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

Name _____

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.

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.

PART B: Research

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

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?		

Name _____

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"...)

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.

OUR QUESTION OR OUR PROBLEM TO SOLVE:

_____

_____

Name _____

DEVELOP YOUR HYPOTHESIS

Ready to dive into scientific inquiry? It's time to develop a hypothesis, or a prediction statement that you will test.

PART A: Read and Analyze

1. An **independent variable** is what **you** change during an experiment. (Always test only one independent variable at a time.) What is the Green Team's independent variable?

_____

2. A **dependent variable** is what changes **as a result** of changing the independent variable. What is the dependent variable in the Green Team's hypothesis?

_____

3. A **hypothesis** must be able to be tested. Can the Green Team's hypothesis be tested? Why or why not?

_____

_____

_____

_____

SEE IT IN ACTION After conducting research on different solutions to water pollution caused by the toxic runoff of herbicides, Quan, Aaliyah, and Matt decide on a hypothesis: *If we use a vinegar-based herbicide, it will kill weeds equally and as effectively as a conventional herbicide.*

PART B: Write a Hypothesis for Your Project

QUESTION	RESPONSE
Independent Variable: What are we changing?	
Dependent Variable: What are we expecting to change as a result?	
Hypothesis: What is our prediction? If _____ (we do this), then _____ (this will happen).	

Name _____

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)? What questions do you have?

_____

_____

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)?

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.

_____

_____

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)? _____

Name _____

DESIGN YOUR EXPERIMENT

To continue your **scientific inquiry**, test your hypothesis by designing and conducting an experiment.

PART A: Read and Analyze

1. Read the Green Team's approach on the right. Why does the Green Team apply each herbicide to 3 trays instead of just 1?

_____

2. A **control** is a group that receives "normal" treatment during an experiment. What is the control in the Green Team's experiment? Why do experiments need a control?

_____

3. A **constant** is what you keep the same in an experiment. What are the constants in the Green Team's experiment?

_____

4. What is the Green Team's plan for data collection?

_____

SEE IT IN ACTION To test whether a vinegar-based herbicide will kill weeds as effectively as a conventional herbicide, the Green Team has decided to plant nine identical trays of crabgrass. They will use a vinegar-based herbicide on three trays and a conventional herbicide on three trays, making sure to use safety gear. They will not put any herbicide on the last three trays. They will use the same amount of soil for all trays and give all the crabgrass the same amount of sun and water daily. Then they'll measure the crabgrass weekly and record their findings.

PART B: Plan

Now work with your team to justify the procedures for your own experiment. Copy the following chart on a separate sheet and fill it in. Be as **specific** as possible.

- ❑ Include a plan for collecting your data and making sure your results are reliable.
- ❑ Make sure to include any safety precautions.

STEP	WHY IS THIS STEP NEEDED?
Step 1:	
Step 2:	
(Add more rows as needed.)	

PART C: Test

Test your hypothesis by conducting your experiment. Record your data in a table. (Refer to Activity 7: Analyze Your Data for an example data table.)

Name _____

ANALYZE YOUR DATA

After your investigation, it's time to look at the results. Practice by analyzing some of the Green Team's data.

PART A: Read and Analyze

CRABGRASS GROWTH	TRAY 1 (CONVENTIONAL HERBICIDE)	TRAY 2 (VINEGAR-BASED HERBICIDE)	TRAY 3 (NO HERBICIDE)
Week 1	1.2 mm	4.5 mm	5.0 mm
Week 2	1.0 mm	3.8 mm	4.9 mm
Week 3	1.4 mm	4.3 mm	5.0 mm

1. Find the **central tendency** (also known as the **mean**, **median**, and **mode**) of the weekly growth measurements for each tray.

2. Which plant grew the most during Week 1? How do you know?

3. Do you notice a pattern between the independent variable (type of herbicide) and the dependent variable (growth of weeds)? Describe it.

▶ **MEAN:** This is the average. To calculate, add all measurements, then divide by how many measurements there are.

▶ **MEDIAN:** This is the middle value when the measurements are put in order from smallest to largest.

▶ **MODE:** This is the value that appears most often in a data set.

PART B: Your Turn—Collect and Analyze Data

1. What will you need to observe and measure as you test your hypothesis?

_____

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

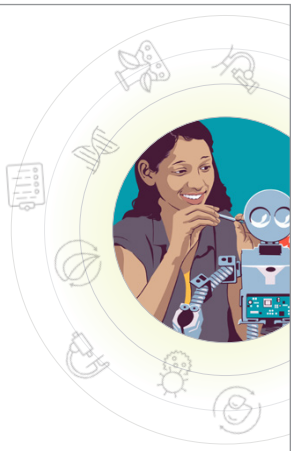
	TRIAL 1	TRIAL 2	TRIAL 3
Measurement 1			
Measurement 2			

3. Using your own experiment, find the measures of central tendency and look for patterns.

4. Circle the visual representation that will work best with your data. Now create it!

bar chart **line chart** **diagram** **infographic** **other:** _____

Name _____



FIND SOURCES OF ERROR

Every **scientific inquiry** experiment has errors—but this isn't the same as making a mistake! Learn the most common types here.

PART A: Read and Respond

TYPE OF ERROR	CHARACTERISTICS	EXAMPLES
Systematic Error	★ Predictable (repeated) ★ Affects how accurate a measurement is (accurate = how close it is to the real value?)	★ Instrument is old or not calibrated ★ You only survey a very small group of people
Random Error	★ Not predictable ★ Affects how precise a measurement is (precise = same result with multiple measurements)	★ A reading on a scale fluctuates ★ You estimate a measurement when it falls between two markings on an instrument

Now help the Green Team figure out the source of their errors:

1. When Aaliyah is measuring a plant, she notices the height falls between the 4.1 cm mark and the 4.2 cm mark on her ruler. What type of error does this cause? _____

2. When Quan is measuring a plant, he notices that the markings on the end of the ruler he is using have worn away. What type of error does this cause? _____

3. When Matt is measuring a plant, he notices that the soil has shifted, affecting the height of the plant. What type of error does this cause? _____

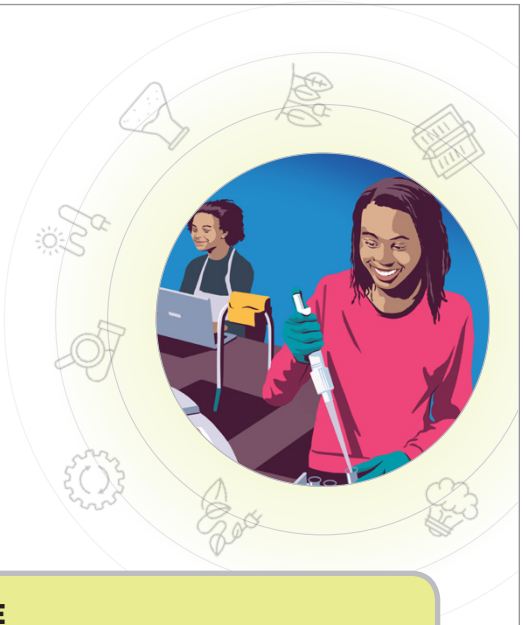
PART B: Your Turn—Check Your Project

Summarize your project's errors on this chart.

TYPE OF ERROR	EXAMPLES IN OUR PROJECT
Systematic Error	
Random Error	

Name _____

DRAW CONCLUSIONS



Almost done! In the final step, connect the dots by analyzing your results.

Draw Conclusions

Now work with your team to draw conclusions from your experiment or model. Copy the chart below on a blank sheet of paper and fill it in. Then, turn your answers into paragraph form.

QUESTIONS FOR SCIENTIFIC INQUIRY	RESPONSE
Did your experiment support or refute your hypothesis? Why?	
What is the relationship between the independent variable and the dependent variable?	
What evidence do you have to support your conclusions?	
Were your results reliable?	
What changes would you make to your experiment in the future?	

QUESTIONS FOR ENGINEERING DESIGN	RESPONSE
Did your testing display that your design fits within your criteria and constraints? Why?	
Does your design solve the problem stated in your problem statement? Why or why not?	
What evidence do you have to support your conclusions?	
Were your results reliable?	
What changes would you make to your design to improve it?	