

# STEM PATHWAYS

## Cookie Prospecting **STEM** Challenge!

### The Problem

Buckeye Resources is looking for its next location to mine. They have failed on three previous attempts and will have to shut down if unsuccessful. Plus, the EPA (Environmental Protection Agency) is requiring them to minimize their mining impacts or face stiff penalties.

### The Challenge

As a team of geologists, your challenge is to go cookie prospecting . . . collect a sample, analyze it in the lab and determine the site's potential for mining.

### Find a Measurable Solution

**ASK:** What is your hypothesis?

**HYPOTHESIZE:** Identify independent & dependent variables.

**TEST:** Conduct an experiment.

**ANALYZE:** Results, draw conclusions, try again!

**COMMUNICATE:** Findings and make recommendations.

### Things to Consider

1. What things are important in selecting a new location?
2. What information will you need from your sample?
3. How can you minimize the impact of mining on the surrounding environment?
4. What costs will be associated with the mining operation?
5. How can the selected location impact those costs?

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What is your hypothesis?  
What are your variables?

- Independent?
- Dependent?

Record them on your data sheet with your analysis.



### Prospecting Expenses

\$1000 - Cookie Location

### Excavation Equipment

Round toothpicks - \$100

Flat toothpicks - \$75

Paper clips - \$150

Straw - \$100

Fork - \$200

### Labor

Each minute = \$50 per person

### Income

Standard chocolate chip mined = \$500

Combine partial chips to make a whole chip



### SAFETY ALERT:

Be mindful of allergies when working with any food products including cookies.



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Bring Your Samples Back to the Lab for Testing & Analysis



**TIME: 30 - 45 MINUTES**

### Materials and Supplies

- Straws
- Round toothpicks
- Flat toothpicks
- Paper clips
- Forks
- Paper/Paper Towels
- 3 different kinds of chocolate chip cookies (chunk, mini, soft, hard)
- GPS Units or GPS App (shows latitude & longitude coordinates)

### Design Space

- Outdoor space to locate cookie mine locations
- Table space to mine chips from cookies
- Wi-Fi Access to Download Apps
  - Android apps are GPS Essentials and Latitude Longitude Coordinates by Proxit Apps and others.
  - iPhone Apps are GPS Coordinates and Find My Latitude and Longitude, but there are others.



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### Engage the Learner

- What factors are most important when choosing a location?
- How will the equipment you used impact the economics of the projects? (better equipment, more efficient workers, lower labor costs, more complete removal of the material, etc.)
- How will the softness or hardness of the bedrock (cookie) impact your decisions?
- What are your plans to protect the environment in and the around active mining location?

### Observations & Conclusions

- What worked? What didn't? Knowing what you know, what changes will you make?
- How would a different cookie selection change the equipment you decided to use?
- What factors impacted your profit?
- What did you do to protect the environment?

Refer to Career Focus Card for more details.

### STEM Career Path ... Geologist

- Who else might be involved? *Engineers, geophysicists, heavy equipment operators, environmental inspectors, the community – officials and residents.*
- Who benefits? *Depending on the mining operation it could be everyone. People use natural resources for anything from plastics to jewelry, from the roads we drive on to the electricity in our home.*
- What other issues are they helping to solve? *Water contamination/quality issues, finding oil/gas/mineral/resource alternatives for renewable & non-renewable resources, earthquake & other geo-hazard consultation (rock slides, volcanoes, flooding) understanding the Earth's history & using that information to help make policy and environmental decisions, assisting engineers with building sound and stable buildings, infrastructure, educating the public about Earth's history and natural wonder.*



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### Prospecting Area

- Place “rock” cookie samples for each group in a different location, note latitude and longitude of sites.
- Have each group navigate to locations using a GPS unit or GPS App to collect samples for analysis.
- Each group will select equipment to mine their prospecting site, determine project costs and purchase items from the adult in charge.
- Each group will begin mining their “rocks” (cookies) using the tools selected and keep track of how much time is used to calculate labor costs.
- Encourage geologists to keep their cookie on the paper during mining. We can’t turn the Earth’s surface upside down and the cookies are the Earth’s surface in this challenge.
- As a group finishes, the person in charge will count chips mined and assess any fines for damage to the environment. If damage is determined, the group will need to track time for remedial cleanup.
  - \$300 – each crumb outside prospecting area
  - \$2000 – illegal disposal of prospecting/mining material (eating crumbs, throwing them away before the inspector arrives).



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## STEM PATHWAYS Cookie Prospecting Analysis Data Sheet

Hypothesis: \_\_\_\_\_

Accept  Reject

Independent Variable: \_\_\_\_\_ Dependent Variable: \_\_\_\_\_

### Expenses

Prospecting Location: \_\_\_\_\_  
 Equipment Used: \_\_\_\_\_  
 Labor: \_\_\_\_\_  
 Fines: \_\_\_\_\_  
 Total: \_\_\_\_\_

### Income

Total Standard Sized Chocolate Chips Recovered: \_\_\_\_\_  
 Other Income: \_\_\_\_\_  
 Total Income: \_\_\_\_\_  
 Subtract Expenses: - \_\_\_\_\_  
 Total Profit or Loss \_\_\_\_\_

Sample Tested	Cookie Observations	Chocolate Chip Observations	Other Observations	Final Recommendation
Sample 1				
Sample 2				
Sample 3				





## STEM PATHWAYS

career

## Cooking Prospecting STEM Challenge

Did You Know? Geologists work to find earth's resources such as oil, natural gas, coal, precious metals and gemstones. This history of the Earth and past events in a specific location can determine whether a mineral resource is present, large enough, and high quality enough to be explored. They also learn about Earth's past to make our lives a better place to live and to teach others about our amazing planet.

## SCIENCE

Geologist



View a video about what geologists do.

**Where in the world would you look for these natural resource deposits knowing this information?**

**Oil** is a fossil fuel made over millions of years from the breakdown and gradual heating of marine organisms.

**Diamonds** are found in a special kind of igneous rock called a kimberlite. A kimberlite is like a pipe of magma that reaches the Earth's surface.

**Limestone** is a resource that is used for many different things like roads, agriculture, concrete, building stone, and other every day uses. Limestone is typically formed in warm, shallow, marine environments.

**Aluminum** comes from the rock bauxite. This rock forms in warm tropical climates where the silica has been removed from the soils.

## TECHNOLOGY

Geophysicists



**How can you see what is underground?**

- Use instruments that measure slight changes in gravity, use electrical properties, or seismic (or wave) energy to get a better image of what is under our feet. The technology used to pick up and record the vibrations are very sensitive microphones called geophones on land and hydrophones in the water. These vibrations travel through different layers (rock, oil, salt, water, etc.) at different speeds and can help the geophysicist determine where deposits can be found.

## ENGINEERING

Geologist

**How will the activity impact the environment around the site? How can we design the mining location to be the safest for our workers and enable us to get the most material?**

- Work with civil engineers and other professionals to determine the best materials for a job. They test soils, analyze hazards (earthquakes, landslides, etc.) They also work to ensure the environment around active wells and mines is not damaged.

## MATH

Economic Geologist

**How big is the mineral deposit and how long can we mine it? What are the costs of the land, equipment, labor and transportation needed to obtain it? What are the current market value and forecast for the resource?**

- Work with the others to determine whether the mineral or resource deposit is profitable enough to explore.



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### Geologist

#### Finding Solutions For...

- Use of natural resources and policy development.
- Understand geo-hazards (volcanoes, earthquakes, landslides) and minimize.
- Climate and preserving our natural environment and water supply.

#### Job Forecast Looks Like...

- **Median Income:** \$90,890, highest salaries in petroleum and mining, lowest in government
- **Job Outlook:** 16% growth from 2012-2022
- **Job Environment:** Field work: sample collection and observations in the environment,. Lab: Sample analysis with microscopes, chemicals, and other testing methods. Office: Computers to make and test models based on field observation, to make maps and reports.
- **Expected Growth Areas:** The need for energy, environmental protection, and responsible land and resource management will spur demand. New jobs will be in management, scientific, and technical consulting services and to replace the growing number of retirees.

#### Skill Set Needed...

- **High School Courses:**
  - Math: algebra and calculus
  - Science: earth science, biology, chemistry, and physics
- **Survival skills:** ability to work in any environment and weather.
- **Problem solving:** observation skills, ability to take those and apply general rules to specific problems to produce sensible answers.
- **Interpersonal:** ability to get along and work well with others.
- **Communication:** excellent written and verbal

#### Education and Training Required...

- **Entry Level Jobs:** Require Bachelor's degree
- **Additional Training and Certifications:** HAZMAT training and computer certifications. Advanced degrees Master's and doctorate increase jobs.



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