

Name \_\_\_\_\_

# WORK AS A TEAM

The key to a successful project is teamwork! Get ready for the **eCYBERMISSION** by responding to the scenarios below, then create your own team plan.



## PART A: Read and Analyze

► **SCENARIO 1:** Paulo, Kayla, and Ben are collaborating on their project. They decide that Paulo will take meeting notes, Kayla will be the meeting leader, and Ben will gather the materials they need. Through their discussions, they discover that Kayla is a good artist, Ben is a computer whiz, and Paulo is comfortable making presentations in class. They use these strengths to assign tasks in their group.

1. How is the team demonstrating teamwork?
2. What strengths do the people on your team have?

► **SCENARIO 2:** Britney, Jamaal, and Lucia have been working together for several weeks and have set deadlines for each team member to meet. But Lucia has a cold and doesn't feel well enough to finish her tasks this week. She texts Britney and Jamaal to let them know, and the three team members make a plan for dividing up her work.

1. How is the team demonstrating teamwork?
2. What would you do if your team faced this problem?

► **SCENARIO 3:** Tasha, Xavier, and Anthony are planning their project. Tasha and Xavier agree on the topic, but Anthony wants to investigate something else. The three team members argue until Anthony gives in. Tasha and Xavier schedule their next meeting without telling Anthony.

1. How could the team handle this situation differently to promote teamwork?
2. What would you do if your team faced this problem?

## PART B: Your Turn

On a separate sheet, develop and write a team working agreement. Make sure to include:

- How your team will share responsibilities
- How your team will communicate
- How your team will handle any problems that arise

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# READY, SET, BRAINSTORM

The first step in developing your Mission Folder for the competition is to come up with possible topics as a team, then do research.

## PART A: Brainstorm

What area will your team focus on? Circle one.

Alternative Sources of Energy      Environment

Food, Health & Fitness      Forces & Motion

National Security & Safety      Robotics      Technology

Now consider how it affects your community. On a separate sheet of paper, write down as many problems as you can think of that are related to your chosen subject.

Finally, circle the three problems that you are most interested in exploring.

## PART B: Research

Have each group member choose one issue to research. Create a chart like this one to record your answers.

**MEET THE GREEN TEAM!** A team of three middle school students are entering the eCYBERMISSION competition. They're focusing on environmental issues in their town, so they named themselves the **Green Team**. They brainstorm a big list of issues, then each team member chooses one to research: Quan selects flood prevention, Aaliyah picks reducing water pollution, and Matt picks air quality.



PROMPT	NOTES	SOURCE
What is the issue?		
Who is affected by this issue?		
Where can you observe this issue?		
When did it start?		
Why is this issue important?		
How have people tried to address this issue?		

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# CREATE A PROBLEM STATEMENT

The next section of the Mission Folder is called the Problem Statement section. If you choose the **scientific inquiry** path, your team will develop a question you hope to answer. If you select the **engineering design** path, your team will identify a specific problem you hope to solve.

## PART A: Choose Your Focus

1. What is the **issue** we chose? \_\_\_\_\_
2. What specific **topic within that issue** will we focus our project on? \_\_\_\_\_

## PART B: Research

Conduct research to learn more about your problem and how people have tried to address it before. Take notes on **innovations** that engineers have tried or **experiments** that scientists have conducted. Compile a list of at least 10 different sources from your research. Sources include books, periodicals (magazines and journals), websites, and experts.

## PART C: Choose Your Path

Now that you know more about your topic, which path will you choose for your project?

- ☐ **Scientific inquiry** (conducting experiments)
- ☐ **Engineering design** (building a prototype or model)

## PART D: Ask Your Question **or** Identify Your Problem

- ★ For **scientific inquiry**, you should establish the **question** your team hopes to answer through investigation.
- ★ For **engineering design**, you should state the specific **problem** your team hopes to solve through engineering.

### Some ideas to get you started:

- ★ For **scientific inquiry**: What are the effects of...? Which type of...? (Consider words like “prevent,” “identify,” “analyze”...)
- ★ For **engineering design**: We want to reduce... (Consider words like “construct,” “design,” “prototype,” “model”...)

## OUR QUESTION OR OUR PROBLEM TO SOLVE:

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**SEE IT IN ACTION** The Green Team selects water pollution as their topic. They decide to pursue the *scientific inquiry* path and narrow their question to: Which type of herbicide will be most effective in controlling weeds while also reducing the level of harmful chemicals in the local water supply? Another team, the Food Waste Warriors, decides to develop an *engineering design* project. They define this problem: We want to address the problem of food waste and illness due to spoiled food.

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# PLAN YOUR DESIGN

Ready to continue the **engineering design process**? It's time to create a prototype, or working model, of your solution.

## PART A: Design a Prototype

1. What **criteria** (requirements) does your solution need to meet to be successful?
2. What **constraints** (limitations) do you have?
3. As a team, brainstorm prototype ideas. Be specific about how each one would work. Then copy and complete the below chart to decide whether each idea meets your criteria and constraints.



	MEETS REQUIREMENT 1	MEETS REQUIREMENT 2	MEETS REQUIREMENT 3
Prototype Idea 1			
Prototype Idea 2			

Now choose the prototype idea that best meets your team's requirements.

## PART B: Prepare to Build

1. **Sketch a diagram** of your team's design and discuss how it will function. Label each part carefully.
2. **Identify all of the materials** you will need to build a working model of your solution. Don't forget to list any tools you will use.

**TIP:** Remember that the engineering design process is a cycle—you'll be able to revise your design after you start building!

**MEET THE FOOD WASTE WARRIORS!** For their eCYBERMISSION entry, Richie, Deja, and Monica are building a device that will alert people when food is about to spoil. They brainstorm a few ideas for how to build their prototype using different materials and approaches. Then they compare their ideas with their requirements list (criteria for success as well as constraints). One prototype idea meets all the requirements, so they get to work sketching it and gathering their materials.

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# CONDUCT A SAFETY CHECK

Before you start your experiment, be sure you're following the competition and safety guidelines. Then review this list again before you submit your project.

## PART A: RULES

1. Have you reviewed the eCYBERMISSION Rules and Guidelines ([bit.ly/eCYBRules](https://bit.ly/eCYBRules))? What questions do you have?

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## PART B: SAFETY

2. Did you work with your Team Advisor to identify possible risks in your project and complete the Risk Assessment Form ([bit.ly/eCYBRisk](https://bit.ly/eCYBRisk))?
3. Does your project involve any hazardous:

☐ Chemicals? \_\_\_\_\_ ☐ Activities? \_\_\_\_\_

☐ Devices? \_\_\_\_\_ ☐ Biological agents? \_\_\_\_\_

4. Describe the safety precautions you will follow while working on your project.

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## PART C: ETHICS

If your project involves humans (including if you conduct a survey) or animals, you'll need to have the risk evaluated by a committee called an Institutional Review Board (IRB).

5. Does your project involve testing humans (including conducting a survey)? \_\_\_\_\_

6. Does your project involve testing animals? \_\_\_\_\_

7. If yes, do you have IRB approval for your project ([bit.ly/eCYBIRB](https://bit.ly/eCYBIRB))? \_\_\_\_\_

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# BUILD YOUR VISION

The next step in the **engineering design process** is to create your prototype and make revisions to your design.

## PART A: Build

1. Use your design to build your prototype. As part of the process, make any necessary adjustments to the design.
2. As you build your prototype, write down the steps you take.
3. Did you make any adjustments to your original plan while building? Why or why not?

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4. What safety precautions did you follow while building your prototype?

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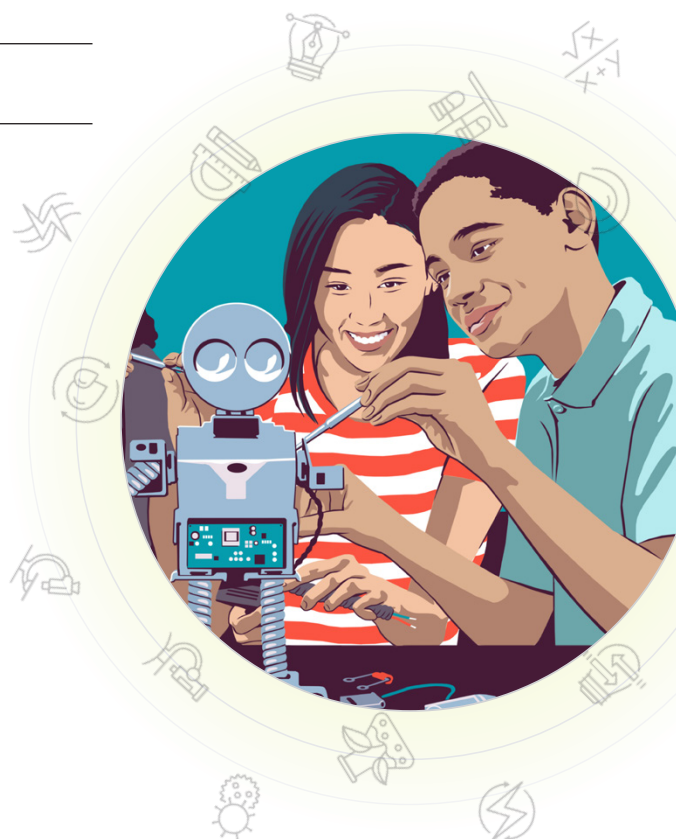
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## PART B: Prepare to Test

Write the procedures for testing your prototype on a separate sheet of paper. Be specific, so that someone else could follow your instructions. Make sure to:

- ☐ Include a plan for collecting your data and making sure your results are reliable.
  - ☐ Include any safety precautions.
- ★ Remember that the engineering design process is a cycle—you may want to repeat some of the steps as you improve your design!

**SEE IT IN ACTION** The Food Waste Warriors make a safety plan, then start building a working model of a sensor that alerts people when fresh food is about to go bad. They follow their diagram, but some of the parts don't fit, so they make adjustments along the way. Then they make a plan to test the sensor to make sure it will work with different foods and in different refrigerators.



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# TEST, ANALYZE, IMPROVE

Continue the **engineering design process** by testing, then dive into the data.

## PART A: Test and Collect Data

1. What will you need to measure as you test your solution?

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2. What other observations will you need to record?

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3. Create a chart like the one below to record your data from each trial.

	TRIAL 1	TRIAL 2	TRIAL 3
Measurement 1			
Measurement 2			

**SEE IT IN ACTION** The Food Waste Warriors use their device to measure the amounts of moisture and chemicals released by food that is about to spoil. They test the device in multiple *trials* and record the measurements in a data table. They find that their device was reliable at detecting fruit that was about to go bad, but not meat.

4. Now test your prototype! Be sure to test it in as many situations as you can think of.

## PART B: Analyze and Draw Conclusions

1. Which visual representation will work best with your data? Create it!

bar chart

line chart

diagram

infographic

other: \_\_\_\_\_

2. Based on your tests, did your design address the problem you set out to improve?

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3. Was there an issue with a part of the design or the entire design? Which part?

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4. What improvements will you make to your design before you test again?

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# FIND SOURCES OF ERROR

Every engineering design model has errors—but this isn't the same as making a mistake! Learn the common types here.

## PART A

Review the chart below, then respond to the questions.

TYPE OF ERROR	CHARACTERISTICS	EXAMPLES
Systematic Error	<ul style="list-style-type: none"> <li>★ Predictable (repeated)</li> <li>★ Affects how accurate a measurement is (accurate = how close it is to the real value?)</li> </ul>	<ul style="list-style-type: none"> <li>★ Instrument is old or not calibrated</li> <li>★ You only survey a very small group of people</li> </ul>
Random Error	<ul style="list-style-type: none"> <li>★ Not predictable</li> <li>★ Affects how precise a measurement is (precise = same result with multiple measurements)</li> </ul>	<ul style="list-style-type: none"> <li>★ A reading on a scale fluctuates</li> <li>★ You estimate a measurement when it falls between two markings on an instrument</li> </ul>

1. After the first set of trials, Richie realizes that the moisture sensor is not calibrated correctly. All of the readings are 1% higher than they should be. What type of error is this? \_\_\_\_\_
2. When Deja is testing the device, she notices that the reading for the level of a chemical fluctuates between two quantities. What type of error is this? \_\_\_\_\_
3. When Monica is testing the device, she accidentally knocks one of the wires out of place so the device's alarm does not sound. What type of error is this? \_\_\_\_\_

## PART B

Copy this chart on a separate sheet and fill it out to summarize the sources of error in your project.

TYPE OF ERROR	EXAMPLES IN OUR PROJECT
Systematic Error	
Random Error	



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## WRAP IT UP

Now that you're finished, it's time to explain how your solution will help your community—and complete your Mission Folder to enter the competition.

### PART A: The Last Step

**What Is the Community Impact?** ➡ Your audience will want to know how your findings or innovation help people. Use these prompts to brainstorm your message.

PROMPT	NOTES
Who would use your findings or innovation (families, students, small business owners, etc.)?	
How will your findings or innovation help the community?	
Is anyone in the community left out of your findings or innovation? What can you do about this?	

### PART B: Ready to Submit!

**Mission Folder Questions** ➡ Scientists and engineers share their findings in many ways—through articles, posters, reports, and social media. Your team will communicate your results by submitting your Mission Folder.

Use your notes and charts to make sure that your team responds to all the Mission Folder questions.

- ★ If you design an experiment, use the Scientific Inquiry questions ([bit.ly/SIquestions](https://bit.ly/SIquestions))
- ★ If you build a prototype/model, use the Engineering Design Process questions ([bit.ly/EDPquestions](https://bit.ly/EDPquestions))

### MISSION FOLDER CHECKLIST

- ☐ Our explanations are clear and complete. Someone who was not involved in our project can understand them.
- ☐ We have used visuals to help our audience understand our project. For example, we included labeled diagrams, graphs, and/or charts.
- ☐ We connected our project to the original problem facing our community.
- ☐ We used the correct scientific terms when describing our process and results.
- ☐ We checked our spelling and grammar to make sure our responses are polished and easy to understand.