In the Passport section . . .

Track your exciting journey in STEM!

Get your passport stamped when you:
- Participate in STEM Pathways experiences.
- Reflect about your STEM Pathways experiences.
- Think about your future in STEM.
My STEM Pathways Experiences
My STEM Pathways Career Log

What do YOU want to do? YOU can do anything!

You will learn about many different STEM careers through your STEM Pathways experiences.

Track the careers that are most exciting to YOU!

Name of Career:

What do you find interesting about this career?

What questions do you have about this career?

Name of Career:

What do you find interesting about this career?

What questions do you have about this career?

Name of Career:

What do you find interesting about this career?

What questions do you have about this career?
STEM Reflection - The Bakken Museum

What do you remember about your experience with The Bakken?

I will always remember . . .

because . . .

What was your favorite part of doing STEM with The Bakken?

My favorite part of doing STEM with the Bakken was . . .

What is something new that you learned with The Bakken Museum?

Why do you think your teachers wanted you and your class to visit the Bakken Museum?

Describe a career you learned about at The Bakken Museum.
STEM Reflection - The Works Museum

What do you remember about your experience with The Works?
I will always remember . . .

because . . .

What was your favorite part of doing STEM at The Works?

What is something new you learned at The Works?

How do you think The Works experience will help you in 4th grade and in your future?

Why do you think your teachers wanted you and your class to visit The Works?
I think my teacher wanted me to experience The Works because . . .
What do you remember about your experience at STARBASE Minnesota?

What was your favorite part of doing STEM at STARBASE Minnesota?

What is something new you learned at STARBASE Minnesota?

I learned . . .

Describe a STEM career you learned about at STARBASE Minnesota.

I think . . .

What are some skills you learned or practiced at STARBASE that could help you in this career?
Scientists use a creative process to ask and investigate questions about the world around them.

Describe a process you used during your STEM Pathways experience.


How did you use technology, engineering, or math in this process?

<table>
<thead>
<tr>
<th>Science</th>
<th>Technology</th>
<th>Engineering</th>
<th>Math</th>
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Draw a picture of a process you used as a scientist during your STEM Pathways experience. Label the parts of your process.
Technology in STEM Pathways

What do you think about when you read the word technology?

When I read the word technology I think about . . .

Sometimes we think technology is only things like cell phones and computers. Technology can be so many things! Technology can be anything we create to meet a need or want.

How did you use or observe technology during your STEM Pathways experience?

Draw a picture of two examples of technology from your STEM Pathways experience. Make sure at least one example is something that doesn’t have batteries, a cord, or a screen!

Technology Example 1

What did you draw?

How is this an example of technology?

I drew . . .

I think this is technology because . . .

Technology Example 2

What did you draw?

How is this an example of technology?

Why do you think technology is important to the other parts of STEM?

Science
Technology
Engineering
Math
Engineering in STEM Pathways

Engineers are inspired to make things better. They identify problems and then work to design a solution to meet human needs and wants.

Think about an engineering problem you learned about or solved during your experience. Describe the problem below.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Draw a picture of the idea, invention, or solution that solved this problem.

As an engineer, what inspires you? Describe a problem you would like to solve.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

How did the other parts of STEM help you to be a successful engineer?

Science
Technology
Engineering
Math
Math in STEM Pathways

Math is a vital tool for scientists and engineers as they work to answer questions and solve problems.

How did you use math during your STEM Pathways experience?

<table>
<thead>
<tr>
<th>Describe the math skills you used.</th>
<th>How did this math help you learn something new or solve a problem?</th>
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</table>

How do you think you will use math in future STEM experiences?

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
In the Activities section . . .

Showcase how you do STEM!

To earn stamps, complete the activities from STEM Pathways partners, do STEM in school, or do STEM on your own. Add your own STEM pages to this portfolio!
Think Like an Engineer

As an engineer, it is important to know why different parts are included in a design.

**Why do you think the electromagnet needs a battery?** I think the electromagnet needs a battery because . . .

**Why do you think the electromagnet uses an iron nail?** I think . . .
My Questions

1. How many paperclips can you pick up?
2. Is your Bakken magnet or your electromagnet stronger?
3.
4.
5.

Choose a question from above that interests you. What investigation can you do to answer your question? Describe your investigation below.


Did you try your experiment? If so, share your results here. If you didn’t try your experiment, use the space below to predict what you think would happen if you did.


Congratulations! You created an electromagnet!

Think like a scientist! Look at your your electromagnet.

How strong is your magnet?
Is your Bakken magnet or your electromagnet stronger?
What else do you wonder about the electromagnet?

Brainstorm some of your questions below.
Butter Races

Heat moves, or transfers, through some materials better than others. **Conductors** transfer heat quickly. **Insulators** transfer heat slowly.

Question: Which types of materials are conductors and which are insulators?

**Materials Needed:**
Using these materials you can decide which types of materials are conductors and insulators of heat.

- butter
- wooden craft stick, metal spoon, plastic spoon
- glass of hot water

Set up your experiment:
1. Place the craft stick, plastic utensil, and metal utensil in a line on your table.
2. Put a pad (small amount) of cold butter on each item, about 1 inch from the top of the handle.

Think about the question: Which materials are conductors and which are insulators of heat?
*Hint: If a material is a conductor of heat, will it get hotter faster or stay cooler longer?*

Make a prediction. What will happen when you put the craft stick and spoons into hot water? *Which pad of butter will melt the fastest? I think . . .*

Conduct your experiment: Fill your glass with hot water. Carefully place all of the items into the water and observe. Keep the handles and butter out of the water!

Share Your Results!
Which material was the best conductor of heat?

Which material was the best insulator of heat?

Think about the materials you tested and answer this question. You need to stir a large pot of hot soup. *Which type of spoon would you use, a wooden, metal, or plastic spoon? Why?*

*I would use a . . .*
Soaring

Engineers are inspired to make things better.

What’s the Problem?
The standard glider flies well, but how can you make it fly farther?

Explore
Build the standard glider and test it, making observations about its flight.

You Need:
straws, paper, tape, and a ruler

Build and Test the Standard Glider

1. Cut one long strip of paper and one short strip of paper.
   - 30 cm
   - 20 cm

2. Tape the paper to make two loops, a big loop and a small loop.

3. Tape a loop to each end of the straw.

4. Try It Out!
   Fly your glider, throwing it with the small loop forward.
   Measure the distance.
   My glider flew _____________.

Be the Engineer!

How can you redesign your glider to fly a greater distance?
Before redesigning the glider, experiment with changing different parts.
Change one thing about the glider at a time and test the glider.

Ideas: move loops, add loops, take away loops, add straws

<table>
<thead>
<tr>
<th>Variable</th>
<th>How did this change affect the flight of the glider?</th>
</tr>
</thead>
<tbody>
<tr>
<td>What one thing did you change?</td>
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</tbody>
</table>
Create, Try it Out, and Make It Better!
Build another glider according to your plan and test it, comparing your new glider to the standard glider. Keep redesigning and testing your glider until you have created a glider that flies a greater distance than the standard glider.

How did you design your glider to fly farther than the standard glider? What helped your design?

Redesign
Think about what you learned as you changed parts of your glider. How can you design a glider to fly farther than the standard glider?

Sketch your glider design here.

What inspires the engineer inside you?
Think about your everyday life and the things you use each day. What would like to redesign? How would you make it better? I want to redesign . . .

because . . .

I would make it better by . . .
Program a Person

Technology exists in many different forms. One form of technology is robotics. A robot follows a process, or program to complete a task. Design a program for a person to follow to complete a task.

Gather Your Materials

- two friends
- blindfold

Define the Task

Program a person to travel from _______________________ to _______________________.

Test the Program

Put the blindfold on your friend, spin them three times, and tell them the program one step at a time.

Rewrite the Program

Did your program work well? How can you make it better? Edit the steps to your program and ask the other friend to test it.

Write Your Program - List the steps your friend must follow to travel from one spot to another.

1.
2.
3.
4.
5.
6.
7.

Use more paper if needed.

Analyze Your Program

Describe the improvements you made to your program and why.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
**Program a Rover**

Write a program to make a rover travel the path below!

- Move Forward 60 cm
- Move 45 cm
- Turn Right 15°
- Move 80 cm
- Turn Left 90°
- Move Forward 135 cm
- Turn Right 120°

### Step 1 - Fill in Missing Data

Use the data provided to predict the distance the rover will travel at 1, 3, and 5 wheel rotations. Fill in the table and create bars on the graph.

<table>
<thead>
<tr>
<th>Rover Wheel Rotations</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>30 cm</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>60 cm</td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

### Step 2 - Write the Program

Use the graph to predict the rotations needed to travel the required distance. Write the predicted rotations here!

- Distance = 60 cm
  - Left Turn
  - Move Forward
- Distance = 45 cm
  - Left Turn
  - Move Forward
- Distance = 80 cm
  - Left Turn
  - Move Forward
- Distance = 135 cm
  - Left Turn
  - Move Forward

How would your program change if you put larger wheels on your rover? ____________________________
________________________________________________________________________________________
________________________________________________________________________________________
The Game of STEM is a fun way for you to track the STEM you do throughout the school year as part of the STEM Pathways experiences, in your classroom and on your own. As you participate in STEM, your teacher will stamp your Game of STEM board with a STEM Pathways stamp. You can receive stamps for your STEM Pathways experiences, completing activities in this binder, or any other STEM stuff you complete in or out of school that your teacher wants to recognize. As you receive stamps on your board, you can total your points and increase your level of STEM. As you increase your levels of STEM, you'll earn certificates and other recognition from your teacher. Good luck and have fun this year in STEM!
How far will you go on your STEM Pathway?

Think about the STEM experiences you have participated in at school. Describe or draw a picture of your favorite one.

Whenever you reach a STEM Points square, calculate the total STEM Points you've earned. You earn 50 points per stamp.
Google Earth has a ruler you can use to measure distances in a variety of units such as meters, kilometers, and miles. You can also measure in smoots. A smoot is a unit of measurement created by Oliver Smoot. The length of a smoot is the same as Oliver Smoot’s height. He used his own body to create a unit of measurement. He and his friends measured the entire length of the Boston Bridge in smoots.

Use yourself, or a part of your body, as a unit of measurement. Measure the length or distance of things in and around your house, neighborhood, or school.

1. What did you use as a unit of measurement? ___________________________________

Use yourself, or a part of your body, as a unit of measurement. Measure the length or distance of things in and around your house, neighborhood, or school.

1. What did you use as a unit of measurement? ___________________________________

<table>
<thead>
<tr>
<th>What did you measure?</th>
<th>Measurement (label the units!)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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<td>2.</td>
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<td>3.</td>
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</table>

Earn STEM Points for completing this activity!
One of the keys to a successful future is a great career. The best careers are built on what you already enjoy. Think about your STEM experiences this year.

What did you enjoy the most?

Draw a picture or describe your best STEM experience of the year.
Some of the most exciting technology is in the form of apps for a phone, tablet, or computer. Do you have an idea for the next great app?

**What is the goal of your app?**

**Who will the audience be? Who do you think will buy it?**

**Describe how your app will work.**
The Game of STEM

I have started my Game of STEM at Level 1!

Level 1
0-999 points

Level 2
1,000-1,999 points

I reached Level 2 on
date:__________

Level 3
2,000-2,999 points

I reached Level 3 on
date:__________

Level 4
3,000-3,999 points

I reached Level 4 on
date:__________

Level 5
4,000 points and above

I reached Level 5 on
date:__________