

SCIENCE FAIR CENTRAL

Maker Corner Activity



MAKE AN "UPCYCLED" LAMP

Grades 6-8

MAKE. CREATE. EXPLORE.

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The plastic we discard clutters up the Earth and poses a threat to plants and animals.

Overview

Did you know that we throw away one-third of plastics after only one use?¹

The plastic we discard clutters up the Earth and poses a threat to plants and animals.

Here's the good news—plastic is a highly recyclable material that can be used over and over again. It's great for "upcycling"—taking something that would go into the trash and transforming it into a new useful object. In this activity, students will "upcycle" a bottle and plastic spoons in order to make a pendant lamp. They will learn about electric currents, principles of light, and how recyclable materials can be used in ways they would never expect.

This activity focuses on the creating/prototyping and refining/improving stages of the engineering design cycle. Students will create their own unique "upcycled" pendant lamp, and in doing so, will refine and improve the design by using recycled materials.



This activity focuses on the **Creating or Prototyping** and **Refine or Improve** stages of the Engineering Design Cycle.

Engineering Design Cycle

- Defining the Problem
- Designing Solutions
- **Creating or Prototyping**
- **Refine or Improve**
- Communicating Results

Objectives

Students will be able to:

- **Analyze** how light moves through different materials
- **Apply** that knowledge to create a lamp made of recyclable items, and
- **Evaluate** how their design allows for beautiful and functional transmission of light



A “translucent” object is one through which some light can pass.

Materials

- (1) 3-liter or gallon-sized plastic container (can be a soda bottle or water jug— just make sure that it is transparent or translucent and you can cut through the bottom with a hobby knife!)
- Upcycled Lamp Design student handout
- Division of Labor student handout
- 100-150 white plastic spoons, depending on the size of your container
- (1) hot glue gun
- (1) package of hot glue sticks
- 60-watt eco-friendly light bulb
- (1) hobby knife
- (1) 12ft. white hanging lamp light cord with E26 socket
- (1) pair of cutting pliers
- (1) pencil compass
- 2–3 large clear strip command hooks (3lb or over)



Have you ever wondered . . .

Why light can shine through some materials and not others?

The plastic spoons that you’ll use for this project are translucent—that means that they absorb some light as it passes through, but not all. This is different from transparent materials like glass, which let through all visible light. Opaque items like metal, wood, or stone absorb light and do not allow it to travel through.²

How electricity becomes the light that glows from our lamps?

Believe it or not, sound, light, heat, and electricity are all made of the same thing—waves! The longer the wave is, the slower it moves. Sound waves are long, so they travel much slower than light waves. That’s why we’ll often see lightning before we hear thunder! The shorter the waves, the higher up they are on the electromagnetic spectrum. Electricity is the force we use to convert energy from a power source like wind, water or gas into light. The electricity is created at the power plant and travels through power lines to our homes. When we plug a lamp into an outlet, the metal prongs on the plug act as conductors that allow the electricity to transmit from the wires in our walls to the wires in the lamp. The light bulb then takes that energy and kicks it up a notch so that the buzzing electricity becomes visible light.³

Believe it or not, sound, light, heat, and electricity are all made of the same thing—waves!



How electricity becomes the light that glows from our lamps?

All it takes is a little bit of creativity to take everyday items and transform them into treasures! Recyclable materials like plastic and aluminum are widely used for a reason—they are durable, lightweight, and inexpensive. It takes much less energy to recycle these products than it does to create them or mine them from the ground, and we know that the more energy we conserve, the better it is for Earth. Architects and designers are using recyclable materials in surprising ways. For instance, many playgrounds are made safer because the rubber from shredded sneakers is there to break your fall! This solution is easy on the eyes and great for Earth.⁴

As students build this “upcycled” lamp, think about other materials that that could be used (or re-used!) in order to make unique projects.

Make connections!

How does this connect to students?

You can prevent recyclables from ending up in landfills! More designers and engineers are working to repurpose recyclable materials, and you can do your part by participating in this “upcycled” lamp project. You’ll use the properties of light and some recyclables from your home to make a beautiful pendant lamp.



How does this connect to careers?

Interior designers—Interior designers work with architects, engineers, and customers to make homes and offices look beautiful. They pick out lighting, furniture, colors and materials to ensure that spaces are accessible and easy to use.⁵

Electrical engineers—Electrical engineers develop a variety of electrical equipment, including lights, motors, and even your smartphone!⁶

Electricians—Electricians install and repair the electrical systems that we use every day. They mend power lines, build infrastructure that helps us communicate and keep the electricity in our homes operating smoothly.⁷

How does this connect to our world?

What would happen if just one lamp in each home or office used less power? Homes, offices and commercial spaces are in need of furniture and lighting that is good for the environment, cost effective, and well designed. As you build your pendant lamp, think about how the use of recycled materials and an eco-friendly light bulb protects our environment. How could you replicate this design for larger spaces in order to save money and conserve energy?

Blueprint for Discovery

1. Display a word splash of the following words: recycle, energy, landfill, design. Note: A word splash is a collection of key terms or concepts. The terms represent important ideas in this activity. Organize students in groups of three or four. Ask groups to brainstorm and generate complete statements, which predict the relationship between each term and the broader topic. Groups will revisit these statements at the end of the lesson to make any changes based on what they have learned.

2. Ask students to brainstorm what comes to mind when they hear the word, “upcycle”. Allow 2 minutes for students to share their ideas with a partner.

Ask students to then discuss:

- What are the similarities and differences between your ideas?
- What purpose does upcycling serve?

3. Invite groups to present answers to the questions. Then, explain to students that they will be working as part of a team to design an upcycled lamp. Clarify that upcycling means to take something that would go into the trash, and later to a landfill, and transform it into a new, useful object.

4. Share an image of a [pendant lamp](#) and display the suggested materials for students. Ask students to sketch out ideas of how they could turn the materials into an upcycled pendant lamp design.

5. Distribute the *Upcycled Lamp Design student handout*. Invite students to review the directions and use the *Division of Labor student handout* to divide up roles and responsibilities during the build. Students may have their own ideas to incorporate the materials and the provided directions can serve as a model.

6. Designate at least one area of the classroom for a 60-watt eco-friendly light bulb and 1 12ft. white hanging lamp light cord with E26 socket for students to test their designs as they work.

7. After students have created and tested their designs, ask students to share out the following about their upcycled lamp design:

- How do you feel about your design?
- Did you solve a problem?



- What parts of your design do you like? Dislike? Why?
- What would you do differently next time?

8. Display the word splash again: recycle, energy, landfill, design. Ask groups to summarize the relationship between each term and how it connects to their upcycled lamp design.

Take Action

Expand on your new knowledge of lighting and continue the eco-creativity by exploring these fun activities:

- [Upcycle any remaining plastic spoons with these activities](#)
 - [Stations of Light: Observe how light moves through different materials](#)
 - [Upcycle old egg cartons by making these flower lights](#)
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National Standards

Science

[Next Generation Science Standards](#)

[4-PS3-2 Energy](#)

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

[4-PS3-4 Energy](#)

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

[HS-PS3-3 Energy](#)

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



2-PS1-2 Matter and Its Interactions

Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.*

Technology Education

[Next Generation Science Standards](#)

MS-ESS3-3 Earth and Human Activity

Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*

[International Technology and Engineering Educators Association](#)

Students will develop an understanding of Design. This includes knowing about:

- The attributes of design.
 - Engineering design.
 - The role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
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Mathematical Practice

[Common Core](#)

CCSS.MATH.PRACTICE.MP5 Use appropriate tools strategically.

CCSS.MATH.PRACTICE.MP7 Look for and make use of structure.



Works Cited

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Upcycled Lamp Design

- 1. Use a 3-liter or one-gallon recyclable plastic container in your home.** This can be a water jug or a soda bottle. The container should have a bottleneck in order to keep the lampshade on the light bulb. The container must be either translucent or transparent so that light will shine through.
- 2. Clean and dry the container with soap and water.**
- 3. Hold the container upside down.** Using the compass, draw a circle that is at least 4-6 inches in diameter on the bottom of the container. The size of the circle will depend on the size of your container, but make sure to remove almost the entire bottom of the container. This will allow ample light to shine through and will prevent your lampshade from overheating.
- 4. Using the hobby knife, carefully cut along the circle you traced with the compass.** Remove the cut circle from the container.
- 5. Place the container right side up.**
- 6. Plug in your hot glue gun.** Place a stick of hot glue in the gun and allow it to warm up for about 5 minutes.
- 7. While the glue heats up, use the pliers to cut the handles off of the plastic spoons.** Make sure to leave about ¼" of the handle on each spoon. This is where you'll apply the hot glue.
- 8. Hold a spoon so that the concave side faces you** (that's the part of the spoon that holds the liquid).
- 9. Apply a small amount of hot glue to the small bit of handle left on the spoon.**
- 10. Place the spoon, pointy end facing down, at the bottom of the container.** The concave side of the spoon should be facing away from you. Hold the spoon to the container for a few seconds while the glue cools.
- 11. Repeat steps #9-11 with the next spoon.** Place the spoon right next to the first spoon, leaving as little space as possible between spoons.
- 12. Repeat steps #9-11, gluing spoons to create a ring around the bottom of the container.**
- 13. Once you have glued the first ring of spoons at the bottom of the container, begin the next ring** by placing a spoon slightly above the bottom row so that the pointy end overlaps with the first



row of spoons. This should resemble fish scales or bird feathers. This design helps to cover the transparent parts of the bottle and allows the light to filter evenly through the translucent spoons.

14. **Continue to glue spoons around the next ring of the container.** When you have finished that ring, repeat step #14, continuing to place the pointy end of the next row of spoons on the container in a fish-scale pattern. Continue until you have covered your container in spoons.
15. **You'll now create a ring to cover the bottleneck of your container.** Apply a small amount of hot glue to the pointy end of the concave side of a spoon. Place the back side of another spoon onto the hot glue, overlapping it with the first spoon. You'll want to glue the spoons closer or further together, depending on the size of your container's bottleneck.
16. **Repeat step #16 until you have completed a ring of spoons glued together.**
17. **When your ring is complete, affix it to your container** by applying 4-5 small dots of glue on the top row of spoons. Then, place the ring down on top of the dots of glue. Make sure to hold the ring onto the spoons until the glue dries!
18. **Let your container sit for approximately 30 minutes in order to cool and dry.**
19. **While your container dries, screw a 60-watt bulb into the socket of your hanging light cord.**
20. **When your container is dry, thread your hanging light cord through the bottleneck** so that the light socket rests inside the pendant and the plug comes through the top. Pull the cord until the socket rests up against the bottleneck of the container.
21. **Plug it in and test your pendant!** Take a look—are there any translucent spots or places where the plastic spoons are too opaque and don't let enough light shine through? Add and remove spoons as necessary.



