



American Innovation

educator guide



AMERICA'S
250TH

1776-2026

WELCOME TO THE AMERICAN INNOVATION Educator Guide!

This guide contains information and additional resources that you can use to amplify the activities inside the Learning Lunchbox for your students.

This guide contains information and additional resources that you can use to amplify the activities inside the Learning Lunchbox for your students.

Each box contains seven activities that will provide hours of STEAM content centered around innovation in America's past and present. The supplies to complete each of the activities are inside of the box.

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.

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.



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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 - the key learning goals that schools and educators use.

This box is full of experiences designed to engage K-8 learners; it is especially recommended for grades 3-6. As you look through the Activity Guide, you will find step-by-step instructions, interactive questions that will promote critical thinking, and explanations of the science behind each activity. If you want to dig deeper into science, additional experiences are available through our free Connects digital platform. 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 critical thinking questions and extensions that work well with different grade levels at home and in the classroom.

The American Innovation Kit: <https://cosi.org/connects/kits/american-innovation-kit.php>

Resources: <https://cosi.org/connects/kits/american-innovation-kit-resources.php>

Connects: <https://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 <https://cosi.org/connects/kits/>. Click on the correct kit theme, then click the “Parent/Educator Resources” tab. Or click the [link](#) here.

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
<p>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 <i>will</i> 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!</p>	<ul style="list-style-type: none"> • 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?
<p>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.</p>	<ul style="list-style-type: none"> • 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)?

<p>Help learners see themselves as scientists by challenging negative misconceptions</p> <p>Importantly, “science” is a <i>process</i>, 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.</p> <p>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!</p> <p>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.</p>	<ul style="list-style-type: none"> • 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?
<p>Invite sense-making and peer discussion</p> <p>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.</p> <p>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!</p>	<ul style="list-style-type: none"> • 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?
<p>Explore real-world connections</p> <p>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.</p>	<ul style="list-style-type: none"> • 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?
<p>Reflect on progress and experiences</p> <p>At the end of each activity, or even after a step within an activity, ask your learners questions that help them see things like:</p> <ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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 the provided screen reader friendly version of the activity book which can be found on the kit website.
- 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 aligns with the Ohio English Language Arts, Technology, and Digital Literacy Learning standards listed below.

Kindergarten – 2nd Grade

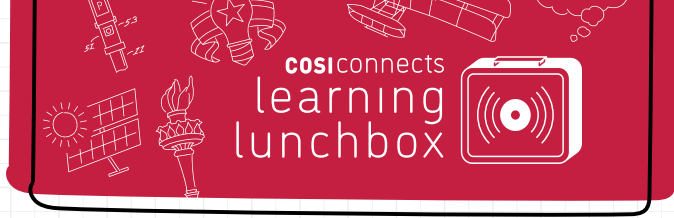
- K-2.ICT.3.b.: Use visuals found in digital learning tools and resources to clarify and add to knowledge.
- W.K.2: Use a combination of drawing, dictating, and writing to compose informative/explanatory texts that name what is being written about and supply some information about the topic.
- W.1.8: 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.



American Innovation

ACTIVITY 1: Liberty's Torch

Learn about the Statue of Liberty and freedom as you make your own torch.

Ohio Learning Standards

2nd Grade Math 2.MD.1-Measure and estimate lengths in standard units.

2nd Grade Math 2.MD.3-Measure and estimate lengths in standard units.

4th Grade Social Studies 4.HS.4-The 13 colonies came together around a common cause of liberty and justice, uniting to fight for independence during the American Revolution and to form a new nation

GRADES
K-2

Extended Learning Questions:

- 1) What words would you use to describe the torch you made? What does it look like? How does it feel? How does it sound when you touch it?
- 2) Look at the cardboard tube and tissue paper you used to make your torch. How are these two things similar? How are they different?
- 3) Look at two symbols used on a walk sign: a red hand and a walking person. Have you seen these symbols before? Where? What do they symbolize? (Educator: Following the discussion, print out one of each sign. Use them to play a game of red light/green light with the stop and walk signs.)

Ohio Learning Standards:

Kindergarten Science K.3RE:
Observe and describe works of art.

K – 2nd Grade Technology K.PS.1:
Objects and materials can be sorted and described by their properties.

Next Generation Science Standards:

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

GRADES
3-5

Extended Learning Questions:

- 1) How do you think glow sticks work? Look at your glow stick. Think about what you had to do to make it glow. What clues are there that tell you about how the glow stick might work? (Optional: watch this video: <https://www.youtube.com/watch?v=uJgNteBWhDk>)
- 2) Will your glowstick continue to glow forever? If not, why do you think it will stop glowing?
- 3) If you made a symbol to represent you, what would it look like? Why?

Ohio Learning Standards:

Science 3.PS.1: All objects and substances in the natural world are composed of matter.

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

4th Grade Fine Arts 4.1RE:
Identify qualities that contribute to the design and meanings of works of art.

5th grade Fine Arts 5.3RE:
Evaluate the relationship between works of art and human experiences.

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 electrical currents.

American Innovation

ACTIVITY 1: Liberty's Torch

Learn about the Statue of Liberty and freedom as you make your own torch.

GRADES
6-8

Extended Learning Questions:

- 1) If you made a symbol to represent you, what would it look like? What important aspect(s) of you would your symbol represent? Optional: Design and draw the symbol. Observe the similarities and differences between different peoples' symbols.
- 2) Look at a series of street signs. These signs are important symbols to drivers. Do you know what any of them symbolize, or mean? Which ones? Do you think these symbols are the same all around the world? Why or why not?
- 3) How do you think glow sticks work? Look at your glow stick. Think about what you had to do to make it glow. What clues are there that tell you about how the glow stick might work? Then, look online to find the answer. (Optional: watch this video: <https://www.youtube.com/watch?v=uJgNteBWhDk>).
- 4) Take 2 glow sticks. Place one in a freezer and another at room temperature. What do you think will happen after some time passes? Look at the glow sticks after 1 hour. What do you notice? Look at the glow sticks the next day. What do you notice? Why do you think this is? (Optional: watch this video: <https://www.youtube.com/watch?v=YVVtQnHYadk>)

Ohio Learning Standards:

6th Grade Art 6.3C0: Link observations, life experiences, and imagination for personal and creative expression.

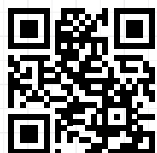
7th Grade Art 7.3C0: Explore how personal experiences influence style and choice of subject matter.

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

Next Generation Science Standards:

MS-PS1-2: Matter and its Interactions: Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

MS-PS1-4: Matter and its Interactions: Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

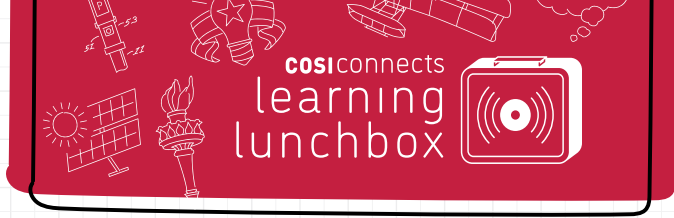


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American Innovation

ACTIVITY 2: Inventors and Inventions

Discover some famous inventors and their inventions, learn about patents as you play a matching game, and create your own invention.

GRADES
3-5

Extended Learning Questions:

- 1) Pick one object in the room (e.g. a lamp, a desk, or any toy). Describe the object. Identify two specific features, or parts, of the object. How does the design of those parts help the people who use it? How would you change the design of that object?
- 2) Name one problem that you or someone you know faces in life. Brainstorm two or three possible solutions to that problem. Does one of these solutions seem better than the others? Why or why not?

Ohio Learning Standards:

3rd – 5th Grade Technology
3-5.DT.4.b.: Examine a familiar product or process and suggest improvements to its design.

3rd – 5th Grade Technology
3-5.DT.2.a.: Critique needs and opportunities for designing solutions.

Next Generation Science Standards:

3-5-ETS1-2 Engineering Design:
Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

GRADES
6-8

Extended Learning Questions:

- 1) Pick one object you use every day. Describe the object. How does the design help the people who use it? How would you improve the design of that object?
- 2) Name one problem that you or someone you know faces in life. Brainstorm two or three possible solutions to that problem. Does one of these solutions seem better than the others? Why? What constraints (limitations) limit the possibilities for solutions?
- 3) A smartphone is an example of a technology that has both a positive and a negative impact on society. What is one example of a positive impact of smartphones? What is one example of the negative impact of smartphones?

Ohio Learning Standards:

6th – 8th Grade Technology
6-8.ST.3.c.: Analyze how technological innovations and inventions can have multiple applications, both intended and unintended.

6th – 8th Grade Technology
6-8.ST.2.a.: Critique specific instances of how technology has impacted access to information, communications and collaboration.

6th – 8th Grade Technology
6-8.ST.2.b.: Explain the positive and negative impact the use of technology can have on personal, professional and community relationships.

Next Generation Science Standards:

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.

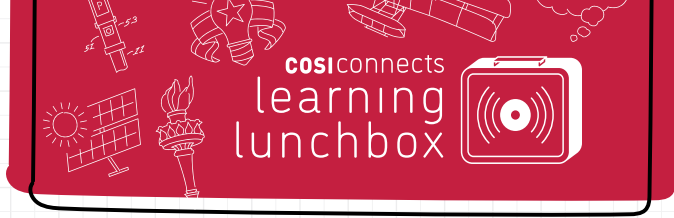


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American Innovation

ACTIVITY 3: Make a Prosthetic Hand

How innovative are you? Make a prosthetic hand and then make it even better.

Ohio Learning Standards

K-2nd Grade Technology K-2.ST.3.c.; Identify how the use of technology affects self and others in various ways.

2nd Grade Math 2.MD.1: Measure and estimate lengths in standard units.

2nd Grade Math 2.MD.3: Measure and estimate lengths in standard units.

3rd-5th Technology 3-5.ST.3.a: Describe the advantages and disadvantages of technology (past, present, future) to understand the relationship between technology, society and the individual.

3rd-5th Technology 3-5.DT.1.a: Demonstrate how applying human knowledge using tools and machines extends human capabilities to meet our needs and wants.

Next Generation Science Standards

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.

GRADES
K-2

Extended Learning Questions:

- 1) Use your prosthetic hand to count 1-2-3-4-5. Now use it to wave to a friend.
- 2) Imagine you were going to create the best prosthetic hand ever made. What would your prosthetic hand be able to do? How would it help the people who use it?
- 3) Imagine you are an inventor. Design the perfect backpack. What would the backpack look like? Would it have anything special on it?

Ohio Learning Standards:

Kindergarten - 2nd Grade Technology K-2.DT.2.b.:

Demonstrate the ability to follow a simple design process: identify a problem, think about ways to solve the problem, develop possible solutions, and share and evaluate solutions with others.

Next Generation Science Standards:

K-2-ETS1-1: Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

American Innovation

ACTIVITY 3: Make a Prosthetic Hand

How innovative are you? Make a prosthetic hand and then make it even better.

GRADES
3-5

Extended Learning Questions:

- 1) Look up the American Sign Language (ASL) alphabet. Can you make the signs for any of the letters with your prosthetic hand? Try spelling your name.
- 2) Imagine you are going to design a prosthetic foot. Make a list of things that you want the foot to be able to do. How might you design it to be able to do those things? In what ways would the design need to be different from a prosthetic hand?
- 3) Imagine you are an inventor. It is your task to design a backpack that can be used by anyone. What might you add to your design to make sure everyone can use it? How would you make sure that someone could use it even if they can't carry it on their shoulders?

Ohio Learning Standards:

3rd – 5th Grade Technology

3-5.DT.2.a.: Critique needs and opportunities for designing solutions.

3rd – 5th Grade Technology 3-5.

DT.2.b.: Plan and implement a design process: identify a problem, think about ways to solve the problem, develop possible solutions, test and evaluate solution(s), present a possible solution, and redesign to improve the solution.

Next Generation Science Standards:

3-5-ETS1-1 Engineering Design:

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

GRADES
6-8

Extended Learning Questions:

- 1) Tape a pencil or marker to your prosthetic hand. Have a competition with a friend: who can write their name faster?
- 2) Imagine you are going to design a prosthetic foot. Make a list of things that you want the foot to be able to do. How might you design it to be able to do those things? What materials might you use? How would you ensure it is strong enough for day-to-day life? How would you ensure it is comfortable for the wearer? Sketch your design. Share with a classmate and compare your designs.
- 3) Imagine you are an inventor. It is your task to design a bicycle that can be used by anyone. What might you add to your design to make sure everyone can use it? How might you adapt the bike for someone that can't see the bike path?

Ohio Learning Standards:

6th – 8th Grade Technology 6-8.

DT.1.d.: Explain how optimization is the process of making a product as fully functional and effective as possible.

6th – 8th Grade Technology

6-8.DT.2.d.: Consider multiple factors, including criteria and constraints, (e.g., research, cost, time, materials, feedback, safety) to justify decisions when developing products and systems to solve problems.

Next Generation Science Standards:

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.

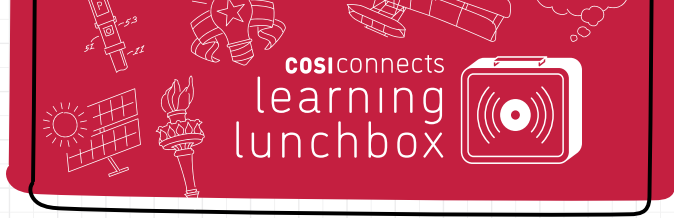


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ACTIVITY 4: Blast into Space

Learn about NASA's past and upcoming space missions and send your own rocket to space.

Ohio Learning Standards

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

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

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

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

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.

GRADES
K-2

Extended Learning Questions:

- 1) Was the antacid tablet a solid, liquid, or gas before your experiment? What did it become after it was placed in the water? How do you know?
- 2) Try launching another antacid rocket with more water in the container. Then, launch another with less water in the container. Which launched faster? Which launched higher? Which stayed in the air longest?
- 3) Try launching another antacid rocket using more alka seltzer. Then, launch another with less alka seltzer. Which launched faster? Which launched higher? Which stayed in the air longest?

Ohio Learning Standards:

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

Kindergarten-2nd Grade Technology K-2.DT.4.d.: Discuss and give examples of how changes in design can be used to strengthen or improve a product.

Next Generation Science Standards:

K-PS2-1: Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.

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

GRADES
3-5

Extended Learning Questions:

- 1) Did the addition of antacid tablet create a new substance? Why or why not?
- 2) After it launches into the air, what force causes your film canister to come back down? What do you think would happen if you did the same film canister rocket activity on another planet?

Ohio Learning Standards:

4th Grade Science 4.PS.1: When objects break into smaller pieces, dissolve, or change state, the total amount of matter is conserved.

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:

5-PS1-4: Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

5-PS2-1: Support an argument that the gravitational force exerted by Earth on objects is directed down.

American Innovation

ACTIVITY 4: Blast into Space

Learn about NASA's past and upcoming space missions and send your own rocket to space.

GRADES
6-8

Extended Learning Questions:

- 1) Is antacid dissolving in water an example of a physical or chemical reaction? How do you know?
- 2) A dissolution happens when a solute dissolves into a solvent. Are all dissolutions examples of chemical reactions? Why or why not? (Hint: Think about the dissolution of salt in water)
- 3) How did the energy of the chemical reaction transfer in this experiment? How do you know?

Ohio Learning Standards:

7th Grade Science 7.PS.2:
Matter can be separated or changed, but in a closed system, the number and types of atoms remains constant.

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

Next Generation Science Standards:

MS-PS1-2: Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

MS-PS3-5: Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

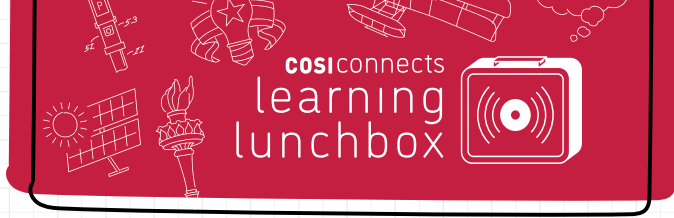


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American Innovation

ACTIVITY 5: The Power of Innovation

Find out how NASA powers things in space, then use solar panels and the Sun's power to make a buzzer vibrate.

Ohio Learning Standards

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

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

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

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

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) Try putting your solar panel circuit in a dark closet. Does it work? Why or why not?
- 2) Other than solar panels, what things get energy from the Sun?
- 3) 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?
- 4) Where in the world do you think solar panels work best? Why?

Ohio Learning Standards:

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

1st Grade Science 1.LS.1: Living things have basic needs, which are met by obtaining materials from the physical environment.

Next Generation Science Standards:

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

1-ESS1-2: Make observations at different times of the year to relate the amount of daylight to the time of year.

2-LS2-1: Plan and conduct an investigation to determine if plants need sunlight and water to grow.

GRADES
3-5

Extended Learning Questions:

- 1) 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?
- 2) What other ways do we get energy from the environment besides solar panels? How does using each type of energy affect the environment?
- 3) Try putting your solar panel in a dark place. Does it work? Why or why not? Design an experiment to determine the minimum amount of sunlight that your solar panel needs to power the buzzer.

Ohio Learning Standards:

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.

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.



American Innovation

ACTIVITY 5: The Power of Innovation

Find out how NASA powers things in space, then use solar panels and the Sun's power to make a buzzer vibrate.

GRADES
6-8

Extended Learning Questions:

- 1) Solar panels work better in some places in the world than others. What other types of renewable energy can be used to generate electricity? Where would be the best place for each energy source on your list? Why?
- 2) Starting with the Sun and ending with the buzzer, explain how the energy gets transformed and transferred. How would the energy transfer be different if you were powering the buzzer with a battery instead of a solar panel?
- 3) Design an experiment to determine the minimum amount of sunlight that your solar panel needs to power the buzzer.

Ohio Learning Standards:

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

Next Generation Science Standards:

HS-PS3-3: Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

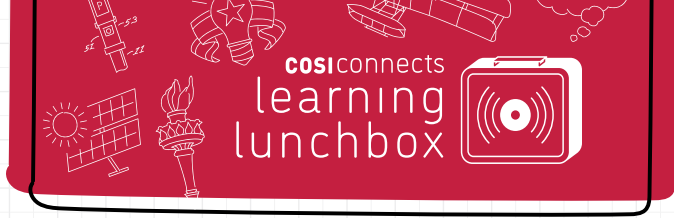


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American Innovation

ACTIVITY 6: America the Beautiful

The creation of national parks is one of the United States' most beautiful innovations. Learn about some of the natural features in these parks and make your own geyser.

Ohio Learning Standards

First Grade Science 1.ESS.2: Water on Earth is present in many forms.

Third Grade Science 3.ESS.1: Earth's nonliving resources have specific properties.

Fourth Grade Science 4.ESS.1: Earth's surface has specific characteristics and landforms that can be identified.

Next Generation Science Standards

2-ESS2-2: Develop a model to represent the shapes and kinds of land and bodies of water in an area.

GRADES
K-2

Extended Learning Questions:

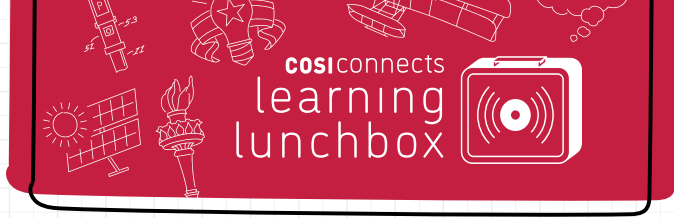
- 1) What happens if you blow very gently into the straw? What if you blow very hard into the straw? Test it out!
- 2) What happens if you put more water into your model geyser? What if you put less water in your geyser? Test it out!
- 3) National parks have all kinds of exciting things to see. Some have forests, mountains, beaches, or deserts. They have animals too. If you visited a national park, what would you hope to see?

Ohio Learning Standards:

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

Next Generation Science Standards:

K-PS2-1: Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.



American Innovation

ACTIVITY 6: America the Beautiful

The creation of national parks is one of the United States' most beautiful innovations. Learn about some of the natural features in these parks and make your own geyser.

GRADES
3-5

Extended Learning Questions:

- 1) For a geyser to form, water must first be heated in a hot spring. What do you think is responsible for heating that water below the Earth's surface?
- 2) Geysers have plumes of hot water that erupt in through narrow openings. But sometimes, visitors are not respectful towards nature in National Parks. What do you think happens when tourists throw garbage or rocks in geysers? Do you think it is important to be respectful of nature? Why or why not?
- 3) Looking at the location of each national park, which ones do you think have mountains? What about deserts? What about beaches?
- 4) Look at the pictures of national parks on Page 24 of your activity guide. Based on the pictures, which one of these would you want to visit? Now, find that park on the map. What state or territory is that park in? How far away is it from where you live?

Ohio Learning Standards:

3rd Grade Science 3.ESS.1:

Earth's nonliving resources have specific properties.

4th Grade Science 4.ESS.1:

Earth's surface has specific characteristics and landforms that can be identified.

3rd Grade Social Studies

Spatial Thinking 4: Physical and political maps have distinctive characteristics and purposes. Places can be located on a map by using the title, key, alphanumeric grid and cardinal directions.

4th Grade Social Studies

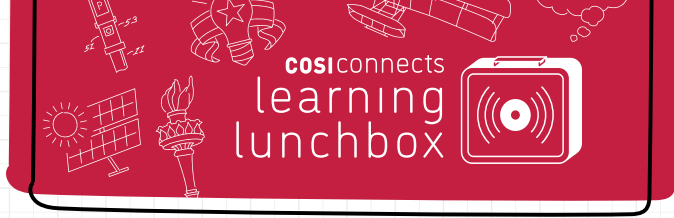
Spatial Thinking 9: A map scale and cardinal and intermediate directions can be used to describe the relative location of physical and human characteristics of Ohio and the United States.

Fifth Grade Social Studies

Human Systems 7: The variety of physical environments within the Eastern Hemisphere influences human activities. Likewise, human activities modify the physical environment

Next Generation Science Standards:

4-ESS2-2: Analyze and interpret data from maps to describe patterns of Earth's features.



American Innovation

ACTIVITY 6: America the Beautiful

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GRADES
6-8

Extended Learning Questions:

- 1) For a geyser to form, water must first be heated in a hot spring. What is responsible for heating that water below the Earth's surface? How do we know?
- 2) Choose one of the National Parks listed on Pages 23-24. Use the computer to research that park. What geographic features can be found at the park? What animals? What is the climate usually like? Describe the location of the park using latitude and longitude.
- 3) Geysers have plumes of hot water that erupt in through narrow openings. But sometimes, visitors don't take care of those features. What do you think happens when tourists throw garbage or rocks in geysers? How do you think the National Parks can or should stop people from tossing materials into geysers? Do you think it is important to be respectful of nature? Why or why not?
- 4) Geothermal energy makes geysers. It also could be used to produce electricity. Do you think the geysers in Yellowstone should be preserved in their natural state or used for electricity production? Why?

Ohio Learning Standards:

Sixth Grade Social Studies Spatial Thinking Skills 4:

Latitude and Longitude can be used to identify absolute location.

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

Eighth Grade Science 8.ESS.2: Earth's lithosphere consists of major and minor tectonic plates that move relative to each other.

Eighth Grade Science 8.PS.2- Forces can act to change the motion of objects.

Next Generation Science Standards:

HS-ESS2-3 Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.

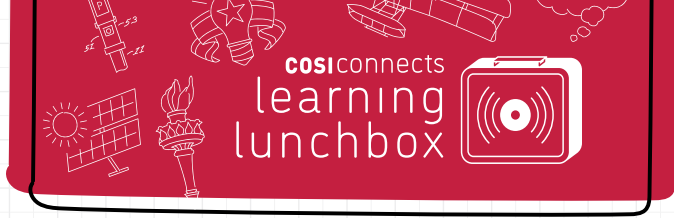


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American Innovation

ACTIVITY 7: Colors of Science

Discover some innovators and inspiring people and make a portrait of someone who inspires you.

Ohio Learning Standards

Kindergarten Social Studies K.HS.2: Personal history can be shared through stories and pictures.

Second Grade Social Studies 2.HS.4: Biographies can show how peoples' actions have shaped the world in which we live.

Fifth Grade Fine Arts 5.4PR: Select and use the elements and principles of art and design to communicate understanding of an interdisciplinary concept.

GRADES
K-2

Extended Learning Questions:

- 1) Think of a cartoon character or superhero that you admire (look up to). What is it about them that you like? Draw a picture or write about them.
- 2) Think of an adult you know that you admire (look up to). What is it about them that you like? Can you name something that they did to help another person? Draw a picture or write about what they did.
- 3) Think of a kid you know that you admire. What is it about them that you admire? Can you name something that they did to help another person? Draw a picture or write about what they did.
- 4) Read Page 4 of the Color of Science Passport, which shares the story of Ruth Graves Wakefield, inventor of the chocolate chip cookie. If you were to invent a new kind of cookie, what would you put in it? How would it be better than other cookie recipes? Does everyone agree on what makes a cookie the best? Optional: with an adult's help, bake the cookie you designed!

Ohio Learning Standards:

Kindergarten ELA 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.

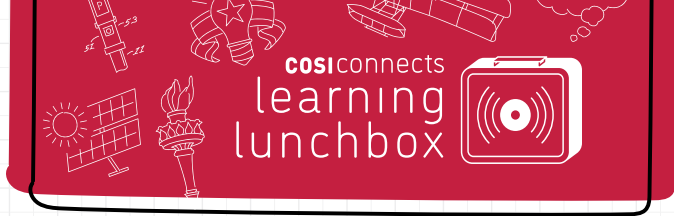
1st Grade ELA W.1.2: Write informative/explanatory texts that name a topic, supply some facts about the topic, and provide some sense of closure.

2nd Grade ELA W.2.2: Write informative/explanatory texts that introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section.

2nd Grade Social Studies Heritage 4: Biographies can show how peoples' actions have shaped the world in which we live.

Next Generation Science Standards:

K-2-ETS1-1: Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.



American Innovation

ACTIVITY 7: Colors of Science

Discover some innovators and inspiring people and make a portrait of someone who inspires you.

GRADES
3-5

Extended Learning Questions:

- 1) Choose one person from your Color of Science passport to research. With an adult's help, use the internet to learn more about them. Find three interesting facts about them. Be sure to write down what websites you used. Then, write a one-paragraph biography of the person. Be sure to include citations for any resources you used. Do you find this person's story inspiring? Why or why not?
- 2) Think of one person you know that you admire (look up to). What is it about them that you like? Can you name something that they did to help another person, group of people, or the Earth? Write a one-paragraph story about what they did. Share your story with others.
- 3) Read the story about Temple Grandin on Page 6 of the Color of Science Passport. Dr. Grandin used her empathy for animals to design more humane centers that treat the animals better. She was able to imagine how the animals might feel and help them to be more comfortable. Think of another thing we could re-design using empathy for animals. How would you re-design that thing? (Hint: you might want to think about pet shops, farms, research labs, or petting zoos).

Ohio Learning Standards:

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

5th Grade ELA W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

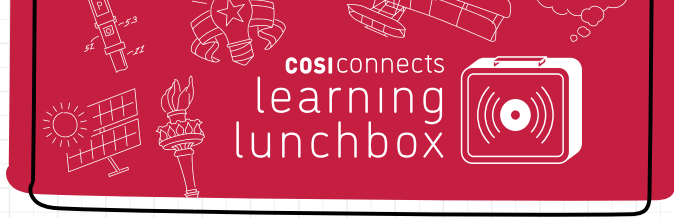
3rd – 5th Grade Technology 3-5.ICT.2.e. Use digital citation tools to cite sources with appropriate guidance.

3rd – 5th 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:

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

3-5-ETS1-2 Engineering Design
Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.



American Innovation

ACTIVITY 7: Colors of Science

Discover some innovators and inspiring people and make a portrait of someone who inspires you.

GRADES
6-8

Extended Learning Questions:

- 1) Choose one person from your Color of Science passport to research. Go online to learn more about them. Maybe you'll learn about where they grew up, what inspired them to pursue their career, or other interesting facts about them. Write a brief biography of the person. Be sure to include citations for any resources you used. Do you find this person's story inspiring? Why or why not?
- 2) Think of one person you know that you admire. Think of a story that illustrates why you admire them. Write a one-page paper telling the story about what they did. Use clear examples from the story to illustrate why you admire them. Share your story with others.
- 3) Read about Josephine Cochrane on page 3 of the Color of Science Passport. Cochrane invented the dishwashing machine to make the chore of washing dishes much easier. Think about one chore or task that you or someone you know has to do. Could you invent a machine or tool to make that chore easier? Write about or draw what you would invent and how it would make the task easier.

Ohio Learning Standards:

6th-8th Grade Technology 6-8.

ICT.2.a. Use advanced search techniques to locate needed information using digital learning tools and resources.

6th-8th Grade Technology

6-8.ICT.2.c. Apply principles of copyright, use digital citation tools and use strategies to avoid plagiarism.

8th Grade ELA W.8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

6th – 8th Grade ELA W.6-8.1

Write arguments to support claims with clear reasons and relevant evidence.

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 ELA W.6-8.3

Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences.

Next Generation Science Standards:

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.



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Glossary:

Geyser – a jet of hot water and steam that bursts from a hole in the ground.

Hot Spring – a place where water, heated by hot rocks underground, comes to the surface in pools.

Innovation – coming up with new ideas or processes.

Invent – to create or design something that didn't exist before.

LED – LED stands for Light Emitting Diode. It is an electronic device that lights up when a current passes through it.

National Park – an area of land protected by the government.

Patent – a certificate that protects an invention or idea. It stops other people from making or selling the ideal without the inventor's permission.

Prosthetic – a human-made body part.

Solar Panel – a technology that turns energy from sunlight into electricity.

Symbol – Something that stands for, or represents, something else. For example, a heart is a symbol for love.

United States of America – a country located mostly in North America. It has 50 states, 14 territories and islands, and 326 Indian reservations within its borders. Washington, D.C. is the capital of the United States of America.