



Welcome to STEM@Home!

As we maneuver the challenges of the COVID-19 epidemic, we strive to continue to make STEM accessible to all.

The STEM@Home Newsletter is intended to be a resource to provide engaging and educational activities that can be done with minimal materials and a whole lot of imagination.

In this Issue...

Create Your Own Recycled Paper (Grades K-2)

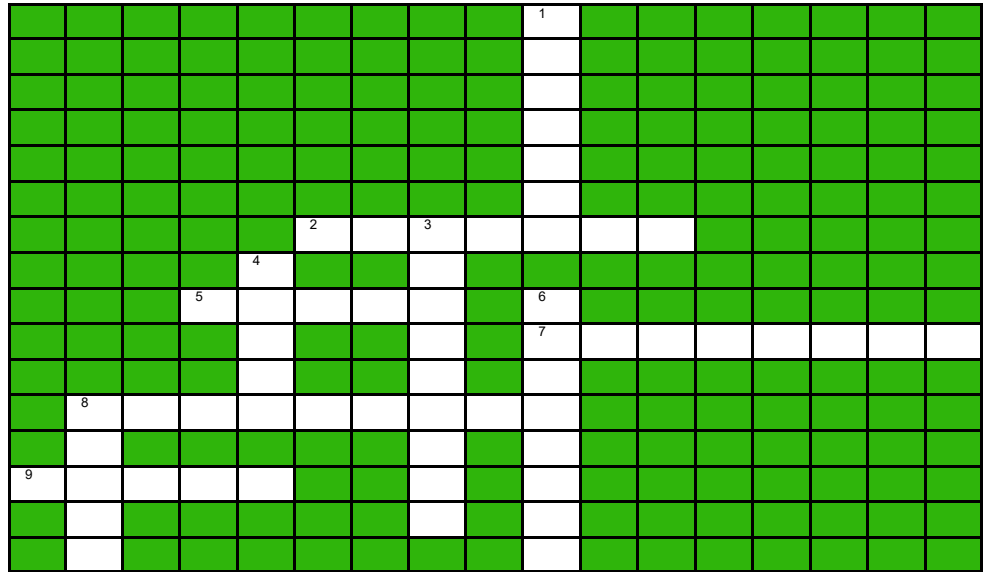
Build a Structure (Grades 3-5)

Landfill Design (Grades 6-8)

Human Impact on the Environment (Grades 9-12)

Issue 9

It's Not Easy Being Green...



Across

- 2. This simple act converts trash into reusable material
- 5. Only 3% of this substance found on Earth is drinkable
- 7. This is a place to dispose of refuse and other waste by burying it and covering it with soil
- 8. This material, commonly used for take out food containers, never decomposes
- 9. Bottles made from this material can take 4,000 years or more to decompose

Down

- 1. Every hour in America, 2.5 million bottles made of this material are thrown away
- 3. The U.S. produces 100 Billion boxes of this material each year
- 4. This recyclable material is made from trees
- 6. Recycling this common soda can material can save enough energy to watch 3 hours of TV
- 8. This type of clean power is drawn from the Sun

Answers on page 4



SHARE YOUR STEM...

Visit the C5ISR Center on Facebook to post a photo or video of your child completing one of the STEM@Home Activities.

<https://www.facebook.com/CCDC.C5ISR/>

#C5ISRCenterSTEM

Creating Your Own Recycled Paper (Grades K-2)



FUN FACT...

Each ton (2000 pounds) of **recycled paper** can save 17 trees, 380 gallons of oil, three cubic yards of landfill space, 4000 kilowatts of energy, and 7000 gallons of water. This represents a 64% energy savings, a 58% water savings, and 60 pounds less of air pollution!

Materials:

- Lid of plastic container to use as a mold
- Fork or hand blender
- Tissue or toilet paper
- Mixing bowl
- Colander/pasta strainer
- Water
- Piece of plastic wrap or parchment paper
- Towels or cloths

Ask an adult to
Share your STEM
on Facebook.

Use
#C5ISRCenterSTEM

The Importance of Recycling

Every day, you and your family use paper products such as newspapers, food packaging, printer paper, napkins, paper towels, and more. Almost half of all the trash produced by humans comes from paper. That is why it is important for engineers to develop new technologies that allow for the recycling of human-made materials, especially paper.

Recycling paper helps us to protect the environment because we will cut down fewer trees to make the paper, and we will reduce the amount of trash being dumped in landfills. How do you recycle paper? Newspaper, cardboard, and paper are put through a process of de-inking, which removes the colors. Next, the paper is mixed with water in a huge blender and then beaten until the paper is broken down into small fibers. Finally, the fibers are pressed onto screens to remove the water and dried to make new paper.

Using just a few materials from home, you will be able to follow a similar process to make your own paper.

Procedure:

NOTE: This project will be very messy. Before you begin, work with a grownup to make sure your worktop is able to get wet and can be cleaned up easily.



1. Prepare the paper mixture: tear 5-6 sheets of toilet paper or tissue paper into small pieces and place them in your mixing bowl.
2. Cover the pieces with water and leave them to soak for 10-15 minutes.
3. **With help from an adult**, use a fork or a hand mixer to combine the water and pieces of toilet paper. Blend the mixture until the paper mixture has turned into a pulp.
4. Pour the mixture into a colander/pasta strainer.
5. Using a towel, press down on the pulp in the colander/pasta strainer to strain out any excess water.
6. Line a plastic lid with a piece of plastic wrap or parchment paper.
7. Use a spoon or your hands to press the paper mixture onto the plastic lid, making a thin layer.
8. Use a towel or cloth to press firmly on the paper mixture to remove any remaining water.
9. When as much water as possible has been removed, take the paper off of the lid and place it on a towel. Ensure you keep the paper as thin and flat as possible.
10. Place the towel with the thin layer of paper in a warm spot, and allow it to dry fully.
11. Once the paper is completely dried, you can write a fun message on it to give to a friend or family member.

Build a Structure Challenge (Grades 3-5)



Materials for Building

| Materials | Cost |
|--------------------------------------|--------------------|
| Water bottle | \$200 |
| Plastic container | \$350 |
| Tape | \$40 for 12 inches |
| Glue | \$50 |
| Popsicle sticks | \$85 for 15 |
| Straws | \$40 for 8 straws |
| Cardboard | \$60 |
| String or yarn | \$75 for 24 inches |
| Paper towel roll tubes | \$100 |
| Aluminum foil | \$180 |
| Paper cup | \$200 |
| 2 cups the same size | \$220 for 2 |
| Rubber bands | \$25 for 3 |
| Material item of choice (not listed) | \$225 |

Ask an adult to **Share your STEM** on Facebook. **#C5ISRCenterSTEM**

Withstanding the Weather

Weather hazards – such as hurricanes, tornadoes, lightning, strong winds, and flooding – can all have a major impact on people and communities by damaging or destroying businesses, schools, and homes. Engineers strive to design structures that can endure these weather conditions and protect the human population. Engineers are constantly designing and testing new technologies for buildings that can better withstand natural disasters. Some of these technologies include roofs, lightning rods, special building structures, and permanent barriers that are placed around the structure of a home.

Mission:

Qualitative Homes Building Company has hired you as an engineer to build a model home with new and improved technology that will be able to withstand strong winds and flooding. You'll need to take into consideration a budget when designing your home.

Requirements:

- You must build a flood-resistant and windproof structure that will slow or stop water from getting in the house.
- You must stay within a budget of \$1,500.
- Test your structure to make sure it can withstand wind by using a fan or hair dryer.
- Test your structure to see if it can slow or stop water from getting inside by placing it in a flat bowl or tub and pouring water around it.

Testing Materials:

- Tub or flat bowl
- Cup of water
- Fan or hair dryer

Design Process:

ASK: What is the problem you need to solve?

IMAGINE: Brainstorm and decide on an idea.

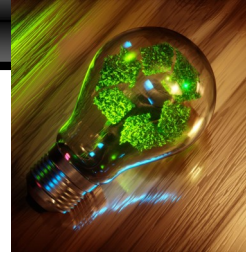
PLAN: Draw a picture of the model of your home and label it with materials you intend to use.

CREATE: Use the materials to build a prototype of your house.

IMPROVE: Test your house structure by placing it in a flat bowl or tub and pouring water around it. Use a fan to test for strong winds.



Landfill Design and Test Challenge (Grades 6-8)



Vocabulary:

Leachate:

Contaminated water that seeps out of landfills and contains high amounts of organic matter and toxic chemicals.

Landfill: An

engineered site used to dispose of garbage by burying it.

Where does all your trash end up?

Household garbage, worn-out tires, sludge from waste-water treatment plants, old couches, and scrap metal all get sent to landfills. When planning a landfill, it must be as small as possible while also being able to hold the largest amount of waste material possible. This is because of economic and environmental constraints. Engineers work with regulators to design landfills that are sufficient for hazardous and non-hazardous waste. The main challenge they face is how to keep the waste materials from being hazardous to nearby cities. To do this, engineers need to ensure the leachate from the landfill does not get into the groundwater, and the landfill is able to withstand extreme weather conditions.

Mission: The Waste Management Landfill Company has hired you as an engineer to design a new landfill in the city of Sunnyville. The landfill must hold hazardous and non-hazardous waste material and be able to withstand erosion from rain, wind, and earthquakes.

Materials:

- Clear plastic tub
- Clay or silty soil from your backyard
- Sand
- Gravel
- Cotton balls
- Water
- Food coloring
- Straws
- Plastic bag or strips of a garbage bag
- Spoon
- Straws
- Small Dixie cups to hold gravel, sand, and dirt
- Watering can or water bottle for "rainstorm"
- Optional – house made out of paper or index cards
- Other materials that you may find useful in your home

Before you begin:

1. Prepare your tub by covering the bottom with a sand or dirt layer to serve as your landscape.
2. Set up a town on one end using small houses or by simply drawing and cutting out houses on paper or index cards. That will represent the population of your city.
3. Prepare your "trash" by mixing the cotton balls, food coloring, and water.

Requirements:

1. Your landfill must be able to hold the most "trash" and be able contain the waste during a rainstorm without allowing leachate to get into the groundwater.
2. You must test your landfill by pouring water (a "rainstorm") over it. Use a pencil or popsicle stick to dig into the sand outside of the landfill and near the town to look for any seeping of food coloring.

Begin your design process:

ASK: What is the problem you need to solve?

IMAGINE: Brainstorm and decide on an idea. What will you use to make sure your landfill does not leak?

PLAN: Draw a picture of your landfill and label the picture with the materials you intend to use.

CREATE: Use the materials to build a prototype of your landfill.

IMPROVE: Test your landfill by pouring water over it to determine if it will be able to keep leachate from running into the groundwater.



Page 1 Puzzle Answer

Across

2. Recycle
5. Water
7. Landfill
8. Styrofoam
9. Glass

Down

1. Plastic
3. Cardboard
4. Paper
6. Aluminum
8. Solar

Ask an adult to
Share your STEM
on Facebook.

Use

#C5ISRCenterSTEM

Human Impact on the Environment (Grades 9-12)

Vocabulary:

Global warming: An increase in the average air temperature of the Earth.

Renewable resources: A natural resource that can be replaced by a natural process.

Nonrenewable resources: A natural resource that cannot be produced, re-grown, or re-used.

Questions to think about:

- What was successful about your design?
- How will your product or device impact the environment?
- What was the most beneficial material in your design and why?
- How would you change your design to make it better?

Building a Better World

Environmental engineering involves using science and engineering concepts to care for and restore our natural environment as well as seek solutions for environmental problems. Air, land, and water quality are all big topics among scientists and engineers. Poor air quality can lead to smog, acid rain, and global warming in addition to causing respiratory problems and other illnesses. Problems with land quality can result from harmful chemicals applied to crops, large landfills, and an excessive use of renewable and nonrenewable resources. Water pollution is caused by toxic substances – such as harmful chemicals applied to crops, sewage, and industrial waste discharge – that seep into large bodies of water. Environmental engineers work to develop solutions for waste disposal as well as air, land, and water quality.

Mission: The U.S. Environment Protection Agency has hired you as an environmental engineer to design a product or device that will reduce air pollution or land pollution in the environment.

Requirements: Using recyclable materials and other items that you find on your own, design a prototype of a product or device that will reduce air, land, or water pollution in the environment.

Design Process:

ASK: What is the problem you need to solve?

-Design a prototype of a product or device that will reduce air, land, or water pollution in the environment.

IMAGINE: Brainstorm and decide on an idea.

-What will your product or device do to reduce pollution in our environment?

PLAN: Draw a picture of your product or device. Label your picture with the materials you intend to use for each purpose.

CREATE: Use the materials to build a prototype of your product or device.

IMPROVE: Think of ways you could improve your product or device.



C5ISR Center STEM Outreach Activities Align with the Next-Generation Science Standards

ACTIVITY ONE: K-ESS3-2 Earth and Human Activity: Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.

ACTIVITY TWO: 3-ESS3-1 Earth and Human Activity: Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. 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.

ACTIVITY THREE: MS-ESS3-3 Earth and Human Activity: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. MS-ETS1-4 Engineering Design: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

ACTIVITY FOUR: HS-ESS3-3 Earth and Human Activity: Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.