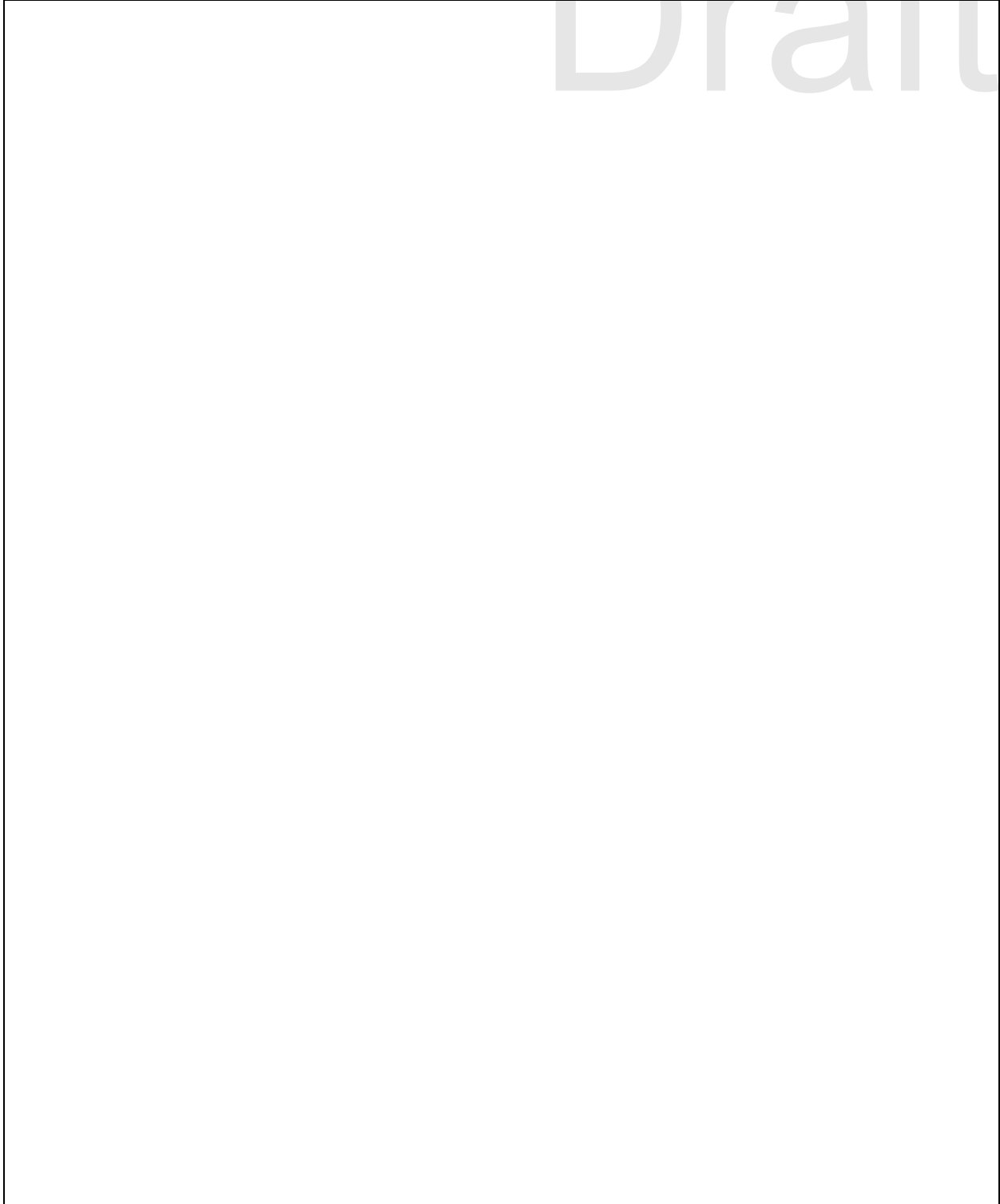
Version	What works well?	What needs improvement?	What will you change for the next version?
Version 2			

Version	What works well?	What needs improvement?	What will you change for the next version?

Share: Receive feedback.

How can you share what you created and learned? Work with your group to plan your presentation. Include details from your Activity Guide, including your final diagram and your device.

Final Diagram: Create a final diagram of your design to share during your presentation. In the diagram, label where the energy transfer and energy transformations happen in your device.



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Lesson 22 Activity Guide

Engineering Challenge Rubric

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Your presentation should answer the following questions:	3 (Meets Expectations)	2 (Partially Meets Expectations)	1 (Does Not Yet Meet Expectations)
What energy did you harness to power your device? How do you know?	Accurately states the energy harnessed and explains reasoning	Accurately states the energy harnessed	Does not accurately describe the energy harnessed
What materials did you use to harness energy? Why did you choose those materials?	Accurately states materials used to harness energy and explains their decision with scientific reasoning	States materials used to harness energy	Does not state materials used to harness energy
Where did energy transformation occur? How do you know? (Label energy transformations in your model and explain in your presentation.)	Accurately states and labels locations of energy transformation and explains reasoning	Accurately states and labels locations of energy transformation	Does not accurately state or label locations of energy transformation
Where did energy transfer occur? How do you know? (Label energy transfers in your model and explain in your presentation.)	Accurately states and labels locations of energy transfer and explains reasoning	Accurately states and labels locations of energy transfer	Does not accurately state or label locations of energy transfer

Your presentation should answer the following questions:	3 (Meets Expectations)	2 (Partially Meets Expectations)	1 (Does Not Yet Meet Expectations)
What changes did you make to your device after testing? Why did you make those changes?	States changes and explains with scientific reasoning and evidence from test results	States changes, with an incomplete explanation or no explanation	Does not state changes
Presentation note: Make sure all group members play a role in the presentation.	All group members contribute equally to the presentation	Most group members participate in the presentation	Few group members participate in the presentation

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Lesson 24 Activity Guide A

Key Terms about Energy

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Cut out the key terms about energy.

Collide	Energy	Energy transfer
Energy transformation	Generator	Indicators of energy
Speed	System	

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Map

Create a relationship map in the space below. Arrange the terms, draw arrows (or other symbols), and write words to show the relationship between the terms. Glue the terms to the paper once you have finalized your map.

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Lesson 24 Activity Guide C

Collaborative Conversation Strategies

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Choose one or two strategies with sample sentence frames that you want to use in the Socratic Seminar. Circle them or cut them out.

<p>Make a connection between ideas.</p> <p><i>That idea relates to _____.</i></p>	<p>Explain your thinking.</p> <p><i>I think that because _____.</i></p>
<p>Add to what someone else says.</p> <p><i>I agree with _____, and I'd like to add _____.</i></p> <p><i>I like that idea because _____.</i></p>	<p>Offer an example to support your own or someone else's idea.</p> <p><i>An example of that would be _____.</i></p>

<p>Give a different viewpoint.</p> <p><i>I politely disagree with _____ because _____.</i></p> <p><i>That's a good point, but I think _____.</i></p>	<p>Ask a question to clarify someone else's idea.</p> <p><i>I have a question about _____.</i></p> <p><i>In other words, are you saying _____?</i></p>
<p>Refocus the conversation on the question or purpose.</p> <p><i>I'd like to go back to what _____ was saying about _____.</i></p> <p><i>Let's go back to the question (or idea) that _____.</i></p>	<p>Elaborate on an idea to explain why it is important.</p> <p><i>That idea is important because _____.</i></p>
<p>Encourage someone to tell more about their ideas.</p> <p><i>It is an interesting idea that _____. Can you say more about that?</i></p>	<p>Summarize the conversation.</p> <p><i>So, the big idea seems to be _____.</i></p> <p><i>So, what can we conclude from _____?</i></p>

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Lesson 26 Activity Guide

Module Performance Expectations

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4-PS3 Energy

- 4-PS3-1 Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- 4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electrical currents.
- 4-PS3-3 Ask questions and predict outcomes about the changes in energy that occur when objects collide.
- 4-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

3–5-ETS1 Engineering Design

- 3–5 -ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

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