

Energy Transfer

Lesson 1b: Energy Detectives

Grade 4	Length of lesson: 50 minutes	Placement of lesson in unit: 1b of 6 two-part lessons on energy transfer
Unit central question: How does the energy of an object move and change?		Lesson focus question: How do we know whether something has energy?
Main learning goal: Seeing objects move, hearing a sound, feeling heat, and seeing light are all ways of detecting energy.		
Science content storyline: Energy is all around us, and we can detect it using our senses. We can see objects moving, feel heat, hear sound, and see light. All of this is evidence that energy is present.		
Ideal student response to the focus question: You can know whether something has energy by seeing motion, feeling heat, hearing sound, or seeing light.		

Preparation

<p>Materials Needed</p> <ul style="list-style-type: none"> • Science notebooks • Chart paper and markers • <i>For each group of 3 students:</i> <ul style="list-style-type: none"> • 1 plastic bag containing the following objects: <ul style="list-style-type: none"> • 1 windup toy that moves • 1 flashlight with good batteries • 1 noisemaker (not one that students put in their mouths) • 1 rubber ball (All balls should be identical.) • Access to an electrical device that has been running in the class (e.g., a computer, a monitor, or a projector). Students need to be able to feel heat coming from the device. 	<p>Ahead of Time</p> <ul style="list-style-type: none"> • Review the Energy and Energy Transfer Content Background Document: sections 1–3. • Assemble a bag of objects for each group of 3 students (see list in Materials Needed). The bags should <i>not</i> contain rubber balls.
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Lesson 1b General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
5 min	Link to previous lesson: The teacher announces that students will become energy detectives and use their senses to find more evidence of energy in this lesson.	<ul style="list-style-type: none"> • Energy is all around us, and we can detect its presence.
5 min	Lesson focus question: The teacher reviews the focus question from the previous lesson: <i>How do we know whether something has energy?</i>	
5 min	Setup for activity: The teacher introduces the activity and shows students the objects they'll examine for evidence of energy. Then the teacher explains that students will record their evidence on the data tables from last time.	
10 min	Activity: Students examine and manipulate several small objects as they look for evidence that these objects have energy. Then students record their observations and evidence on their data tables.	<ul style="list-style-type: none"> • Objects exhibit energy in a variety of ways. When objects move or produce sound, heat, and/or light, they demonstrate that they have energy.
10 min	Follow-up to activity: Students share their evidence of energy from the activity and use it to support their ideas about energy in objects.	<ul style="list-style-type: none"> • We can detect energy in an object by using our senses. We can see movement, feel heat being released, hear sound, and see light.
10 min	Synthesize/summarize today's lesson: Students answer the focus question using what they've learned so far.	<ul style="list-style-type: none"> • Energy is all around us, and we can detect it using our senses. We can see objects moving, feel heat, hear sound, and see light. This is evidence that energy is present.
5 min	Link to next lesson: The teacher engages students in an activity using rubber balls to demonstrate the idea of giving energy to an object. Then the teacher announces that next time, students will explore how the amount of energy in an object can change.	

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5 min	<p>Link to Previous Lesson</p> <p>Synopsis: The teacher announces that students will become energy detectives and use their senses to find more evidence of energy in this lesson.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Energy is all around us, and we can detect its presence. 	Link science ideas with other science ideas.	<p>Show slides 1 and 2.</p> <p>Today, each of you will become an energy detective.</p> <p>ELL support: You may want to write the lesson title Energy Detectives on the board for ELL students to refer to throughout the lesson.</p> <p>What is a detective? What does a detective do?</p> <p>Did you act like detectives in our last lesson? What were you trying to detect?</p> <p>Were you successful? How do you know you detected energy?</p> <p>Yes, you used your senses to find clues or evidence of energy. What did you do with your evidence?</p> <p>Today, you'll become energy detectives and look for evidence that energy is</p>	<p>A detective solves mysteries.</p> <p>A detective looks for clues.</p> <p>We were trying to detect energy, first in ourselves and then in a match.</p> <p>We found evidence of energy using our senses.</p> <p>We recorded it on our data tables from last time.</p>	

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			present in different objects.		
5 min	<p>Lesson Focus Question</p> <p>Synopsis: The teacher reviews the focus question from the previous lesson: <i>How do we know whether something has energy?</i></p>	Set the purpose with a <u>focus question</u> or goal statement.	<p>Show slide 3.</p> <p>In this lesson, we'll keep thinking about the same focus question from last time: <i>How do we know whether something has energy?</i></p> <p>What initial ideas did you come up with for answering this question?</p>	<p>We know something has energy if it's moving.</p> <p>We can tell there's energy if we see light, hear sound, or feel heat.</p>	
5 min	<p>Setup for Activity</p> <p>Synopsis: The teacher introduces the activity and shows students the objects they'll examine for evidence of energy. Then the teacher explains that students will record their evidence on the data tables from last time.</p>	Make explicit links between science ideas and activities before the activity.	<p>For today's investigation, you'll work in groups of three to examine some different objects and look for clues or evidence that they have energy. Like last time, you'll use your senses to figure out whether these objects have energy.</p> <p>As you examine each object, you may have to do something to it to find out whether it has energy. Remember that you're energy detectives trying to detect energy.</p> <p>Show slide 4.</p> <p>NOTE TO TEACHER: <i>Show students the objects in one of the bags.</i></p>		

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			<p>Do you think any of these objects have energy? How could you find out?</p> <p>Show slide 5.</p> <p>In a moment, we'll begin our investigation. As you examine each of the objects in the bag, talk with your group about how whether the object has energy.</p> <ul style="list-style-type: none"> • What do you observe? • Which sense(s) are you using to detect energy? • What evidence can you find that shows the object has energy? <p>Then record on your data tables from last time any evidence of energy you find. Make sure to include what you observed and anything you did to each object to detect energy.</p>		
10 min	<p>Activity</p> <p>Synopsis: Students examine and manipulate several small objects as they look for evidence that these objects have energy. Then students record their observations and evidence on their data tables.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Objects exhibit energy 	<p>Make explicit links between science ideas and activities during the activity.</p>	<p>NOTE TO TEACHER: <i>Continue displaying slide 5 so that students can refer to it throughout the activity.</i></p> <p>Your goal for today's activity is to gather more evidence to help you answer the focus question at the end the lesson. Think like energy detectives!</p> <p>NOTE TO TEACHER: <i>Divide the class into groups of three students. Then distribute a bag of objects to each group.</i></p>		

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	<p>in a variety of ways. When objects move or produce sound, heat, and/or light, they demonstrate that they have energy.</p>	<p>Ask questions to probe student ideas and predictions.</p>	<p>Take the objects out of your bag and begin examining them. Make sure everyone in your group has an opportunity to look at and handle each object. Remember to use your senses as you search for clues that the object has energy. Talk about your observations and any evidence of energy you detect. Then record your observations and evidence on your own data tables.</p> <p>ELL support: To make sure that ELL students understand what they should do, you may want to provide instructions for this activity before asking them to do it.</p> <p>NOTE TO TEACHER: <i>Allow adequate time for students to investigate each object and record their observations and evidence on their data tables. Move from group to group during this investigation and ask probe questions (see column 6).</i></p> <p><i>If students say they think an object has energy, probe their ideas to find out how they know. Note whether students think that an object has energy only if it's moving. If they don't think the object has energy, challenge their ideas by demonstrating that it does have energy (e.g., wind up the toy, turn on the flashlight, cause the noisemaker to make noise). Then ask, "Can you detect energy now?"</i></p>		<p><i>Probe questions:</i></p> <ul style="list-style-type: none"> • How do you know the object has energy? • How do you know? • What is your evidence?

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			<p><i>Students may say the flashlight battery has energy. If they do, probe to find out how they think the battery has energy. This is a good connection if students bring up stored energy in the match.</i></p> <p><i>While students are investigating their objects, invite them to take turns observing and touching an electrical device in the room. They should be able to feel heat coming from the device. Have students add this device as well as any observations and evidence to their data tables.</i></p> <p>NOTE TO TEACHER: <i>A few minutes before the end of the activity, inform groups that they need to wrap up their observations and finish recording their evidence on their data tables.</i></p>		
10 min	<p>Follow-Up to Activity</p> <p>Synopsis: Students share their evidence of energy from the activity and use it to support their ideas about energy in objects.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • We can detect energy in an object by using our senses. We can see movement, feel heat 	Engage students in analyzing and interpreting data and observations.	<p>Whole-class discussion: Before we began our investigation, I asked if you thought any of the objects in this bag might have energy. What did you say?</p> <p>Show slide 6.</p> <p>During our investigation, you acted like energy detectives and carefully examined each of the objects in a bag. What did you discover?</p> <p>What do you think now? Do these objects</p>		

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	being released, hear sound, and see light.	<p>Ask questions to probe student ideas and predictions.</p> <p>Engage students in communicating in scientific ways.</p>	<p>have energy? What is your evidence?</p> <p>Use the sentence starter on the slide when you share your answers.</p> <p>NOTE TO TEACHER: <i>Call on several students and probe their ideas to find out why they think the objects have or don't have energy (see questions in column 6). As students share their ideas and offer evidence, ask them to demonstrate with each object what they saw, felt, or heard as they used their senses to detect energy. Ask others whether they agree or disagree with the ideas and evidence and probe their thinking to find out why. If possible during this discussion, display a sample student data table using a document reader so that students can compare their evidence and revise their own data tables if warranted. Alternatively, you could record student ideas on a model data table for them to refer to during the discussion.</i></p>		<p><i>Probe questions:</i></p> <ul style="list-style-type: none"> • How do you know? • Can you show us what you observed and describe it to us? • Does anyone agree or disagree? Do you have anything to add on?
10 min	<p>Synthesize/Summarize Today's Lesson</p> <p>Synopsis: Students answer the focus question using what they've learned so far.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Energy is all around us, 	<p>Highlight key science ideas and focus question throughout.</p> <p>Engage students in making connections by</p>	<p>Show slide 7.</p> <p>Today we continued exploring the focus question, <i>How do we know whether something has energy?</i></p> <p>At the end of our last lesson, you completed the sentence, <i>I know that something has energy because it _____.</i></p>		

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	<p>and we can detect it using our senses. We can see objects moving, feel heat, hear sound, and see light. This is evidence that energy is present.</p>	<p>synthesizing and summarizing key science ideas.</p>	<p>Find that sentence in your science notebooks and read your answer. Then review the evidence you recorded on your data tables for today’s activity and revise or rewrite your sentences based on this new information.</p> <p>Individual work time.</p> <p>Now we’re going to add a new sentence starter to the one we just revised:</p> <p><i>I used my sense of _____ to gather my evidence.</i></p> <p>Write this sentence starter in your notebooks and then complete the sentence. Make sure to think about all of the evidence you gathered and the senses you used to detect energy in each object.</p> <p>ELL support: Give ELL students (or the entire class) a few minutes to discuss this task with shared-language partners in a Think-Pair-Share before writing an answer in their notebooks. To provide a model for ELL students to refer to, you could write the sentence starter on the board, ask a few students to share their responses, and then complete the sentence on the board using their answers.</p> <p>NOTE TO TEACHER: <i>After students have completed the new sentence in their</i></p>		

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		<p>Ask questions to probe student ideas and predictions.</p> <p>Engage students in communicating in scientific ways.</p> <p>Highlight key science ideas and focus question throughout.</p>	<p><i>notebooks, call on several students to share both of their sentences with the class. As each student shares her or his evidence and the senses they used to gather it, probe their ideas to connect their evidence to what they did during the activity to show that an object had energy. For example, if a student says, “I know that something has energy because it gives off heat,” ask what he or she observed in the activity that demonstrated heat. Also ask which sense the student used to detect heat energy in an object.</i></p> <p>Whole-class share-out: Let’s have a few of you share your sentences. How do you know that something has energy and what senses did you use to gather your evidence?</p> <p>Listen carefully as your classmates share their sentences and be ready to agree, disagree, add on, or ask questions. Remember to talk like scientists!</p> <p>Show slide 8.</p> <p>Now I’d like you to write an important science idea in your science notebooks underneath the focus question: <i>Moving objects and objects that produce sound, heat, and/or light have energy.</i></p> <p>NOTE TO TEACHER: <i>Write this key</i></p>		

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			<p>group member to present your ideas to the class.</p> <p>ELL support: Make sure ELL students understand the meaning of the word <i>give</i> in the phrase “Give the ball energy.”</p> <p>NOTE TO TEACHER: <i>Have one representative from each small group come to the front of the room one at a time. Hand each student a rubber ball and ask the student to demonstrate how to give the ball energy or make it have energy.</i></p> <p>Class demonstrations: OK, let’s have one group representative come to the front of the room one at a time and demonstrate giving your ball energy without throwing it or breaking something!</p> <p>NOTE TO TEACHER: <i>During the demonstrations, you may want to record on chart paper student ideas for giving the ball energy.</i></p> <p>Show slide 10.</p> <p>NOTE TO TEACHER: <i>Ask different members of each group to describe how they know the ball was given energy.</i></p> <p>You’ve just demonstrated how to give a</p>		

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		<p>Ask questions to probe student ideas and predictions.</p> <p>Ask questions to challenge student thinking.</p>	<p>rubber ball energy. But how do you know the ball has energy?</p> <p>NOTE TO TEACHER: <i>Once group representatives have demonstrated their ideas, ask the following questions. The purpose of these questions is to link ideas to the next lesson, so expect a variety of answers. Accept all answers without saying they're right or wrong. Ask probe and challenge questions to find out more about students' ideas and challenge their thinking (see sample questions in column 6).</i></p> <p>So which ball has the <i>most</i> energy? How do you know? What's your evidence?</p> <p>ELL support: ELL students will be better equipped to participate in this discussion if they engage in a Think-Pair-Share to answer these questions.</p> <p>Today we gathered more evidence of energy from examining different objects. We also explored ideas about giving objects energy.</p> <p>Show slide 11.</p> <p>Before our next lesson, I'd like you to be energy detectives at home. Look for at least three objects that have energy and show it in different ways. Don't just</p>	<p>Because it moved.</p>	<p><i>Possible probe and challenge questions:</i></p> <ul style="list-style-type: none"> • Why did you say that ball has the most energy? • How do you know that ball has the most energy? • How do you know that ball has <i>more</i> energy?

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			<p>select three objects that move. Instead, choose objects that require you to use different senses to detect evidence of energy. For example, you might see light coming from one object and hear sound coming from another. Try to use as many senses as you can to detect evidence of energy.</p> <p>Add these objects to your data tables and write down your observations and evidence that they have energy. Be prepared to share what you discovered.</p> <p>Show slide 12.</p> <p>Next time, we'll investigate whether the <i>amount</i> of energy can change in a moving object and think about how we can know whether an object has more energy than another object.</p>		