C5ISR Center Outreach STEM@Home

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 for our C5ISR Center Family to provide engaging and educational activities that can be done with minimal materials and a whole lot of imagination.

In this Issue…

Issue 6

MAGIC MATH BOX

Instructions:
Complete the grid below so that each number between 1 and 16 appears only once, and so that all rows and all columns have the same sum. The grid has been started for you. Use each of the remaining numbers once to complete the puzzle. (the solution is on the last page)

	13	3	6
7	2		9
14	11		
	8	10	

REMEMBER: The sum of every row and every column is THE SAME

REMAINING NUMBERS:

1, 4, 5, 12, 15, 16

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

Shelter from the Sun Challenge (Grades

Did you know? Light from the sun takes 8 minutes to reach Earth.

Suggested materials for shelter:

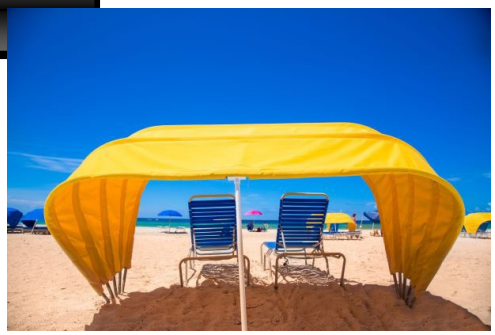
- Pipe cleaners
- Popsicle sticks
- Tape
- Glue
- Construction paper
- Foil
- Cardboard
- Fabric scraps
- Toilet paper tubes
- Paper bag

Questions to think about:

- Was your shelter able to provide shade for your character?
- What could you change to make your shelter better?

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

The Summer Sun...



With summer starting to heat up, it's a great time to think about how we protect ourselves from the summer sun. Energy from the sun warms things up on the surface of the Earth as the sun's energy becomes heat. Of course, how hot something gets depends on if the item is in direct sunlight or if there is any kind of protection in place.

In the summer, many people use items to protect themselves from the sun, such as sunglasses, hats, or umbrellas. When planning to be outside for a long time, many people will make sure there is some shelter or shade where they can cool off. As much as we may love the summer, being able to find some shade keeps us healthy and lets us cool off.

Mission: The mayor of Sunnyville is worried that the people and animals in her town have no place to cool off. She has asked you, her engineer, to create a model of what a sun shelter should look like. Your job is to build a shelter for people OR animals that will protect them from the hot summer sun.

STEP One: ASK: Ask yourself who your shelter is for.

- Decide who or what is going to use your shelter. Is it for children? Grownups? Cats? Dogs? Lizards?
- Once you have made this decision, make or find a model of who is going to use the shelter. You can use a game piece, a small figure, or you can make a model. Use your imagination and know that your model does not need to be an exact size or shape.

STEP Two: IMAGINE: Decide on one idea. What will your shelter look like?

- Now that you know who or what is going to use your shelter, think about what the shelter needs to be useful. For example, would a shelter for cats be different than a shelter for kids? What would be different about it?
- Once you have decided what your shelter needs to be useful, you must also make sure it meets the basic requirements the mayor has given you.
    - **Requirements of shelter:**
        - Your shelter must be at least 5 inches tall and 5 inches wide
        - You must be able to put the model of who is going to use the shelter INSIDE the model of the shelter
        - You must be able to see the model inside of the shelter
        - Your shelter must have a large opening.
        - You cannot use a closed box as your shelter

STEP Three: PLAN: Draw a picture of your sun shelter.

STEP Four: CREATE: Build a model of your sun shelter.

STEP Five: IMPROVE: Think of ways you could improve the sun shelter.

STEP Six: SHARE: Share your shelter with your family and friends.

Make it Melt/Keep it Cool Challenge (Grades 3-5)

Vocabulary:

Conduction: heat transfers between two objects that touch each other.

Convection: movement of a group of molecules such as a warm current of air rising.

Radiation: energy that moves from one place to another.

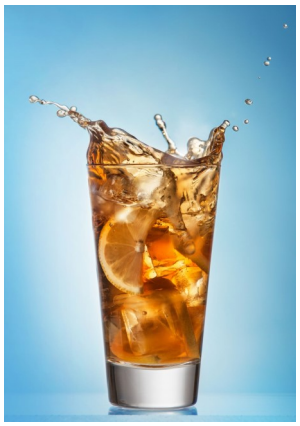
Heat: energy present in the molecules of an object and is affected by the speed of the particles and number of the particles.

Temperature: measure of the average kinetic energy of the molecules in an object.

Suggested materials:

- Two same-sized ice cubes
- Small cups
- Aluminum foil
- Plastic bags
- Pipe cleaners
- String
- Cardboard pieces
- Cotton balls, tissue, or paper towels
- Scissors
- Tape
- Newspaper or construction paper

There is nothing better on a hot day than a cold drink. But have you ever watched ice cubes melt in your drink and wondered how to make them melt slower? Or have you ever had a glass full of ice left after drinking your drink too quickly and have wanted the ice to melt so you can drink that too?



Ice melts when heat energy is lost or transferred. There are three different ways this happens: conduction, convection, and radiation. For example, ice melts when you take it out of the freezer because the air in the room is warmer than the melting point of the ice. Heat in the air causes the ice to melt to a liquid.

Challenge: Design and build two devices for your ice cubes: one that will keep the ice cube cool and one that will speed up the melting process.

Science Fact:

Ice forms when water freezes and has a melting/ freezing point of 0 degrees Celsius or 32 degrees Fahrenheit.

Requirements:

- Both designs must work when placed in sunlight.
- Both designs must fully contain the ice cube with no leaks.
- Both designs must allow quick and easy access to observe changes happening in both designs.
- You will need to keep data on what is happening in both your devices every 5-10 minutes, for a total of 30 minutes.

Real-World Connection: The heating and cooling of buildings uses a lot of energy. Engineers are always looking for ways to reduce heating and cooling demands and to reduce the total amount of energy required. One way they do this is by using insulation. Insulation is used to prevent the transfer of heat. This is what you are doing when you create a device to keep the ice cube from melting by limiting the heat from the sun.

ASK: What is the problem you need to solve?

- Design one device that will keep an ice cube cool and one device that will speed up the melting process of the ice cube.

IMAGINE: Brainstorm and decide on one idea. What will your two devices look like?

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

CREATE: Use the suggested materials to build your devices.

IMPROVE: Think of ways you could improve your device to keep the ice cube cool and your device to speed up the melting process.

Questions to think about:

- What was successful about your designs?
- What was more effective, the keep-it-cool device or make-it-melt device?
- What could you do to improve your designs?

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

Water Wheel Challenge (Grades 6-8)

Vocabulary:

Dam: barrier constructed across a waterway to control the flow of water.

Hydroelectricity: electricity produced by the energy of moving water.

Kinetic energy: energy of motion, for example, a spinning top, falling object, or rolling ball.

Waterwheel: a wheel that rotates by direct action of water that is used to generate power or do work.

Suggested materials:

- Straws
- Wooden skewers or dowels
- 2- 15 cm. Styrofoam plates
- Dixie cups
- Stapler
- Tape
- Toothpicks
- Plastic spoons
- Plastic soda bottle
- Index cards
- Plastic wrap
- Aluminum foil
- String

Materials for testing waterwheel:

- Pitcher filled with water
- Dishwashing tub or bin

Water Power

How can water be used for power? A waterwheel is a simple turbine with buckets, paddles, or blades that uses the kinetic energy of moving water to perform many types of mechanical work.

Waterwheels have been used to power machinery, drive pumps, saw timber, grind corn, forge iron, and power textile mills over the years.

Engineers today develop hydroelectric plants to meet the growing energy demand and use the concept of the waterwheel in dams to generate electricity.

Mission: The hydroelectric plant has tasked you as an engineer to design a waterwheel that uses the force of falling water as the power source. They would like you to build a model that you can use to demonstrate to customers how water power can produce energy.

Requirements:

Waterwheel must rotate when water is poured over the top of it.

Design Process

ASK: What is the problem you need to solve?

- Design a waterwheel that uses the force of falling water as its power source.

IMAGINE: Brainstorm and decide on an idea. What will your waterwheel look like?

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

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

IMPROVE: Think of ways you could improve your waterwheel.

Questions to think about:

- What was the most beneficial building material in your design and why?
- How would you change your design to make it better?
- What is the most beneficial material that you used in your waterwheel?

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

Wind Turbine Challenge (Grades 9-12)

Vocabulary:

Electrical energy: exists when charged particles attract or repel each other.
Generator: a device that transforms mechanical energy into electrical energy.
Kinetic energy: energy of motion, for example, a spinning top, falling object, or rolling ball.

Materials for building:

- Craft sticks
- Index cards
- Paper clips
- Paper or plastic cups
- Rubber bands
- Paper of any type
- Paper plate
- Tape
- Cardboard piece
- Paper plate
- String
- Glue
- Brass fasteners

Materials for testing:

- Fan or hairdryer
- Scissors
- Ruler
- Hole punch

Can we really harness the wind?

As we look at ways to produce clean energy, wind is a source of green power that can be used to make energy in both mechanical and electrical form. A turbine changes wind into electricity by converting it into electrical output. To change the energy of the wind into electricity, the turbine blades spin the hub, which is the center of the turbine. On the inside of the turbine is an electric generator that supplies an electrical output. The rotating action of the hub turns a magnet inside a coil of wire in the generator that produces electricity.

Mission: A new power company has hired you as an engineer to design a wind turbine that can generate the most energy.

Requirements:

- Test your windmill using a fan or hairdryer with at least three trials. Pay attention to how many cycles your blades go for 15 seconds.
- Be able to rotate for at least 15 seconds while staying intact.

Design Process

ASK: What is the problem you need to solve? Design a wind turbine that has the most energy and can rotate for 15 seconds.

IMAGINE: Brainstorm and decide on one idea. What will your wind turbine look like?

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

CREATE: Use the suggested materials to build a prototype of your wind turbine.

IMPROVE: Think of ways you could improve your wind turbine.

Solution to puzzle on pg. 1

12	13	3	6
7	2	16	9
14	11	5	4
1	8	10	15

Questions to think about:

- What was the most beneficial building material in your design and why?
- How fast did your wind turbine move in its fastest trial?
- How would you change your design to make it better?

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

ACTIVITY ONE: K-PS3-1 Energy: Make observations to determine the effect of sunlight on Earth's surface. K-PS3-2 Energy: Use tools and materials to design and build a structure that will reduce warming effect of sunlight on an area. 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.

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

ACTIVITY FOUR: HS-PS3-1 Energy: Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other components and energy flows in and out of the system are known. HS-PS3-3 Energy: Design, build and refine a device that works within given constraints to covert one form of energy into another form of energy.