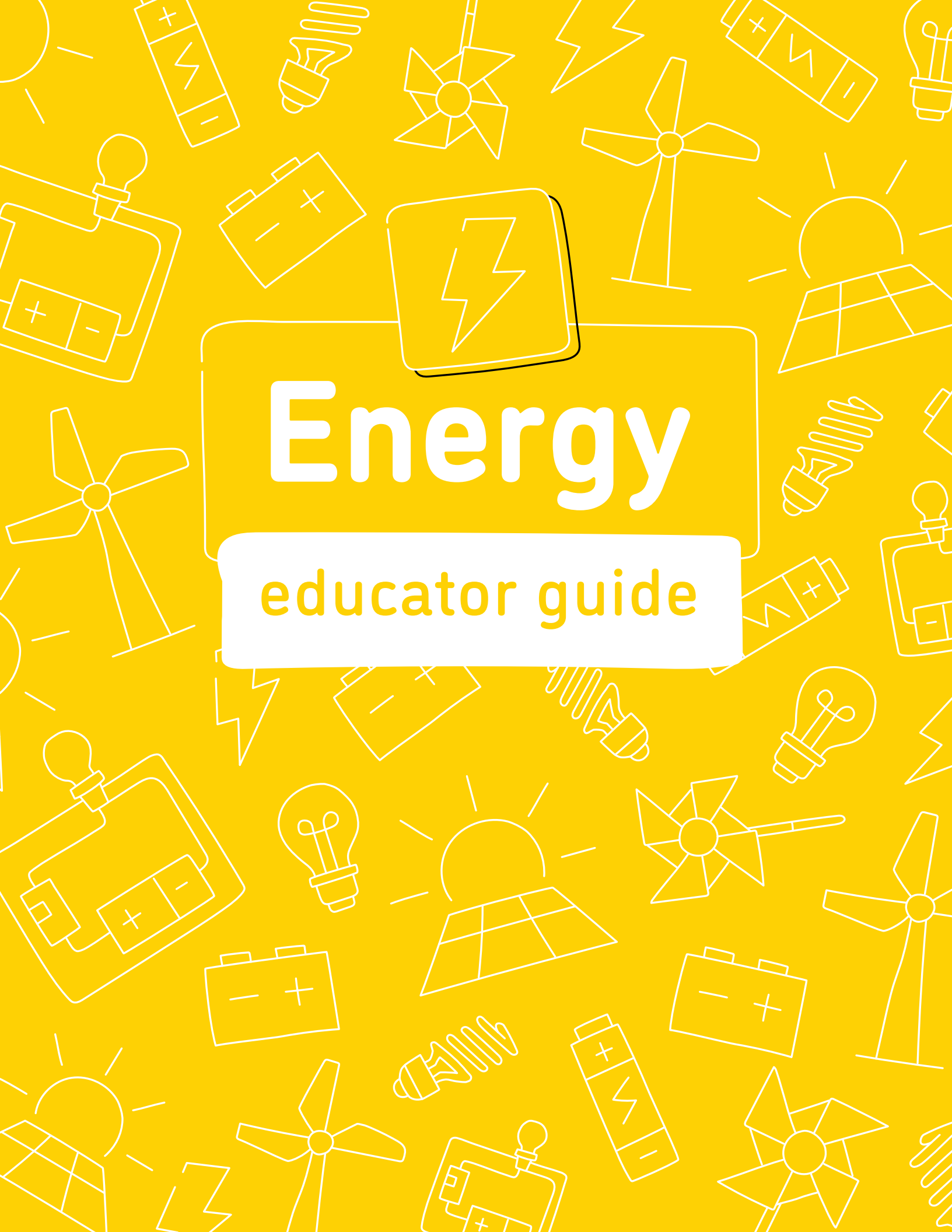


Energy

educator guide

WELCOME TO THE ENERGY Educator Guide!

In this Educator Guide, you'll find Grade Banded Learning Standards aligning to each of the activities. You will also find a QR Code linking you to COSI Connects, an online universe of science through videos, activities and so much more! COSI Connects also includes a section called Community Connects, a digital hub for online and in-person resources from museums, cultural institutions, and other nonprofits.

COSI Connects

For additional resources, including book recommendations, and video instructions for completing each of the activities inside your box be sure to check out **cosi.org/connects/kits/**.

For questions regarding the content inside this educator guide, please email ScienceQuestions@cosi.org.

Table of Contents

Dear Educators, Parents, and Caregivers:

We know education is important now more than ever, and COSI stands ready to be your partner with this COSI Connects Kit. Together, we will engage, inspire, and transform our students and youth in science, technology, engineering, art, and math (STEAM) at school and at home. These activities correlate directly to Ohio's Learning Standards and Next Generation Science Standards - the same key learning goals that schools, educators, parents and caregivers use.

In this Educator Guide, you will find the Ohio Learning Standards and Next Generation Science Standards that correspond to each of the activities in this box. You will also find interactive questions that will promote critical thinking. If you want to dig deeper into science, additional experiences are available through our free Connects digital platform, **www.cosi.org/connects**.

For additional resources, including book recommendations, and video instructions for completing each of the activities inside your box be sure to check out **www.cosi.org/connects/kits/energy-kit-resources.php**

For questions regarding the content inside this educator guide, please email **ScienceQuestions@cosi.org**.

Energy Kit: www.cosi.org/connects/kits/energy-kit.php

Resources: www.cosi.org/connects/kits/energy-kit-resources.php

Connects: www.cosi.org/connects

Facilitating STEAM Learning with Kits

Kits Overview

COSI Connects Kits contain carefully designed hands-on STEAM activities that support fun, engaging learning about a topic or theme. Each box comes with:

- **Supplies**: Materials for activities are in the box
- **Activity book:** This guide provides directions for setting up and completing activities, explains relevant STEAM content knowledge and skills, and offers discussion prompts to deepen the learning experience
- **Instructional videos:** Each kit has a QR code linking you to short videos demonstrating how to complete different steps of the activities. If you cannot scan the QR code, you can find the videos online at **cosi.org/connects/kits**. Click on your kit, then click the "Parent/Educator Resources" tab.

Goals for Using Kits

At COSI, we know science is everywhere and for everyone. To reinforce this message, we've designed our kits to do so much more than just teach STEAM content knowledge. Every kit, regardless of the content or topic, also provides important non-content learning opportunities such as:

- Engaging with STEAM in fun, inspiring, and creative ways
- Making sense of scientific observations
- Seeing oneself as a capable, welcome, and valued STEAM community member
- Practicing a growth mindset by valuing effort and learning over ease and knowing
- Bonding with peers, family, and educators over shared experiences and excitement

Techniques for Facilitating COSI Connects Kits

Decades of research show that learning is rarely as straightforward as receiving information. This is especially true when the goal is to *understand* and *apply* information, not simply recognize and repeat it. Learning and understanding requires the student to make sense of the information for themselves: Have they heard anything like that before? Does it make sense? Does it support or contradict something they already know? Is it useful or interesting enough to warrant the effort to learn and remember it?

When helping your learners accomplish the goals of using a COSI Connects kit, you'll want to ask more questions than you answer (unless they're practical or logistical questions about the directions).

Why? For a few reasons:

1) If learners have a question in mind before doing an activity, or before doing a step of the activity, they'll be primed to notice information that is useful for sense-making or question-asking.
2) This technique helps you model the process of science for your learners. Instead of assuming what they do or don't know and thus what you need to tell them, you are being curious, collecting data (their knowledge and ideas) and interpreting those data to decide how to most effectively help them.
3) This invites critical thinking: you can follow most questions with things like, "Why do you think that?" or "What did you observe during your activity that makes you think that?"
4) It shows your learners that you are interested in their experiences, and that you find them valuable and interesting to know.
5) If something isn't working, it can help you troubleshoot the issue: Did they skip a step? Use a different material? Was the reaction really fast or really subtle and they missed it?

Make sure you ask your questions with curiosity and openness: you are asking the question because you want to learn your learners' answers, not because you will try to change their minds (even if you do want to!). This will help them feel more comfortable sharing, which will deepen and sustain their conversations and learning.

Technique	Examples of Effective Questions
Model the scientific method before, during & after Model the scientific method before, during & after Scientists work together to collect information (evidence) they can use to answer questions about how things work, why things happen, or even if/when things *will* happen! They collect this evidence by learning from their peers, making observations, and conducting experiments. Additionally, scientists are never "done" learning: experiments often leave scientists with more questions than answers, which is exciting!	· What questions could we answer by doing this activity? · What information could we collect to answer that question? What changes or results could we look for? · What do you think will happen? Why? · What information or knowledge did you use to come up with your answer? · What new questions do you have? What about those questions is interesting to you? How would you collect evidence to answer your questions?
Focus on ideas rather than terminology If a learner is having a hard time with a particular word or phrase (pronouncing, understanding – anything!), help them find other words to use instead. It's more important for learners to learn by making sense of ideas and practicing skills than it is for them to use terminology correctly.	· What are other words that mean the same thing? · How would you explain it to a younger sibling? · Can you act out the word, or draw the word? · Is there a similar word that means something different, and that's making this feel confusing? · How can you remember the information/skill even if you forget the specific word(s)?

Help learners see themselves as scientists by challenging negative misconceptions Importantly, "science" is a *process*, not a product - science is not simply a collection of information or facts. Science is a process of asking questions, making observations to collect information, and thinking carefully to make sense of the information. The goal of science is not to "prove" that a certain idea is "right," or to get "the correct result" from doing an experiment. If an experiment produces an outcome that suggests a scientist's idea was wrong, that's great because there is something new to be learned! A "good" scientist is not somebody who is already very smart, works all by themselves without any help, and never makes mistakes. A "good" scientist is curious, collaborative, and learns from their mistakes.	· What does the word "science" mean to you? · Do you think science is interesting? Fun? Exciting? Scary? Boring? Why? · How do we use science to learn about things? · How does science help us understand things? · How do you use science to understand things? · What does the word "scientist" mean to you? · What does a scientist do? · What makes somebody a "good scientist" or "good at science"? · Do you think you can be a scientist? · How are you like a scientist every day? · What attributes make you a good scientist? · Why do you think it's more important for a scientist to learn from mistakes than to never make mistakes? · Have you ever made a mistake that helped you learn something really useful?
Invite sense-making and peer discussion It's great for learners to have questions because that means they're curious, and they have the opportunity to learn something new! Ask your learners to share what kit activity information and experiences they're curious or confused about and want to understand better. Ask other learners in your group to share how they figured something out. This is especially helpful when you have learners who want to work more quickly than others: capitalize on their energy and help them engage more deeply!	· Was any part of the kit activity surprising, strange, or even counterintuitive to what you expected? · Why do you think that was surprising/strange/counterintuitive – what made you think that something else would happen? · Did any part of the kit activity not make sense? · Did you see or try anything in the kit activity that helped something make sense? · Do you have any other information or experiences from before the kit activity that helped something make sense?
Explore real-world connections Learners are more likely to value the effort required to learn or complete a task if they believe the results will provide something useful and relevant. Personal connections can also help learners see themselves as capable STEAM community members and practitioners.	· Is this something you've ever wondered about? · Would a friend or family member find this interesting? · How could you use something you learned from this activity in your own life? · How could you use something you learned from this activity to help someone else?
Reflect on progress and experiences At the end of each activity, or even after a step within an activity, ask your learners questions that help them see things like: · They learned a new fact or skill · They had a fun/cool/interesting experience · They overcame an obstacle and achieved success · They are scientists and they're doing science · They changed their mind with new information · They turned a "mistake" into a learning opportunity · They wondered new and interesting questions	· What is the most interesting thing you learned? · Was anything confusing at first, but now you understand it better? · Was anything frustrating at first, but it helped you learn something? · Why was it confusing at first? How did you get to understand it better? · What is something you learned that you want to tell a friend or family member? · What is something you learned that you want to use in your everyday life?

Kit Accessibility Tips

This is an additional resource to support the success of learners. Below are tips and tools from COSI's accessibility experts that can be used when adapting for learners.

Fine Motor Adaptations

- Get creative! When completing a movement required activity, think of different ways to accomplish it, like moving an object by attaching it to a wheelchair.
- If an object is too small to handle, swap for similar but larger objects, like switching a bouncy ball for a basketball. You can also attach the smaller object to a larger one to make it easier to hold.
- Use hand over hand to support students when completing fine motor tasks.
- For the writing portions, provide notepaper to give extra space for writing.

Blind and Low Vision Adaptations

- Use puffy paint on the activity book images to create additional tactile images.
- Use manipulatives (objects) for students to touch when explaining how something works to help students process what is happening.
- Use the camera on a phone or tablet to magnify the words and images in the activity book.

Deaf Adaptations

- Utilize COSI's demonstration videos with closed captioning when completing an activity.
- Visually demonstrate the activity steps.

Cognitive Adaptations

- Break the activity into smaller steps to make processing easier.
- For harder to understand concepts use manipulatives (objects) to explain or relate to a practical process.
- Model the steps for the child to follow and complete at the same time.
- Ask leading questions to help students problem solve. For example: "How could you change the shape of the wings to make it fly better?"

Speech Adaptations

- Have students present in alternate ways, like with drawings or by demonstrating what they did.

Standards Alignment and Extension Questions

The following pages will include Ohio Learning Standards and Next Generation Science Standards that are aligned with each activity in the kit. In addition to these standards, you will find extension questions to scale up or scale down the content of each activity according to your students' abilities or grade level. These extension questions are arranged in grade level bands of Kindergarten – Second Grade, Third – Fifth Grade, and Sixth – Eighth Grade. Each set of these questions are also aligned with both Ohio Learning Standards and Next Generation Science Standards.

Throughout the kit activities, your students will find opportunities to write down their scientific findings and connect to digital learning resources through COSI Connects. This will allow them to fulfill the Ohio English Language Arts, Technology, and Digital Literacy Learning standards listed below.

Kindergarten – 2nd Grade

- K-2.ICT.3.b.: Use visuals found in digital learning tools and resources to clarify and add to knowledge.
- W.K.2: Use a combination of drawing, dictating, and writing to compose informative/ explanatory texts that name what is being written about and supply some information about the topic.
- W.1.8: With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
- W.2.8: Recall information from experiences or gather information from provided sources to answer a question.
- K-2.ST.2.a.: Communicate and collaborate using several digital methods.

Third Grade – Fifth Grade

- 3-5.ICT.1.a.: With guidance, identify and use digital learning tools or resources to support planning, implementing and reflecting upon a defined task.
- W.3-5.10: Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
- 3-5.ICT.4.d.: Produce and publish information appropriate for a target audience using digital learning tools and resources.

Sixth Grade – Eighth Grade

- 6-8.ICT.4.b.: Select and use a variety of media formats to communicate information to a target audience.

COSIconnects learning lunchbox

Energy

ACTIVITY 1 : Elastic Potential Energy

Learn all about potential and kinetic energy by making your very own rubber-band helicopter.

Ohio Learning Standards

4th Grade 4.PS.2: Energy can be transferred from one location to another or can be transformed from one form to another.

6th Grade 6.PS.3: There are two categories of energy: kinetic and potential.

7th Grade 7.PS.3: Energy can be transformed or transferred but is never lost.

7th Grade 7.PS.4: Energy can be transferred through a variety of ways.

Next Generation Science Standards

4-PS3-1: Use evidence to construct an explanation relating the speed of an object to the energy of that object.

4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

GRADES K–2

Extended Learning Questions:

1) Can you use the rubber band to make a sound? What happens when you stretch it and pluck it with your finger? What do you hear? What do you see?
2) Look at how your helicopter moves. Use words to describe how it moves.
3) Helicopters are used to help people. They can rescue people from fires, earthquakes, or floods. They can take sick people to hospitals. Draw a picture of a helicopter helping someone.

Ohio Learning Standards:

Kindergarten Science K.PS.2: Some objects and materials can be made to vibrate and produce sound.

Kindergarten Art K.1CO: Connect ideas, stories, and personal experiences to works of art.

1st Grade Science 1.PS.2: Objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth.

2nd Grade Social Studies 3: Science and technology have changed daily life.

Next Generation Science Standards:

1-PS4-1: Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.

COSIconnects learning lunchbox

Energy

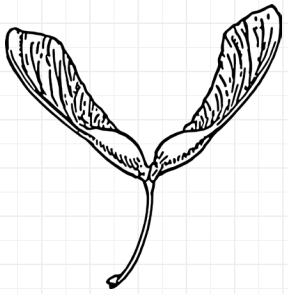
ACTIVITY 1 : Elastic Potential Energy

Learn all about potential and kinetic energy by making your very own rubber-band helicopter.

GRADES 3–5

Extended Learning Questions:

1) How many times should you wind your helicopter propellor to fly it? Try winding it 5 times, then 10, then 15 and 20. Which works best? Why?
2) How many times do you think energy changes from one form to another during the flight of your helicopter? Explain.
3) Look at a maple seed or a picture of a maple seed. Maple seeds are sometimes called helicopter seeds. How do you think the design of a helicopter seed helps the maple tree to spread its seeds? Optional: drop your maple seed from a height. How does it fly similarly to your helicopter? How does it fly differently?



4) Helicopters can be used to help people. They can rescue people from fires, earthquakes, or floods. They can take sick people to hospitals. Write a short story about a helicopter rescuing someone.

Ohio Learning Standards:

3rd Grade Science 3.LS.3: Plants and animals have life cycles that are part of their adaptations for survival in their natural environments.

4th Grade 4.PS.2: Energy can be transferred from one location to another or can be transformed from one form to another.

5th Grade Science 1.PS.1: The amount of change in movement of an object is based on the mass of the object and the amount of force exerted.

3rd – 5th Grade ELA W.3-5.3: Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.

Next Generation Science Standards:

4-PS3-4 Energy: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

COSIconnects learning lunchbox

Energy

ACTIVITY 1 : Elastic Potential Energy

Learn all about potential and kinetic energy by making your very own rubber-band helicopter.

GRADES 6–8

Extended Learning Questions:

1) Watch a helicopter flying. What forces are working on the helicopter when it is flying? In what direction is each force moving the helicopter?
2) One way to change how your helicopter flies is to change the number of times you spin the propellor. Design an experiment to find the best number of times to spin the propellor. Run your experiment. Optional: Compare your results with other people in your class.
3) Think about the different ways you can change the way your helicopter flies. For example, you could use a different rubber band or throw the helicopter differently. Design a new and improved helicopter. Test it out to see if it flies better.
4) Helicopters can be used to help people. They can rescue people from fires, earthquakes, or floods. They can take sick people to hospitals. Research an event in which a helicopter was used to rescue someone. Write an essay explaining what happened. How did the helicopter help? Why was it important to use a helicopter rather than other vehicles?

Ohio Learning Standards:

6th Grade ELA W.6.7: Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.

8th Grade Science 8.PS.1: Objects can experience a force due to an external field such as magnetic, electrostatic or gravitational fields.

8th Grade Science 8.PS.2: Forces can act to change the motion of objects.

6th – 8th Grade ELA W.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

Next Generation Science Standards:

6th – 8th Grade MS-PS2-2: Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

6th – 8th Grade MS-ETS1-1 Engineering Design: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

Join us at our Community Learning Table: "Community Connects"

The Community Connects section of this digital hub brings together educational resources from museums, cultural institutions, and other nonprofits in your community to extend your learning

cosi.org/connects

COSI Center of Science and Industry

COSIconnects learning lunchbox

Energy

ACTIVITY 2 : Chemical Energy

Have you ever seen a lava lamp? In this activity, learn about chemical energy while making a DIY lava lamp!

Ohio Learning Standards

4th Grade 4.PS.2: Energy can be transferred from one location to another or can be transformed from one form to another.

5th Grade 5.LS.2: All of the processes that take place within organisms require energy.

6th Grade 6.PS.3: There are two categories of energy: kinetic and potential.

7th Grade 7.PS.3: Energy can be transformed or transferred but is never lost.

7th Grade 7.PS.4: Energy can be transferred through a variety of ways.

Next Generation Science Standards

4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

GRADES K–2

Extended Learning Questions:

1) Watch the bubbles. How do they move? In what direction are they moving? Do some move faster than others?
2) Do the bubbles change while they move? How? What happens to the bubbles when they get to the top of the liquid?
3) Have an adult add some glitter to the lava lamp. Stir it a bit, then add another seltzer tablet. What happens? How does it look different? Try taking it outside on a sunny day or shining a flashlight on it. What do you observe?

Ohio Learning Standards:

1st Grade Science 1.PS.1: Properties of objects and materials can change.

1st Grade Science 1.PS.2: Objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth.

Next Generation Science Standards:

1-PS4-3: Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.

COSIconnects learning lunchbox

Energy

ACTIVITY 2 : Chemical Energy

Have you ever seen a lava lamp? In this activity, learn about chemical energy while making a DIY lava lamp!

GRADES 3–5

Extended Learning Questions:

1) What happens to the solid seltzer when added to the mixture in the bottle?
2) How long does it take a bubble to get from the bottom of the oil layer to the top? Use a timer to measure the time for three different bubbles. Write your result for each measurement. Are the times similar? Why or why not? If you measured the time in seconds, how many minutes is that?
3) Imagine you are going to design an even better lava lamp. What would you add to it? Why? Draw your design. Write a list of all the supplies you'll need. Compare it to other peoples' designs. Explain your design. If possible, obtain the supplies to build the new and improved lava lamp.

Ohio Learning Standards:

3rd Grade ELA W.3.7: Conduct short research projects that build knowledge about a topic.

3rd Grade Science 3.PS.2: Matter exists in different states, each of which has different properties.

3rd Grade Mathematics 3.MD.1: Work with time and money.

4th Grade Mathematics 4.MD.1: Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.

3rd – 5th Grade Design and Technology 3-5. DT.2.c.: Generate, develop and communicate design ideas and decisions using appropriate terms and graphical representations.

Next Generation Science Standards:

3-PS2-2: Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to produce future motion.

4-PS3-4 Energy: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

GRADES 6–8

Extended Learning Questions:

1) Which is less dense: water or oil? How do you know?
2) Design a better lava lamp: First, think about what changes you would make. Draw your design and follow the engineering design process to build and test the new version. Share your results with others. Compare your results to others' results. Note: can be done in groups.
3) How would you determine the speed of one of the bubbles in your lava lamp? Write down your answer, then test it out. Find the speed of three different bubbles. Then, add those three speeds and divide your result by three to find the average speed. Compare your average to what other people calculated.

Ohio Learning Standards:

6th – 8th Grade Design and Technology 6-8.DT.2.a.: Apply a complete design process to solve an identified individual or community problem: research, develop, test, evaluate and present several possible solutions, and redesign to improve the solution.

6th Grade Science 6.PS.4: An object's motion can be described by its speed and the direction in which it is moving.

6th Grade Mathematics 6.RP.3: Understand ratio concepts and use ratio reasoning to solve problems.

6th Grade Mathematics 6.SP.5: Summarize and describe distributions.

Next Generation Science Standards:

Engineering Design: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

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COSIconnects learning lunchbox

Energy

ACTIVITY 3 : Wind Energy

In this activity, you'll learn about and demonstrate wind energy by building and sailing a wind-powered vehicle.

Ohio Learning Standards

2nd Grade 2.ESS.1: The atmosphere is primarily made up of air.

2nd Grade 2.ESS.3: Long- and short-term weather changes occur due to changes in energy.

3rd Grade 3.ESS.2: Earth's resources can be used for energy.

4th Grade 4.PS.2: Energy can be transferred from one location to another or can be transformed from one form to another.

7th Grade 7.PS.3: Energy can be transformed or transferred but is never lost.

7th Grade 7.PS.4: Energy can be transferred through a variety of ways.

Next Generation Science Standards

4-PS3-1: Use evidence to construct an explanation relating the speed of an object to the energy of that object.

4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*

GRADES K–2

Extended Learning Questions:

1) Can you make your wind powered vehicle move backwards? Zigzag? In a circle? Try it out!
2) Build an obstacle course for your wind-powered vehicle. How long does it take to get through?
3) Have a wind-powered race! Which wind-powered vehicle can get from one spot to another faster? Does that change if they're racing down a ramp?

Ohio Learning Standards:

1st Grade Science 1.PS.2: Objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth.

2nd Grade Science 2.PS.1: Forces change the motion of an object.

Next Generation Science Standards:

K-PS2-2: Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or pull.

COSIconnects learning lunchbox

Energy

ACTIVITY 3 : Wind Energy

In this activity, you'll learn about and demonstrate wind energy by building and sailing a wind-powered vehicle.

GRADES 3–5

Extended Learning Questions:

1) Wind is very powerful. What does the wind do to shape our earth? If possible, take a trip to a region impacted by wind to observe the effects of the wind on the Earth.
2) Add a payload (weight) to your vehicle. How does it run differently on a flat surface? What about going down a ramp? Why does this happen? Try different slopes of ramps.
3) Try changing your source of wind. Use a fan, a straw, or go outside on a windy day. How does it change how your vehicle moves?
4) Build an obstacle course for your wind-powered vehicle. Then, have someone time you as you move your vehicle through the course! How long does it take to get through?
5) Have a wind-powered race! Which wind-powered vehicle can get from one spot to another faster? Does that change if they're racing down a ramp?

Ohio Learning Standards:

4th Grade Science 4.ESS.2: The surface of Earth changes due to weathering.

4th Grade Science 4.ESS.3: The surface of Earth changes due to erosion and deposition.

5th Grade Science 5.PS.1: The amount of change in movement of an object is based on the mass of the object and the amount of force exerted.

Next Generation Science Standards:

3-PS2-1: Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

3-PS2-2: Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

4-ESS2-1: Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind or vegetation.

3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

COSIconnects learning lunchbox

Energy

ACTIVITY 3 : Wind Energy

In this activity, you'll learn about and demonstrate wind energy by building and sailing a wind-powered vehicle.

GRADES 6–8

Extended Learning Questions:

1) When does your vehicle have potential energy? When does it have kinetic energy? While it is moving, when does it have more kinetic energy and less kinetic energy? How can you tell?
2) What forces are acting on the wind-powered vehicle? In what direction is each force? Do any of the forces balance? Where do you see an unbalanced force? How do you know?
3) Build an obstacle course for your wind-powered vehicle. See whose wind-powered vehicle can get through the obstacle course the fastest.
4) Use reliable online sources to research how wind turbines use wind to produce electricity. What are the pros and cons of using wind to generate electricity? Where in the world are people using wind turbines to generate electricity? Write one page describing what you learned. Be sure to cite your sources.

Ohio Learning Standards:

6th Grade Science 6.PS.3: There are two categories of energy: kinetic and potential.

6th Grade Science 6.PS.4: An object's motion can be described by its speed and the direction in which it is moving.

8th Grade Science 8.PS.2: Forces can act to change the motion of objects.

6th – 8th Grade ELA W.6-8.2: Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

6th – 8th Grade Information and Communications Technology 6-8.ICT.2.a.: Use advanced search techniques to locate needed information using digital learning tools and resources.

6th – 8th Grade Information and Communications Technology 6-8.ICT.2.c.: Apply principles of copyright, use digital citation tools and use strategies to avoid plagiarism.

Next Generation Science Standards:

MS-PS3-1: Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and the speed of an object.

6th – 8th Grade MS-PS2-2: Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

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COSIconnects learning lunchbox

Energy

ACTIVITY 4 : Dark Energy

Scientists are still using the scientific method to learn about Dark Energy! You will be challenged to make observations and use the scientific method to determine what is inside your mystery container.

Ohio Learning Standards

While specific Ohio Science Learning Standards do not directly address scientific observation, the overarching student-centered goals for ALL grade levels include helping students to:

- Experience excitement, interest and motivation to learn about phenomena in the natural and physical world.
- Manipulate, test, explore, predict, question, observe and make sense of the natural and physical world.
- Reflect on science as a way of knowing; on processes, concepts and institutions of science; and on their own process of learning about phenomena.
- Think of themselves as science learners and develop an identity as someone who knows about, uses and sometimes contributes to science.

GRADES K–2

Extended Learning Questions:

1) Find five items in the room. Describe them using your senses: what do they look like? Now, what do they feel like? What do they sound like? What do they smell like? After you've observed them, talk about how the objects are similar and different.
2) Look at an ice cube. Make observations about it. Wait 10 minutes. Then, observe the ice cube again. What changed?
3) Scientists look in space to learn about dark energy. Can you look at the sky and make observations at different times of day? What do you notice? How is the sky different at different times of day or night?

Ohio Learning Standards:

Kindergarten Science K.PS.1: Objects and materials can be sorted and described by their properties.

Kindergarten Science K.ESS.2: The moon, sun and stars can be observed at different times of the day or night.

1st Grade Science 1.PS.1: Properties of objects and materials can change.

Next Generation Science Standards:

1-ESS1-1: Use observations of the sun, moon and stars to describe patterns that can be predicted.

2-PS1-1: Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

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Energy

ACTIVITY 4 : Dark Energy

Scientists are still using the scientific method to learn about Dark Energy! You will be challenged to make observations and use the scientific method to determine what is inside your mystery container.

GRADES 3–5

Extended Learning Questions:

1) Why is dark energy called dark? If you aren't sure, use a reliable online resource to find the answer.
2) Scientists study lots of things they cannot see with their eyes. Individual atoms and molecules, viruses, and bacteria are too small to see with our eyes. How do we know these things exist? How do we study them?
3) Get into groups and have each group design your own mystery chamber (use a dark film canister or shoebox). Put an object in the chamber. People cannot look at the object or feel it, but they can use their other senses to learn about it. Then, swap mystery chambers. Can anyone guess what the object is?

Ohio Learning Standards:

3rd – 5th Grade Information and Communications Technology 3-5.ICT.2.b.: Use appropriate search techniques to locate needed information using digital learning tools and resources.

Next Generation Science Standards:

5-PS1-1: Develop a model to describe that matter is made of particles too small to be seen.

GRADES 6–8

Extended Learning Questions:

1) Why is dark energy called dark? If you aren't sure, use a reliable online resource to find the answer.
2) Scientists study lots of things they cannot see with their eyes. Individual atoms and molecules, viruses, and bacteria are too small to see with our eyes. How do we know these things exist? How do we study them?
3) What technologies do you think are being used to study dark energy? Use reliable digital resources like **www.nasa.gov** to find some answers to your questions.
4) Use a reliable resource such as nasa.gov to find an article about dark energy or dark matter. Read the article, looking up any words you do not know. Then, share with a partner what you learned.

Ohio Learning Standards:

6th Grade Science 6.PS.1: Matter is made up of small particles called atoms.

6th – 8th Grade English Language Arts W.7.7: Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.

6th – 8th Grade Information and Communications Technology 6-8.ICT.2.a.: Use advanced search techniques to locate needed information using digital learning tools and resources.

Next Generation Science Standards:

MS-PS1-1: Develop models to describe the atomic composition of simple molecules and extended structures.

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Energy

ACTIVITY 5 : Solar Energy

Harness the sun's energy to melt a piece of chocolate! Everything you need to make a solar oven is included in your kit.

Ohio Learning Standards

1st Grade Science 1.ESS.1: The sun is the principal source of energy.

3rd Grade Science 3.ESS.2: Earth's resources can be used for energy.

3rd Grade Science 3.PS.3: Heat, electrical energy, light, sound and magnetic energy are forms of energy.

4th Grade Science 4.PS.2: Energy can be transferred from one location to another or can be transformed from one form to another.

5th Grade Science 5.PS.2: Light and sound are forms of energy that behave in predictable ways.

7th Grade Science 7.LS.1: Energy flows and matter is transferred continuously from one organism to another and between organisms and their physical environments.

7th Grade Science 7.PS.3: Energy can be transformed or transferred but is never lost.

7th Grade Science 7.PS.4: Energy can be transferred through a variety of ways.

Next Generation Science Standards

4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

MS-PS3-3: Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

GRADES K–2

Extended Learning Questions:

1) How well do you think the solar oven works at different times of the day? Is there any time it wouldn't work at all? Why?
2) Electricity is generated in many ways. How many different ways can you think of?
3) (On a very sunny, preferably also a warm day). Use your solar oven to make a s'more! Place a napkin into the oven, and put a graham cracker on top. Then add a few mini marshmallows and chocolate chips. Set it out in the sun until the chocolate and marshmallows melt a bit. Add another graham cracker on top and enjoy!

Ohio Learning Standards:

Kindergarten Science K.ESS.2: The moon, sun and stars can be observed at different times of the day or night.

2nd Grade Social Studies 14: Resources can be used in various ways.

Next Generation Science Standards:

1-ESS1-1: Use observations of the sun, moon and stars to describe patterns that can be predicted.

COSIconnects learning lunchbox

Energy

ACTIVITY 5 : Solar Energy

Harness the sun's energy to melt a piece of chocolate! Everything you need to make a solar oven is included in your kit.

GRADES 3–5

Extended Learning Questions:

1) Think about the stars that you see at night. Why does the Sun, our solar system's star, look so much brighter than the stars that you see at night?
2) Solar panels get energy from the Sun. What time of day do you think solar panels are getting the most energy? What time of year? What places on Earth are best for using solar energy? How can people who use solar panels still have electricity at night?
3) Electricity is generated in many ways. How many different ways can you think of? Write them all down. Which of these are from nonrenewable resources (resources that will eventually run out)? Which are from renewable resources (resources that are not used up, or are easily replaced)? Is Solar Energy a renewable or nonrenewable resource?
4) What are the pros and cons of using solar energy over other forms of energy?

Ohio Learning Standards:

3rd Grade Science 3.ESS.2: Earth's resources can be used for energy.

3rd Grade Science 3.ESS.3: Some of Earth's resources are limited.

3rd Grade Social Studies 19: Making decisions involves weighing costs and benefits.

5th Grade Science 5.ESS.1: The solar system includes the sun and all celestial bodies that orbit the sun. Each planet in the solar system has unique characteristics.

Next Generation Science Standards:

4-ESS3-1: Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

5-ESS1-1: Support an argument that the apparent brightness of the sun and stars is due to their relative distances from the Earth.

GRADES 6–8

Extended Learning Questions:

1) Solar panels convert solar energy into electricity. Solar panels work better in some places in the world than others. Where would solar panels work well? Where would they not work well? Do some research to find out if solar panels are being used in the places you listed.
2) Solar energy is a renewable resource. What are the benefits of renewable resources? What are the potential impacts of only using nonrenewable resources?
3) What other types of renewable resources can be used to generate electricity besides solar energy? Write a list. Where on Earth would be the best place for each energy source on your list? Why?
4) Research one type of renewable resource that can be used for electricity. Write an essay describing this resource. What are the costs and benefits of using that resource? What places are currently using it?

Ohio Learning Standards:

6th Grade Social Studies 5: Regions can be determined, classified and compared using data related to various criteria including landform, climate, population, and cultural and economic characteristics.

6th Grade Social Studies 6: The variety of physical environments within the Eastern Hemisphere influences human activities. Likewise, human activities modify the physical environment.

6th – 8th Grade English Language Arts W.7.7: Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.

Next Generation Science Standards:

MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

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Glossary:

Chemical Energy – Energy stored in bonds between atoms and molecules.

Dark Energy – An energy in space that scientists think is making our universe get bigger.

Elastic Potential Energy – A type of stored energy that exists after stretching, compressing, or twisting a material. For example, a stretched rubber band has elastic potential energy.

Energy – The ability to do work (move something).

Kinetic energy – Energy of motion.

Potential energy – Stored energy.

Solar energy – Energy from the Sun's light.

Solar panel – A device that absorbs solar energy and changes it into electricity.

Wind energy – Energy from moving air (wind).