

'Tis the Season for STEM



**Your guide to fun and
festive family activities**



National Inventors
Hall of Fame®
EDUCATION PROGRAMS



Hands-on Holiday Activities Ahead

Welcome wintertime with exciting, hands-on activities designed to spark creativity and help you bring your ideas to life. This handbook will encourage you to design, prototype and explore STEM concepts, all while celebrating the season.

Before you get started, identify useful resources that will help as you make your way through this guide. Here are a few basic tips as you're setting up:

1. Gather supplies

Once you select an activity, use the “Materials Needed” section to collect your necessary supplies. Basic items are often all that you need to develop big ideas!

2. Start an Inventor Log

Keep a notebook and pencil handy to record observations, make sketches and jot down ideas while working through each of the activities. Keeping a record of discoveries is a fun way to track thoughts and designs.

3. Designate a Creative Space

Think about what kind of atmosphere in your home might spark imagination. Choose a special space to inspire your learning and creativity, and then assemble your supplies here.

Happy hands-on creating!

Your National Inventors Hall of Fame® team



Light Up Rudolph's Nose

What are we learning?

Have you noticed that the word circuit and circle sound alike? A circuit is a circle that allows energy to move freely in it from a power source – like a battery – to an object that is made to work by that power source, like a light bulb, and back to the power source. Many power sources have two sides — a positive side and a negative side.

Electricity always flows through the circuit from the positive side to the negative side. Discovering how to make circuits can power your imagination in so many new ways!



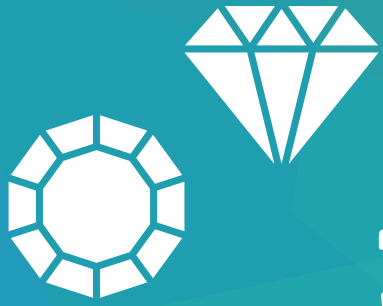
Materials needed:

- Cardboard piece
- Coin battery or AA battery
- Duct tape (optional)
- Electrical tape or masking tape
- Glue stick
- Holiday lights (old)
- Image of Rudolph the Red-Nosed Reindeer

Instructions:

1. Perform an internet-safe search to find a large image of Rudolph the Red-Nosed Reindeer, then print it out.
 - a. Tape the image to a piece of cardboard.
2. With an adult's help, cut the wire on either side of a red bulb on a strand of old holiday lights as close to the neighboring bulb as possible so there is a long length of wire attached to the bulb you will be using.
3. Using your scissors, strip the ends of the wire, removing the rubber casing and exposing the wire strands.
4. Place one exposed wire on one side of a coin battery or AA battery, and the other wire on the opposite end of the battery.
5. Watch the bulb light up!
 - a. If your bulb does not illuminate on the first try, reverse the wires so they touch the opposite sides of the battery they were previously touching.
6. Once lit, secure the wires to the battery using electrical or masking tape.
7. Using your scissors, carefully cut a small hole in Rudolph's nose about the size of your bulb. Then insert the red light in the hole and secure it with tape.
 - a. Congratulations! You just made a circuit to help Rudolph glow!





Create Colorful Ice Jewels

What are we learning?

There are many states of matter, like solid, liquid and gas. The water you placed in the ice cube tray was a liquid. After placing the tray in the freezer, the water molecules slowed down and stuck to each other, forming a solid ice cube and changing state from liquid to solid. Salt and sugar lower the freezing point of water/ice, and when you melt ice cubes, they change from a solid state to a liquid state.

Have you ever been to an ice-skating rink? National Inventors Hall of Fame Inductee Frank J. Zamboni and his brothers were partners who owned an indoor skating rink. To dramatically improve the process of smoothing ice, Zamboni invented and patented an ice rink resurfacing machine. This allowed for an efficient way for skaters to enjoy sleek ice!

Learn more about Frank J. Zamboni here:



Materials needed:

- Bowls (3)
- Cardstock or poster board (optional)
- Digital stopwatch (or other timing device)
- Food coloring
- Ice cube trays (or other plastic containers)
- Paper
- Pencil
- Salt
- Spoon
- Sugar
- Water
- Water balloons (optional)

Instructions:

1. Find an ice cube tray or other small plastic container to make ice cubes, which will serve as your jewels.
2. Prepare your ice jewels by putting water in your ice cube tray.
3. Choose the color(s) you would like your jewels to be, then place a couple drops of food coloring in the water of each section of the ice cube tray.
4. Place your ice cube tray in the freezer and wait until the water is completely frozen.
5. Take the ice cube tray out of your freezer, and you now have ice jewels!
6. Add about four ice jewels in any color to each of the three bowls. Make sure you have the same number of jewels in each bowl.
7. Add a spoonful of salt to one bowl, a spoonful of sugar to the second bowl and add nothing to the third bowl.

The last bowl will be your control in the experiment. A control is the sample that remains unchanged from other variables. In this experiment, the variables are the salt and sugar you added to the other bowls of ice jewels.

8. Start a stopwatch after you have added the salt and sugar to the bowls.
9. Make a prediction, or a guess, about which bowl of ice jewels you think will melt first. Record your prediction on a piece of paper.
10. Check on your ice jewels every 10 minutes and record your observations on the paper.
11. Try doing this activity again choosing different substances to add to the bowls of ice jewels!

Now that you know how to make ice jewels, try these other cool activities!

- If it is snowy in your area, hide your frozen jewels in the snow and have a friend dig for them.
- If it is not snowy in your area, take your ice jewels outside and see how long it takes for them to melt on the sidewalk.
- Use your ice jewels to “paint” on paper. Consider using thick paper like poster board or cardstock if you have it available. Make sure to blot the excess water off the paper when you are done, then hang your creation up to dry.
- If you have water balloons available, add water to the balloons and freeze them. Try making the balloons different sizes to see which size melts fastest when you take them out of the freezer.



Craft Your Own Paper Gift Bags

Note: This activity has many helpful photos in the instructions. See here:

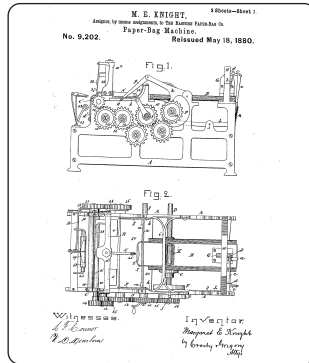


What are we learning?

Thanks to National Inventors Hall of Fame inductee Margaret Knight, flat-bottom paper bags have become commonplace. Prior to her invention, paper bags had to be made by hand, which was an expensive and inefficient process.

With the development of Knight's machine, flat-bottom paper bags could be automatically cut, folded and glued, which allowed them to be mass-produced and replace the less useful V-shaped paper bags. Having created her first invention as a teenager, Knight continued to develop inventions ranging from compound rotary engines to a sole-cutting machine for shoemaking.

Learn more about Margaret Knight here:



Materials needed:

- Bubble solution (optional)
- Glue or transparent tape
- Markers
- Newspaper
- Paper (copy paper works well)
- Paper bowls
- Ruler
- Scissors
- Tempera paint (optional)

Instructions:

1. Creating is fun, but it can be messy, so cover your workspace with newspaper (or other protective material).
2. Place a sheet of paper, or several sheets if you want to make multiple bags, on top of the newspaper.
3. Make some geometric designs on the sheets of paper using your markers.
4. Pour bubble solution into a paper bowl. Then, add a little tempera paint to the solution and stir.
5. Now, blow some bubbles onto the paper. Or, if you'd rather not get too messy, you can trace around circular objects with various markers and have fun overlapping the circles and experimenting with multiple colors.
6. While waiting for the bubbles to dry, try some reverse engineering! Find a flat-bottomed paper bag, like the kind you get at the grocery store. See if you can figure out how it was put together.
7. Once your paper is dry, use your paper folding skills and a little bit of geometry to make your own DIY gift bag!
 - Lay the paper horizontally. Fold your paper into four equal sections.
 - Fold the two outer sections inward toward the center of the paper. Overlap the sections approximately one-quarter inch. Tape or glue these two sections together.
 - Fold the bottom up approximately 2 inches.
 - Gently open the bottom and push in the bottom two corners to create two triangles. The new folded piece should look like an irregular hexagon (a six-sided figure).
 - Hold the top of the hexagon and fold it down halfway. Then, fold the bottom of the hexagon up so it overlaps in the middle. Tape or glue in place.
 - Fold the entire right side of the paper in approximately 1 inch. Then, do the same on the other side.
 - Now, gently open your bag! Push in the middle left fold. Then, do the same for the other side. Crease all the folds.
8. Create other bags by experimenting with the size of the folds and even the size of the paper.
 - Place your gift inside. Fold down the top and you're ready to wrap up the holidays.



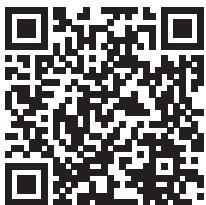
Design a Gingerbread Workshop

What are we learning?

Architects apply mathematics to lay out spaces, and designers use technology to make spaces modular and multifunctional. These are just two simple examples of how STEM is involved in architecture and design.

Few modern products have transformed construction as much as drywall. Drywall is a common material used to make walls in homes, stores, hospitals and other buildings. Sackett Board, the prototype for drywall, was patented by National Inventors Hall of Fame Inductee Augustine Sackett. The evolution of Sackett's invention shaved weeks off the time needed to finish a building and made building homes more affordable.

Learn more about Augustine Sackett here:



Materials needed:

- Edible building materials (like gingerbread, graham crackers, icing, etc.) or nonedible building materials (such as recyclables, craft supplies, scissors, glue or tape, etc.)
- Graph paper
- Pen or marker
- Pencil
- Plain paper
- Ruler

Instructions:

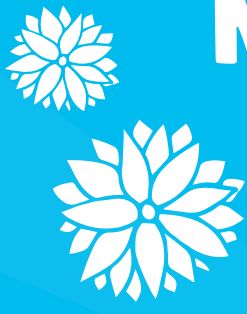
1. Draw a plan for your workshop with a pencil and plain paper. Make your sketch as detailed as you want!
 - How many rooms will it have?
 - How much space will you need in each room?
 - Might you use design layouts from an online search or a book as reference?
2. Draw the layout of your structure on graph paper using the lines to make it precise.

You can print out graph paper using this link:



- Follow a line on your graph paper to make your first wall and count how many boxes you included.
 - To make other walls the same size, draw them using the same number of boxes.
 - Change the number of boxes to make a wall smaller or larger.
3. Now that you have a blueprint, you can decide what materials you want to use to make your 3D model.
 - Will you use graham crackers and icing to build the frame?
 - Might you team up with an adult for help with putting your gingerbread walls together using icing as glue?
 - How might you use recyclables and craft supplies to make your frame?
 4. Keep on building! Your materials might help you push your workshop design beyond its original frame.





Make Your Own Holiday Gifts

Note: This activity has many helpful photos in the instructions. See here:



What are we learning?

A poinsettia is a tropical plant that is native to Mexico. Contrary to popular belief, the leaves are the red portion of the plant and the flowers are the yellow-appearing “seeds” in the middle. To achieve this color, poinsettias are placed in a dark room for weeks. The lack of light causes their leaves to respond and change from green to red.

National Inventors Hall of Fame inductees Sylvia Blankenship and Edward Sisler made groundbreaking improvements in the plant industry. They identified a compound that helps keep plants fresh once they have been harvested, meaning that plants can be picked and shipped long distances without spoiling.

Learn more about Sylvia Blankenship and Edward Sisler here:



Materials needed:

- Buttons (yellow used in the example below)
- Glitter and other decorative materials (optional)
- Glue (hot glue is recommended)
- Paint (red used in the example below)
- Paintbrush, small
- Paper tube (e.g., paper towel or toilet paper tube)
- Scissors
- String or ribbon
- Tissue paper (green used in the example below)

Instructions:

1. Take a paper towel or toilet paper tube and cut off six rings or petal-shaped pieces.
2. Paint all six pieces and let them dry completely.
Dip them in glitter before they dry for some extra sparkle!
3. Glue the bottom edges of five of the painted pieces together to create a flower shape.
4. Take the remaining sixth piece and cut it in half.
5. Glue the bottoms together to create two small petals.
6. Add the two new petals to your flower.
7. Take two (or more) small scrap pieces of tissue paper and glue them between a few petals.
8. Glue the buttons in the middle.
Can't find buttons in the color you want? Take the buttons you have and paint them!
9. Tie a piece of string or ribbon around a petal so it can be hung.
10. Consider giving your craft to someone else to brighten their day!





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