TECH QUEST

ACTIVITY: PLANET PROTECTORS

For Grades 5-8

TECH Quest is a series of hands-on, challenge-driven STEM learning experiences that encourage young people to investigate real-world problems, explore solutions, and develop their own ideas using technology. Along the way, they build STEM knowledge, strengthen critical thinking and creativity, and develop skills they can apply beyond the activity.

Each activity is a ready-to-use resource for afterschool and summer program educators looking to bring engaging, youth-centered STEM challenges into their learning environments.



STEM NEXT
OPPORTUNITY FUND

TECH QUEST

Planet Protectors

In this lesson, students take on the role of Earth and Space Scientists to explore how scientific discoveries help us understand and protect our planet. They will use creativity, teamwork, and technology tools to communicate their findings effectively.



Big Idea: Space Exploration

Essential Question: How does space exploration assist in protecting Earth's environment?

Key Details

Grade Range	5th-8th
Time Requirement	120-140 minutes (Times are suggested and approximate. Use student engagement and interest to determine the pace of the activity)
Next Generation Science Standards (NGSS)	5.ESS3.C: Obtain and combine information about ways individual communities use scientific ideas to protect the Earth's resources and environment.
Learning Objectives	1. Practice explaining complex ideas in simple ways. 2. Develop research skills. 3. Build communication and digital creation skills. 4. Connect scientific research to real-world solutions.

Preparation	
Materials	• Laptop or tablet • Paper • Pencil • Student Research Log (one per youth) • Video: Surprisingly STEM: Wildfire Aeronautics Researcher
Technologies	• Freeform (vision board, planning and collaboration tool) • Keynote (motion graphic) • iMovie (video or stop-motion)
Setup	• Gather and copy all materials • Preview video
Presentation	Keynote format | Google slides format

Facilitation

Overview:

In this lesson, students take on the role of Earth and Space Scientists to explore how space exploration helps us understand and protect our planet. Using technology and creative tools, students research real-world Earth and space challenges, then design and produce an infomercial explaining the connection between research and real-world solutions using iMovie.

Engage:

1. Ask youth: Who would want to travel into space? Why? Does traveling into space help people here on Earth? Why? Allow time for youth to discuss and explain their positions. Ask for any specific ways space travel could positively impact life on Earth.

2. Have youth watch a few of the video clips about Wildfire Aeronautics Researcher. After watching the videos(s) ask: What problems are these scientists studying from space? Why do they matter to people here on Earth? What are some other ways that viewing the Earth from space helps us? What other problems on Earth that we could better understand or solve by looking from space?

3. Share with youth some examples of the use of satellites to assist in protecting the environment. Have the group sort the examples into one of

two categories: Environmental Protection or Climate and Weather Exploration. Have youth suggest other ideas that fit into these categories.

Investigate:

1. Have youth work in one of two groups, Environmental Protectors or Climate and Weather Explorers to answer the important guiding questions for the project. Below are some example guiding questions but you and the youth in your program may develop more that are specific to your program.
    a. What is the big idea or topic we're exploring, and why is it important in our world today?
    b. What do we already know, and what do we need to find out to better understand this topic?
    c. How does this topic connect to our lives, our community, or our future?
    d. What reliable sources, experts, or tools can help us gather useful information?

2. Once groups have reached a consensus on the guiding questions, they should research and find information to support the use of space exploration as either an Environmental Protector or Climate and Weather Explorer. Have youth use the internet, books, or other resources. Youth should record their findings on the Student Research Log. Stress to youth that they should look for important examples of how space exploration is helping live on Earth now.They should also look for any upcoming space exploration missions that will have an impact on Earth or its environment. Allow 20-30 minutes.

Act:

1. Challenge youth to create an infomercial to explain their findings. Youth should use iMovie to create their infomercials. Limit the length of the infomercial to be 1-3 minutes.

    NOTE: If youth are hesitant to appear on camera for the infomercial, encourage them to use an alternative method such as a stop-motion video, stock photos with voice recording, or make a motion graphic. The linked activities will provide instructions.

2. Allow youth time to create their piece. This should take between 15-20 minutes. If youth need more time, allow them to continue to finish their piece during the following program session.

3. Once all pieces are complete, have each group share their infomercial.

Wrap-up:

Lead a short wrap-up discussion. Ask youth: What was the most interesting thing you learned while researching? How can science and technology help protect our environment?

Extension

Coding Connection:

- Youth will use Swift Playgrounds and the About Me app template to design a personalized app that highlights how space exploration helps protect Earth's environment. Using the Task Cards, youth can modify the provided code to communicate the infomercial via an app.

Career Connection:

- Have youth investigate STEM careers by exploring the site, Surprisingly STEM. Youth can find one career that is new to them and use Keynote to create a short presentation (1 slide) for the group.
- Challenge students to create a short "Career Spotlight" poster or mini video about a career related to space exploration or the environment. They can include:
    - Job title
    - What the person does daily
    - Why it's important

Lesson 3: Emulsifiers

In this lesson, youth will be able to:

- Describe the difference between mixtures that separate and mixtures that stay combined.
- Define emulsifiers.
- Use the scientific method to make an hypothesis, complete an experiment, collect data, and draw conclusions.



Time needed: 60 minutes

Preparation

Materials	• Emulsifiers Handout • Vegetable or olive oil • Vinegar • Honey, mustard, garlic paste, tomato paste, or ketchup (at least 3) • Stopwatch • 10 mL graduated cylinder or measuring cups • Scoop or measuring spoons • Zip-top sandwich bags • Kitchen scale with weighing trays (optional)
Setup	• Place all materials in a Materials Hub allowing youth access throughout the activity.
Presentation	Slides

Facilitation

Overview:

This hands-on investigation introduces youth to the science of chemistry by exploring mixtures. Youth test familiar household ingredients to find an effective emulsifier. The activity builds skills in measurement, observation, and data collection while connecting chemistry concepts to real-world applications.

Engage:

1. Pour 1/2 cup of water and 1/2 cup or oil into a plastic sandwich bag. Ask youth to predict what will happen. Close and shake the bag. Say: *Oil and water don't mix! You may have heard that before and now you've seen it. But the truth is that we are surrounded by foods that are made by mixing oil and water. How can we explain this? Foods that mix oil and water are called emulsions. An emulsion is a type of colloid, which is a mixture of very tiny particles that are dispersed in another substance but do not settle out of the substance. Emulsifying is done by slowly adding one ingredient to another while simultaneously mixing. This disperses and suspends tiny droplets of one liquid through another. To prevent the mixture from separating, an ingredient, known as an emulsifier, that is attracted to both oil and water is added, allowing the oil and water to mix.*
2. Show examples of common mixtures (all ingredients mix evenly), colloids (cloudy appearance due to uneven mixing), and emulsions (need to be shaken to distribute evenly) and have youth classify them (Slides 3–4).

Investigate:

1. Divide youth into small groups of 2 or 3. Give each group an extra large hard-boiled egg, a medium hard-boiled egg, two plates, a measuring tape, a plastic knife, a pencil, and a handout.
2. Demonstrate to youth how to measure the length and circumference of an egg.
3. Allow each group time to measure the length, circumference, weight, shell color, and yolk color of their eggs. Direct youth to record this data on the handout.

Wrap-up:

1. Tell youth: *Today you will work in groups to make an emulsion. This emulsion is common in most houses: salad dressing. Most salad dressing contain some type of oil and vinegar along with flavors and an emulsifier. You need to find an emulsifier that will make the dressing stay mixed for as long as possible.*
2. Demonstrate how youth will conduct the experiment by doing the first of four trials together.

a. In a sandwich bag add 1/2 cup oil or measure 10 mL if using a graduated cylinder..

b. Add the same amount of vinegar. Ask youth: *Why is it important to add the same amount of both ingredients?* Have youth record the ingredients and the amount in the data table under Trial 1.

c. Seal and shake the bag for 15 seconds. Hold the bag upright without moving it and using a stopwatch or timer, time how long it takes for the two ingredients to separate. Have youth record the time in the data table under Trial 1. Tell youth this will be their control or what they will compare all the other trials to. Youth are trying to keep the ingredients mixed longer than the control by adding an effective emulsifier.

3. Divide youth into groups of 2 or 3. Provide each group with 4 sandwich bags, a set of measuring devices (measuring cups and spoons or graduated cylinders and a kitchen balance), and an Emulsifiers Handout. Remind youth to only test one new ingredient at a time, to measure the amount of each ingredient added, and to not cross contaminate ingredients. Direct youth to record separation times for each trial.

4. Note: If no separation occurs within 5 minutes, youth should record >5 minutes (Slide 5).

Wrap-Up

Bring youth back together to share their findings. Ask youth: *Which bag took the longest to separate? What was in the bag? Is there anything you would change about your experiment? What do you think would happen if you changed the amounts of ingredients?* If you have extra ingredients and time, have youth test alternative amounts either individually or as a group. Ask: *What kinds of products have the words "Shake before using" written on them? Why do you think you need to shake them?*

Implementation

Alternative Implementation and Extensions:

- What's in a Tablet? This scrollable explains why there are active and inactive ingredients in drug tablets. It looks at how medicine needs to be released in a way that is effective, but customer preferences, shelf life, and storage considerations must also be taken into account.

Career Connection:

- Pharmacist: Youth connect how emulsifiers work in salad dressing to how pharmacists mix medications safely and effectively.
    - Ask youth: *What would happen if medicine ingredients didn't mix well? Would you want a medicine where all the important parts sink to the bottom?*
    - Briefly explain: Pharmacists often need to mix ingredients that don't naturally combine, just like oil and vinegar. Pharmacists rely on emulsifiers to make medicines safe and consistent. Pretend you are a pharmacist creating a liquid medicine for a patient who can't swallow pills. The medicine has two parts that don't mix well. Which ingredient from your experiment worked best as an emulsifier? Why would that matter for medicine? What could happen if the medicine isn't mixed evenly?
- Share the career profile for a pharmacist.

Lesson 4: Make the Connection

In this lesson, youth will be able to:

- Name careers in the healthcare sector.
- Explain responsibilities or duties of several healthcare careers.
- Connect school subjects to specific healthcare career skills or duties.



Time needed: 20 minutes

Preparation

Materials	• Small whiteboards and markers (1 per group)
Presentation	Slides

Facilitation

Overview:

In this activity, youth will identify specific healthcare careers and match them to job duties and school subjects.

Engage:

1. Ask youth to name any of the healthcare careers they remember from the previous activities. Allow time to discuss any careers youth remember. Remind youth of the career profiles shared so far: radiology technologist, physical therapist assistant, medical and health service manager, emergency medical technician (EMT), and pharmacist.

2. Ask youth what subjects they think are important to study in order to be good at each of the careers.

Exploration:

1. Divide youth into groups of 2 or 3 and give each group a small whiteboard and marker. If you do not have small whiteboards, youth can use paper.

2. Explain the rules of the game:

    a. *I will read and show a short scenario.*

    b. *After reading the scenario, I will set the timer for 30 seconds. You will work with your group to identify which of the healthcare careers we have discussed are described in the scenario.*

    c. *You must write your answer on the whiteboard before the timer goes off.*

    d. *When the timer goes off, I will ask for your answers and all groups MUST share their answers at that time.*

    e. *Each group with the correct answer will earn a point.*

    f. *Each group that answers correctly will get 10 additional seconds to write what subject in school is important to develop skills needed for the career. Each group with correct subjects will earn 2 additional points.*

3. Ask groups if they have any questions. Display the first scenario and set the timer. Continue play until all scenarios have been discussed.

Wrap-up:

Ask youth if anyone would be interested in one of these careers. Ask if anyone knows anyone who works in a health field. Discuss other healthcare careers, such as nurse, speech therapist, pharmacist, etc.