



AMERICAN COAL FOUNDATION

Coal-Related Activities for Secondary Students



A M E R I C A N C O A L F O U N D A T I O N

101 Constitution Avenue N.W., Suite 500-E

Washington, DC 20001-2133

202/463-9785 • 202/463-9786 fax • info@teachcoal.org

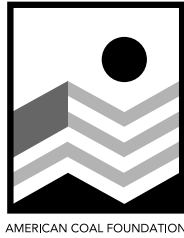
www.teachcoal.org

Note to teachers:

We hope you and your class will enjoy these activities as you learn about coal and electricity.

Please let us know how these activities work in your classrooms or if you have suggestions to improve them. We are always looking for new coal-related activities, so if you have one you would like to share, please contact us so it can be included in future editions of this publication.

The American Coal Foundation



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Coal Formation Activity

OBJECTIVE:

The student will simulate, observe, and explain the conditions under which coal is formed.

CONCEPTS:

- Coal is called a fossil fuel because it was formed from the remains of vegetation that grew as long as 400 million years ago.
- Coal formation is a continuing process.

SKILL REINFORCEMENT:

Critical thinking
Cooperative learning

GRADE LEVEL:

1-8

TIME NEEDED:

Two class periods over four weeks

MATERIALS:

- aquarium (for an individual version you can use a clear plastic shoe storage box or a 2 liter soda bottle with the top cut off)
- fine to medium grain sand
- fern fronds (leaves)
- twigs
- plant leaves
- screen or sifter
- fine silt or mud

PROCEDURE:

1. Pour water into your container to a depth of four to six inches.
2. Spread about two inches of sand on the bottom.
3. Drop small leaves, sticks and pieces of fern on sand. Let it stand for about two weeks. Write down what you observe as change in color and decomposition occur.
4. Gently sift fine silt or mud on top of the plant layer to the depth of two inches.
5. Wait two weeks and drain any water if there is any left. Let it sit and dry for another week or two. Now you not only have simulated coal where the plants were, if you break it gently in layers you might have a simulated fossil imprint from your plant leaves.

NOTE: If you line your container with plastic wrap before you begin, you can lift the whole formation out when it is dry.

TIP: This is a smelly activity. If you have an area where you can put this out of the way and observe it occasionally, you will like it better!

ACTIVITY DEVELOPED BY:

Kathleen Berry, Pennsylvania Teacher

Geologic Time: When Was Coal Formed?

OBJECTIVE:

The student shall construct a time line of geologic periods and label the major happenings in each. The student should pay attention to the climate and conditions during the coal forming periods.

CONCEPT:

Coal began as trees, ferns and other plants that existed in tropical-like forests between 400 million and one million years ago.

SKILL REINFORCEMENT:

Critical thinking
Math-number manipulation
Cooperative learning

GRADE LEVEL:

8 and above

TIME NEEDED:

Two class periods

MATERIALS:

- adding machine tape (five meters long)
- metric ruler
- tape

NOTE TO TEACHER:

Students should have a general knowledge of epochs, periods and eras. They should make a chart similar to the one provided. Research can be done ahead of time by dividing the class into groups and giving each group a period to research. This information can be added to the chart. Students should work in groups of two to construct the time lines. Be sure to have a large area in which to work (a long hallway is good).

PROCEDURE:

1. Measure and cut a strip of adding tape that is five meters long. One meter equals one billion, one centimeter equals ten million, and one millimeter equals one million.
2. Attach adding machine tape to a flat surface where you can work easily.
3. Draw a line near the end of the tape. This will be the beginning of the Earth. Measure four meters from this mark and draw a line. Label it "End of Precambrian Time." Starting at this line, mark the distance that will represent the end of the Paleozoic Era. Label it "End of the Paleozoic Era." Go back and divide the part of the tape representing the Paleozoic Era into correct lengths representing each time period of this era. Label each with the correct name. Do the same with each era and period. Go back and label the main events in each era.

ACTIVITY DEVELOPED BY:

Beverly Bowers, West Virginia Teacher

Coal Identification

OBJECTIVE:

The student should be able to rank, identify, and compare the types of coal.

CONCEPTS:

There are four basic varieties of coal, which are the result of geologic forces having altered plant material in different ways.

SKILL REINFORCEMENT:

Comparison and contrast
Critical thinking

GRADE LEVEL:

6-12

TIME NEEDED:

One class period

MATERIALS:

- coal specimens
- worksheet
- hardness kit (optional)
- Bunsen burner or alcohol lamp
- safety glasses
- tongs

PROCEDURE:

1. Place coal specimens out for students to use.
2. Have students carefully examine the coal specimens and complete the identification chart and accompanying worksheet.
3. Using tongs, hold a piece of each type of coal in a flame for the class to see.
4. Ask the class to note its speed of ignition, remove from flame and observe how it burns. Have class complete second chart on coal identification worksheet.
5. Does burning show that peat is the lowest rank of coal?
6. Does the manner of burning of bituminous coal show that it still has volatile material (gas) in it?

ACTIVITY DEVELOPED BY:

Kathleen Berry, Pennsylvania Teacher

Coal Identification Worksheet

Name: _____ Date: _____

Examine the coal samples and fill in the chart below:

Sample #	Evidence of				
	Plant Origin	Hardness	Luster	Cleavage	Other Characteristics
1					
2					
3					
4					

Why is peat the youngest form of coal? What evidence supports this?

Is anthracite the highest rank of coal? Why?

Record your observations of the four types of coal burning below:

	How Different Types of Coal Burn			
	Speed of Ignition	Flame Color	Speed of Burning	Odor
Peat				
Lignite				
Bituminous				
Anthracite				

Ranks of Coal Activity

OBJECTIVES:

The student will be able to rank or identify coal based on physical properties.

CONCEPT:

There are four basic varieties of coal, which are the result of geologic forces having altered plant material in different ways.

SKILLS REINFORCEMENT:

Critical thinking
Cooperative learning
Comparison and contrast

GRADE LEVELS:

7-12

TIME NEEDED:

One class period

MATERIALS:

- three coal specimens for each of the basic types (rank) and one piece of slate or shale (each sample numbered from one to four – if using more than one set, make sure each types (rank) has the same number in each kit). Each kit has the four specimens in a paper bag.
- worksheet

PROCEDURE:

Divide class into working groups. Inform students that each bag contains three ranks of coal plus a sample of slate. Ask them to write the name for the rank of coal that they think matches the number. Tell them to use their knowledge about how coal forms to help them make decisions.

ACTIVITY DEVELOPED BY:

Kathleen Berry, Pennsylvania Teacher

Ranks of Coal Worksheet

Name: _____ Date: _____

1. Examine the coal samples provided and fill in the following chart based on your knowledge of the different types of coal.

Sample	Type of Coal	Observations
1.		
2.		
3.		
4.		

2. After looking at the specimens in your bag answer the following questions (explain your choices to team members).

a. Why do you think early coal miners of the pick-and-shovel days had difficulty in determining where the coal seam was? (Hint: think about the non-coal specimen in your bag.)

b. Why do slate (shale) dumps burn? (Hint: think about your answer to question A.)

Coal Flowers

OBJECTIVE:

Students will grow crystals on coal and explain the relationship between temperature and crystal development.

CONCEPT:

- Temperature affects crystal formation.

SKILL REINFORCEMENT:

Critical thinking Cooperative learning

GRADE LEVEL:

1-8

TIME NEEDED:

Two classroom periods

MATERIALS:

- | | | | |
|--------------------------------|-------------|------------------|--------------------------|
| • glass bowl, shallow | • coal | • glue | • twigs or toothpicks |
| • paper towels | • salt | • laundry bluing | • water |
| • string/small pieces of cloth | • ammonia | • food coloring | • bowl, small paper cups |
| • thermometers | • worksheet | | |

PROCEDURE:

1. In a shallow glass bowl place several small lumps of coal.
 2. Interwork twigs, toothpicks, paper or cloth with coal. You may select all or some of the items. You may need to use glue to hold the twigs and/or toothpicks to the coal.
 3. In a separate bowl or paper cup mix:
 - 6 tablespoons salt
 - 6 tablespoons laundry bluing (TIP: If your grocery or hardware store does not carry laundry bluing, check with local a pharmacist. Many women's magazines have ads for bluing and it may be purchased over the Internet at www.mrsstewart.com.)
 - 6 tablespoons water
 - 1 tablespoon ammonia
 4. Pour the mixture over the coal mound.
 5. Sprinkle dots of food coloring randomly over the mound.
 6. Crystals will begin to form within several hours.
 7. Have students fill out and turn in worksheet and answer question how "coal flowers" grow and why?
- NOTE: In colder weather, the crystals grow slower and colors are not as vivid due to slower evaporation time.

DISCUSSION:

This activity has an interesting background. Families and wives of coal miners in the late 1800s and early 1900s had little money to decorate or to buy toys so they used things they had around the house to create these. Coal flowers were entertaining and children liked to watch them grow because changes took place in a relatively short period of time. The original "coal flowers" were made without using food coloring. Many people thought the flowers looked like snow and used them to decorate at Christmas. Note that coal plays no chemical role in the creation of the crystals and is no more critical than the toothpicks used.

ACTIVITY DEVELOPED BY:

American Coal Foundation and Women In Mining Education Foundation

Coal Flower Worksheet

Name: _____ Date: _____

List items placed in bowl along with coal: _____

Time experiment started: _____ Time experiment ended: _____

Air temperature: _____ Coal flower bowl temperature: _____

Where did crystals first appear?

Which items did the crystal appear on?

Which items did the crystals completely cover?

What colors were most vivid?

What other items might be used in this experiment?

What effect do you think surrounding temperatures had on the crystal growing? Why?

Why was this a natural activity for mining families in the late 1800s and early 1900s?

NOTE: Check crystals about every two hours to note observations.

Living History Unit (Coal Mining History)

OBJECTIVES:

The student will be able to construct interview questions, organize an interview, conduct and interview and assemble the information about coal history into a written product.

CONCEPTS:

Coal mining played an important part in the history of the United States, especially in several geographic regions.

SKILL REINFORCEMENT:

Critical thinking
Cooperative learning
Evaluation of multiple factors

GRADE LEVEL:

7-12

TIME NEEDED:

Several class periods

MATERIALS:

- tape recorder
- interview permission slip (sample provided)
- interview questions (sample provided)

PROCEDURE:

1. Through class discussion, the students are to construct questions they would like answered about mining in the past.
2. Have students assemble the questions into an interview format.
3. Students who have people in mind that they can interview will do the interviews; the other students will assemble the results into a "history" book.
4. Those who will be interviewing should set up appointments with the person they intend to interview and get the permission slip signed.
5. When the interviews are completed the class will listen to all interviews and organize them into a booklet about local mining history.

SUGGESTION:

Keep copies of the tapes for future use and give a copy to the person you interviewed. It is a nice gift for the future.

ACTIVITY DEVELOPED BY:

Kathleen Berry, Pennsylvania Teacher

Coal Mine History Interview Questions (Sample)

What country were you born in?

Where did you first live in this area?

How old were you when you first started working in the mine?

What was the name of the mine?

Who owned the house you lived in?

Where did you shop?

What did you do for entertainment?

What were your first wages?

Where did you go to school?

What was the ethnic makeup of your community?

Describe your job in the mine.

Did unions develop slowly, quickly or not at all in your mine?

What was the greatest change you saw in mining during your time in the mine?

What was the major use for the coal that came from your mine?

Permission Slip for Living History Unit

STUDENT'S NAME _____

PERSON ACCOMPANYING STUDENT ON INTERVIEW _____

DATE AND TIME OF INTERVIEW _____

LOCATION OF INTERVIEW _____

PARENT/GUARDIAN SIGNATURE APPROVING THE INTERVIEW

(THIS PORTION OF THE PERMISSION SLIP MUST BE TURNED IN TO THE TEACHER AT
LEAST 24 HOURS BEFORE THE INTERVIEW)

PERSON TO BE INTERVIEWED _____

STUDENT INTERVIEWER'S NAME _____

I have agreed to this interview and I allow all or any part of it to be recorded, replayed or
transcribed as long as it is not for profit.

Signature of Person Being Interviewed

Date

(THIS PORTION IS TO BE ATTACHED TO THE TAPE)

Publishing Local Coal Mining History

OBJECTIVE:

Students will create a book or publish information on the local history of coal mining in their county or area.

CONCEPTS:

Coal mining played an important part of the history of the United States, especially in several geographic regions.

SKILL REINFORCEMENT:

Critical thinking

Comparison and contrast

Grammar

Cooperative learning

Interviewing

Researching

Negotiation and compromise

Interpreting and writing information

Editing

GRADE LEVEL:

May be modified for grades 5-12 depending on depth of study.

TIME NEEDED:

May be adapted depending on extent of project. If you don't want to write a book, consider writing articles for publication in the local paper, or producing a county brochure. Our book of 163 pages took one and a half years to complete at the high school level.

MATERIALS:

- writing tablets and folder for notes
- tape recorders, tapes, and batteries
- camera, film, and money for developing
- envelopes and stamps for letters and finished books
- money for long-distance phone bills
- permission slips for field trips
- food for interviews (optional)
- thank you cards (students can create on computers)
- computers for work processing, scanner, digital camera (if available)
- copy machine
- video: "Out of the Darkness: The Story of the United Mine Workers of America."
- the book "Growing up in Coal Country" by Susan Bartoletti or an equivalent book (see ACF website: www.acf-coal.org for other resources)

INITIAL ACTIVITY:

1. Secure grants or other funding for your project.
2. Select the fewest number of students possible. One or two students per chapter is adequate.

OPENING ACTIVITY:

1. View the movie "Out of the Darkness" as a kick off for the project.
2. Read the book "Growing up in Coal Country" to the students a little at a time. Have students practice taking notes.

Publishing Local Coal Mining History

(Continued)

PROCEDURE:

1. Determine the number of chapters and content areas for your book.
2. Discuss interviewing skills and source documentation with the class.
3. Obtain a list of retired miners from the United Mine Workers local chapter in your area.
4. Set up interviews. Ask the miners to bring photos and mementos to the interview. (We invited the miners for lunch and the students conducted the interviews after lunch).
5. Invite active miners in your area to be interviewed at a different time.
6. Schedule a field trip to a local coal mine. The safety director and the reclamation director are valuable resources at the mine.
7. Encourage students to interview additional miners or community members on their own.
8. Have the students write paragraphs on what they learned after each interview. Have students read the papers within their group and combine ideas into one paragraph or page. Repeat this collaborative process throughout the project.
9. Once chapter groups have enough information, have a student write a letter explaining the project for your local paper. Have the groups submit articles to the local paper on their chapters each week.
10. Determine the title of the book. (Hold a contest to determine title.)
11. Those students who show lack of interest in writing assignments may be better at creating maps or arranging photos and other supporting materials, so you may need to adjust assignments.
12. Have students finish rough drafts on computer.
13. Edit rough drafts.
14. Have some of the miners interviewed read the finished chapters for accuracy.
15. Find a publisher or printer. Most publishers won't publish books with a small circulation potential. Contact a local college for assistance.
16. Market your books in local stores, at Union meetings, community events, basketball games, with the historical society in your area, at public libraries, etc.

SUGGESTIONS FOR INTERVIEWS AND INFORMATION:

Retired and active miners
Nursing homes
Retired miners' dinners
Coal museums
United Mine Workers' office
Public library
Older community members
State Geological Survey offices
Labor Day celebrations
Old newspapers

Publishing Local Coal Mining History

(Continued)

ADDITIONAL SUGGESTIONS:

Get all the publicity that you can and each time ask for people to contact you with their information. Television stations, radio, and local papers are good sources.

We started with 26 students and eventually had 13 finish the book. Smaller numbers are better.

Be prepared for the students to tire of the project. You may need to take a break for about a month in order to regain enthusiasm.

This is a project that requires a lot of time on the teacher's part. Be prepared for phone calls at school and home.

Make sure the students document all their sources—interviews, encyclopedias, books, etc. You may even want a special place to store this information.

Keep track of the names of people who assist with information, especially if you are going to create a "thank you" page.

As photos are scanned, document who submitted each photo on the computer with the picture. If you know your printer or publisher before the project begins, check to see if you can do anything to make a transfer of the photos easier.

Items to include in your book:

Content, authors, information about how the book was compiled, a "thank you" section, photo collage of your students working on the book.

ACTIVITY DEVELOPED BY:

Beth Ann Bohnert, Pike Central High School, Petersburg, Indiana

Author of *The Coal Miner's Cry: Coal Mining in Pike County, Indiana from 1835-1999*

Cookie Mining

OBJECTIVE:

Students will demonstrate economics skills in a simulated mining activity.

CONCEPT:

- Coal mining is a capital-intensive industry.

SKILL REINFORCEMENT:

Critical thinking
Math-number manipulation
Cooperative learning
Evaluation of multiple factors
Negotiation and compromise

GRADE LEVEL:

3-12

TIME NEEDED:

One or two class periods

MATERIALS:

- play money
- worksheet
- grid paper
- pencils
- three different types of chocolate chip cookies
- flat toothpicks
- round toothpicks
- paper clips

PROCEDURE:

1. Each student starts with \$19 of play money.
2. Each student receives a Cookie Mining worksheet and a sheet of grid paper.
3. Each student must buy their own "mining property," which is a cookie. Only one "mining property" per player. Cookies are for sale:
Mother's Chocolate Chip — \$3
Chips Ahoy — \$5
Chips Deluxe — \$7
4. After the cookie is purchased, the student places the cookie on the grid paper and, using a pencil, traces the outline of the cookie. The student must then count each square that falls inside the circle. Count partial squares as a full square.
5. Each student must buy their own "mining equipment." More than one piece of equipment may be purchased. Equipment may not be shared between students. Mining equipment for sale is:
Flat toothpick — \$2
Round toothpick — \$4
Paper clips — \$6
6. Mining costs are \$1 per minute.
7. The sale of one chocolate chip mined from a cookie results in a \$2 profit. (Broken chocolate chips can be combined to make one whole chip).

Cookie Mining

(Continued)

8. After the cookie has been “mined,” the cookie should be placed back into the circled area on the grid paper (reclamation). This can only be accomplished using the mining tools — no fingers or hands allowed. Reclamation costs are \$1 for each square covered outside original outline.

RULES:

1. No student may use their fingers to hold the cookie. The only things that can touch the cookie are the mining tools and the paper on which the cookie is sitting.
2. Students should be allowed a maximum of five minutes to mine their cookie. Students who finish mining before the five minutes are used up should only credit the actual time spent mining.
3. A student can purchase as many mining tools as desired and the tools can be of different types.
4. If the mining tools break, they are no longer usable and a new tool must be purchased.
5. The students who make money by the end of the game win (because they realized a mining profit).
6. All students win at the end of the game because they get to eat the remains of their cookie!

REVIEW:

The game provided each student an opportunity to make the most profit that he/she could make with the resources provided. Students were forced to make decisions to determine which properties to buy and which piece or pieces of mining equipment should be purchased.

Each student should have learned a simplified flow of an operating mine. Also, each student should have learned something about the difficulty of reclamation, especially in returning the cookie back to the exact size that it was before “mining” began.

ACTIVITY DEVELOPED BY:

Women In Mining Education Foundation

Cookie Mining Worksheet

Name: _____ Date: _____

Mining start-up funds = \$19

- A. Land acquisition costs = price of cookie
(Mother's - \$3; Chips Ahoy - \$5; Chips Deluxe - \$7)
Name of cookie _____ \$ _____

Size of mine = size of cookie
Squares covered pre-mining (used for reclamation) _____

- B. Equipment costs
Flat toothpick _____ x \$2 = _____
Round toothpick _____ x \$4 = _____
Paper clip _____ x \$6 = _____

Total equipment costs \$ _____

- C. Mining/excavation costs = chip removal
Number of minutes _____ x \$1 _____

Total excavation costs \$ _____

- D. Mining valuation
Number of chips mined _____ x \$2

Gross profit \$ _____

- E. Reclamation
Squares covered outside original outline _____ x \$1

Total reclamation costs \$ _____

- F. Profit/loss
Start-up funds _____

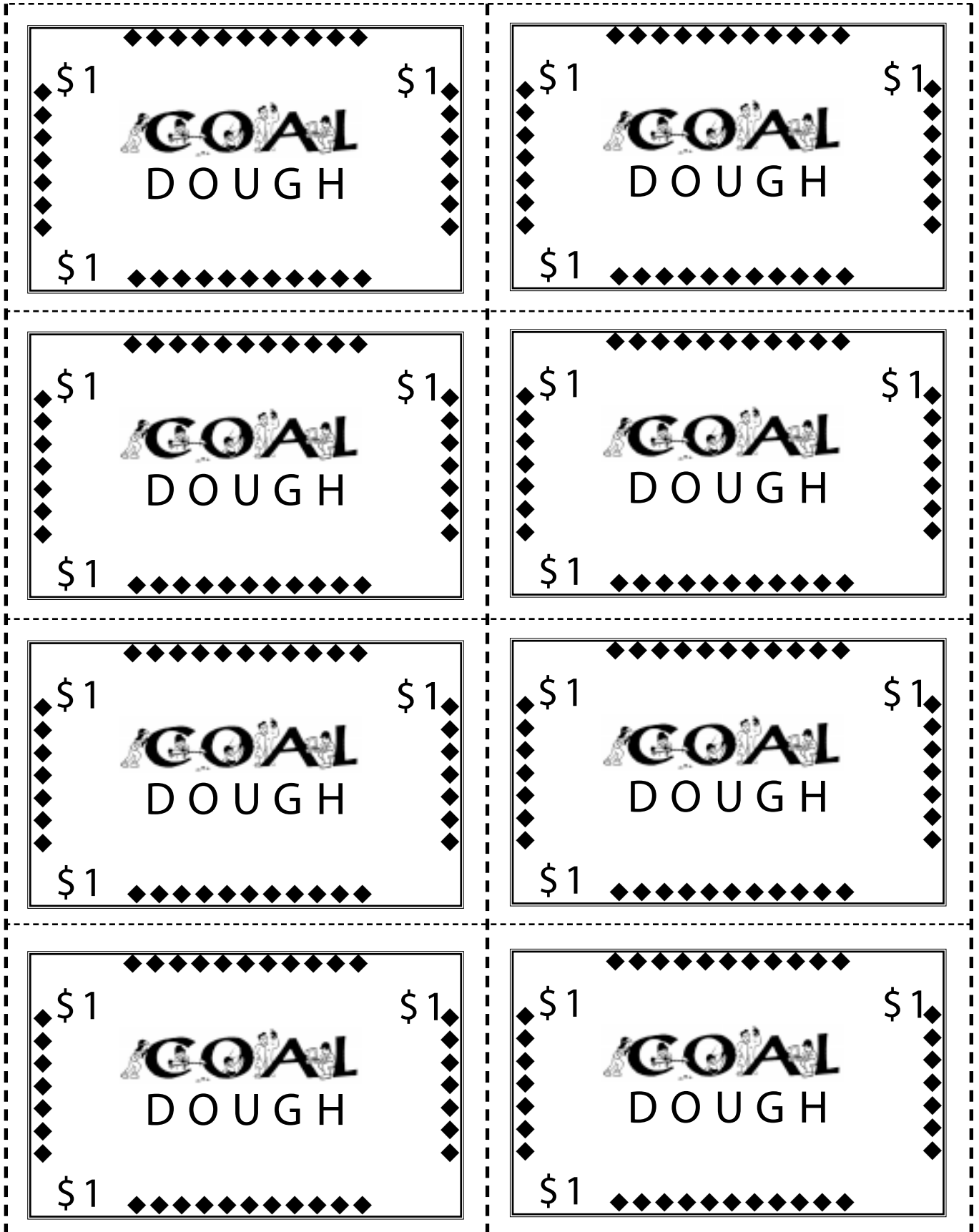
less total mining costs (A, B, & C) _____

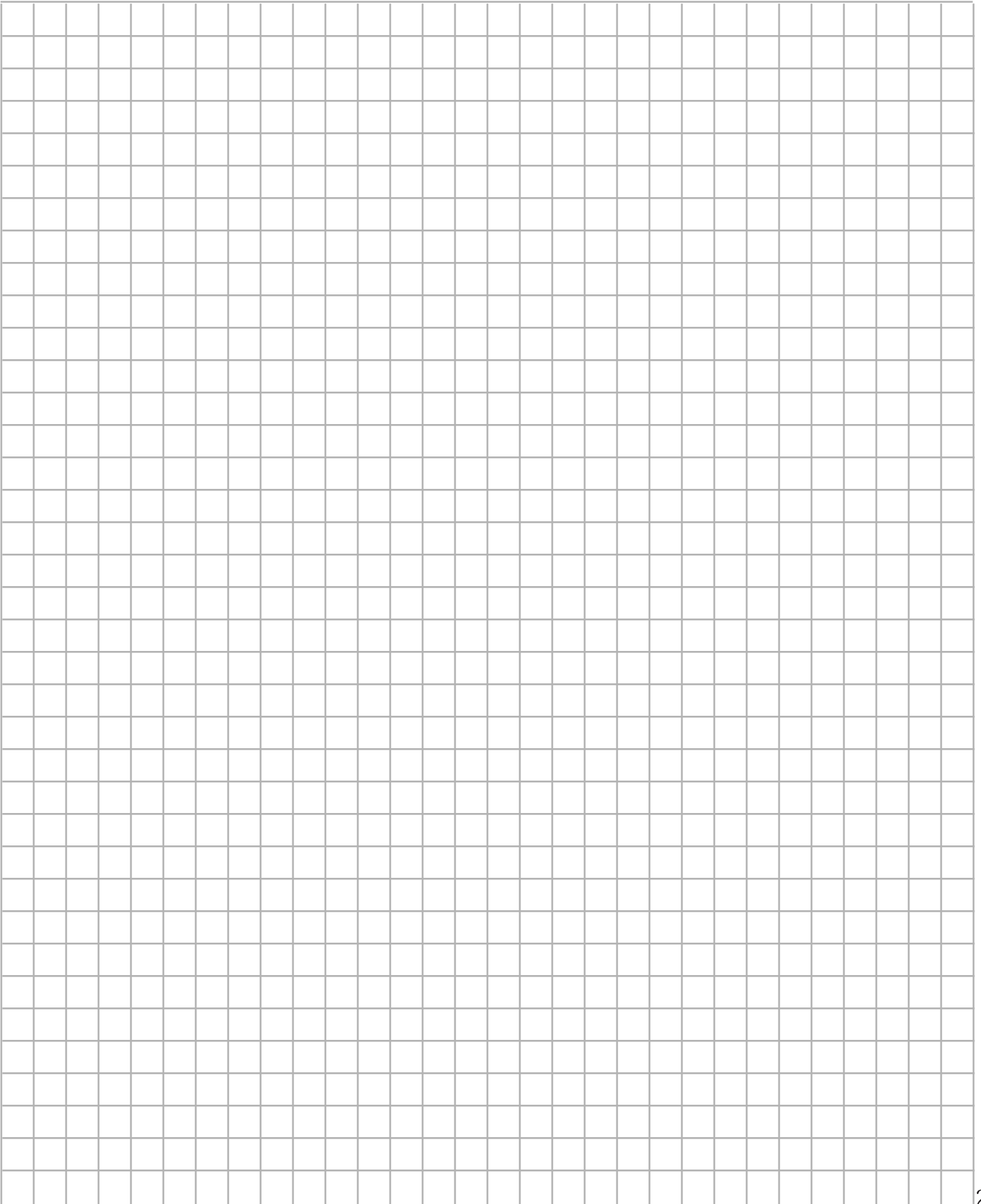
less total reclamation costs (E) _____

plus gross profit (D) _____

Total profit/loss _____

Coal Dough





Mining in a Nutshell—Advanced Version

OBJECTIVE:

This activity will demonstrate the steps that are taken to find, extract, process, and use mineral resources. Students will be able to describe the major steps that a mining company must follow from initial discovery of a mineral deposit through consumption of a finished mineral product. Students will also be able to formulate ideas on ways to use waste products generated during mineral processing.

CONCEPT:

Mining is a complex and capital-intensive industry.

SKILL REINFORCEMENT:

Critical thinking
Mapping
Math-number manipulation
Economics
Decision making
Cooperative learning
Evaluation of multiple factors

GRADE LEVEL:

6-12

TIME NEEDED:

One to two class periods

MATERIALS:

- three to four pounds of roasted peanuts in the shell
- assorted colors of enamel paint and brushes, or permanent markers (four colors minimum)
- "Mining in a Nutshell" currency in denominations of \$5,000, \$10,000, \$50,000, and \$100,000
- graph paper to map room, showing door, tables, and other major features
- worksheet

Optional

- food processor or blender
- scale for weighing in grams or ounces
- vegetable oil, salt, and honey
- celery sticks and crackers
- plastic knives

TEACHER NOTE:

Before class, make the following preparations:

1. Paint spots of color on the unshelled peanuts using markers, model paint or enamel. Use several colors, each of which can represent a different mineral. For example: Yellow = Gold, Blue = Silver, Green = Copper, Red = Iron, Black = Coal. For each color used, paint 25-30 peanuts.
2. Have each student prepare a base map of the room or location where this activity will be done. It should show major features like doors, windows, desks, and tables, cabinets, etc. Make sure the students indicate north on their map. A drawing on 8 x 11-inch graph paper should be sufficient. To increase the difficulty (precision), the map may be drawn to scale.

Mining in a Nutshell—Advanced Version

(Continued)

3. While students are out of the room, put the peanuts in clusters in various locations around the room. You can group different colors together in the “ore bodies.” (Several different minerals are often found together in nature.) Keep track of how many peanuts of each color are used in each cluster. (Refer to diagram for an example of how to set-up “ore bodies.”) Have approximately 25 percent of the colored peanuts “face up” and the rest “face down” so that the students cannot see the color on the shell.
4. Add “plain” peanuts to the “ore” peanuts in a ratio of approximately 3:1. (i.e., 3 “plain” peanuts for each “ore” peanut). The “plain” peanuts represent waste rock.

PROCEDURE:

1. Divide students into groups of four to five each. Identify each group by a company name. Each company is given a budget of one million dollars to bring the mine “on-line.”

EXPLORATION (RECONNAISSANCE) PHASE:

2. Have two representatives from each company look around the room and mark on the base map where the colored and uncolored (unknown) peanuts are located. (DO NOT TOUCH OR REMOVE THE PEANUTS AT THIS TIME!) Each group of peanuts is considered a property which may (or may not) contain a valuable ore body. Relate the peanuts to rock and mineral samples (the rocks may contain useful minerals just as the whole peanuts contain the useful nuts within their shells). By locating peanuts, the students have completed the exploration phase.

DRILLING PHASE:

3. Each company must decide where to proceed with exploration drilling based on its preliminary geologic assessment (mapping). Have each company pick a target site and claim it. If two or more companies want the same property a competitive bid will take place, where a coin toss (or other method) will decide who makes the opening bid (\$20,000). The winner of the bid will control that property and the loser(s) must find another property. Each company can drill up to six holes on its property. Drilling consists of turning over a peanut to see if it represents valuable ore. Calculate the cost of drilling (Worksheet, 3A). (Optional) If a company decides not to mine their property based on their drilling results, it may opt for another property. However, the costs incurred for the first property are added to the costs of the second property.

MINING PHASE:

4. Now that each company has mapped and drilled its property, it is time to put the information to the test by mining. At this point each company will mine by turning over each unknown peanut to see whether it is part of an ore body.

Count the number of peanuts in the ore body and use that number in Phase 4 of the Worksheet. Mined peanuts will include the ones that were originally “face up” or were turned over during drilling. The exposed peanuts are counted because they need to be taken out of the ground.

VALUING THE MINE:

5. Tally the number of peanuts representing each mineral mined (Phase 5 of the Worksheet). Also, calculate the number of “waste” peanuts and their cost. The waste rock must be disposed of as part of the mining operation.

Calculate the value of each group of colored peanuts using the worksheet. This is the gross profit. Calculate the cost of reclaiming the mine at 10 percent of the gross profit. Determine where each group has a profit or a loss for the activity.

Mining in a Nutshell—Advanced Version

(Continued)

PROCESSING PHASE (OPTIONAL):

6. Students can weigh the peanuts for each color group. Have the students shell their peanuts. The peanuts and shells should be kept in separate piles at each table. Weigh the peanuts separately from the shells. Shelling the peanuts represents one step of the PROCESSING phase. Shell all remaining peanuts. Put the peanuts in the food processor/blender, along with vegetable oil, salt (if using unsalted peanuts), and a little honey. Turn on the blender so that the ingredients become peanut butter. This is the second step of the PROCESSING phase.

MANUFACTURING PHASE:

7. Using plastic knives, spread the peanut butter on celery or crackers. This is the MANUFACTURING phase. Minerals are used to make useful products that we purchase as consumers.

CONSUMPTION PHASE:

8. Eat the above manufactured items. This is the CONSUMPTION phase and the part the students will like the most!

RECYCLING PHASE:

9. Brainstorm with the students on ways to use the waste peanut shells. There are some interesting uses for peanut shells. Have your students do research on those uses. This is the RECYCLING phase.

SUGGESTIONS:

This game can continue for additional rounds until all the properties are mined. Some companies may want to pool their resources (Joint Ventures), others may want to borrow or loan money (for a percentage of the gross or net profit). In subsequent games you can change the mix of peanuts to make mines of varying degrees of profitability.

In the second round, a company may sell its geologic information to another company which drilled but did not mine a property. This information may also be used to interest a company in becoming a joint venture partner.

ACTIVITY DEVELOPED BY:

Walt Lombardo, Nevada Division of Minerals

Mining in a Nutshell Worksheet

Name _____ Date _____

Company Name _____

Mine Name _____

PHASE 1: MAP MAKING (BASE MAP)

Cost of Map: \$10,000 per minute (maximum 10 minutes)
minutes x \$10,000/minute

= \$ _____

PHASE 2: EXPLORATION MAPPING (EXPLORATION PHASE)

Cost: \$15,000 per minute (maximum 8 minutes)
minutes x \$15,000/minute

= \$ _____

PHASE 3: DRILLING PROGRAM (DRILLING PHASE)

A) If non-competitive bid:

Cost: \$30,000 per target (peanut), maximum six per site
Targets x \$30,000

= \$ _____

B) If non-competitive bid:

Amount winning of bid (\$20,000 increments)

= \$ _____

PHASE 4: MINE DEVELOPMENT (MINING PHASE)

Choose area for mine to be situated.

Mining costs: \$50,000 for each peanut in ore body
peanuts x \$5,000

= \$ _____

PHASE 5: MINE VALUATION

A) Value of minerals (1 peanut equals):

Gold - \$400,000 x _____ peanuts = \$ _____

Silver - \$50,000 x _____ peanuts = \$ _____

Copper - \$20,000 x _____ peanuts = \$ _____

Coal - \$10,000 x _____ peanuts = \$ _____

Iron - \$5,000 x _____ peanuts = \$ _____

GROSS PROFIT

= \$ _____

B) Waste - \$5,000 (-) x _____ peanuts = \$ _____

= \$ _____

Mining in a Nutshell Worksheet

(Continued)

PHASE 6: PROFIT/LOSS

Gross profit (from 5A)	\$ _____
Expenditures	
Base map (from 1)	_____
Exploration map (from 2)	_____
Drilling (from 3A)	
Bids (from 3B)	_____
Mining Costs (from 4)	_____
Waste Costs (from 5B)	
Reclamation (10% of gross profit)	_____
Subtotal expenditures	- \$ _____
Net profit	= \$ _____

OPTIONAL ACTIVITIES PROCESSING:

- 1) Weight of peanuts in shells _____
- 2) Remove shells from peanuts containing ore _____
- 3) Weight of shelled peanuts _____
- 4) Weight of peanut shells (waste) _____
- 5) Calculate ore to waste ratio _____
- 6) Calculate recovery (weight of peanuts to weight of peanut in shell)
 peanuts to weight of peanut in shell _____
- 7) Discuss how this relates to ore mineral recovery from rock (ore vs. waste)

RECLAMATION:

- 1) Discuss the necessity of reclamation
- 2) Discuss the recycling of the peanut shells. Can they have other (post consumer) uses?

Mining in a Nutshell—Advanced Version

(Continued)

Suggested Ore Body Layout

<u>Ore Body #1</u>		
2	AG	(1, 1)
3	CU	(1, 2)
6	Coal	(2, 4)
7	FE	(2, 5)
22	Waste	

Gross Value \$225,000

<u>Ore Body #2</u>		
2	AU	(1, 1)
6	AG	(2, 4)
3	CU	(1, 2)
1	Coal	(0, 1)
28	Waste	

Gross Value \$1,170,000

<u>Ore Body #3</u>		
4	AU	(2, 2)
5	AG	(0, 5)
1	Coal	(0, 1)
30	Waste	

Gross Value \$1,870,000

<u>Ore Body #4</u>		
5	AU	(0, 5)
2	AG	(1, 1)
33	Waste	

Gross Value \$225,000

<u>Ore Body #5</u>		
1	AU	(1, 0)
2	AG	(1, 1)
2	Coal	(1, 1)
2	FE	(0, 2)
33	Waste	

Gross Value \$530,000

<u>Ore Body #6</u>		
1	AU	(1, 0)
2	AG	(0, 2)
18	CU	(6, 12)
2	Coal	(0, 2)
3	FE	(1, 2)
14	Waste	

Gross Value \$895,000

<u>Ore Body #7</u>		
4	AG	(2, 2)
3	CU	(1, 2)
11	Coal	(3, 8)
7	FE	(2, 5)
21	Waste	

Gross Value \$415,000

<u>Ore Body #8</u>		
3	AG	(1, 2)
10	Coal	(3, 7)
3	CU	(1, 2)
10	FE	(2, 8)
14	Waste	

Gross Value \$360,000

Note: 2 AG (1,1) means 2 silver peanuts, 1 up, 1 down

AU=Gold; AG=Silver; CU=Copper; FE=Iron; Coal=Coal

\$5,000 \$5,000

Mining
in a Nutshell

\$5,000 \$5,000

\$5,000 \$5,000

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in a Nutshell

\$5,000 \$5,000

\$5,000 \$5,000

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in a Nutshell

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Mining
in a Nutshell

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Mining
in a Nutshell

\$5,000 \$5,000

\$5,000 \$5,000

Mining
in a Nutshell

\$5,000 \$5,000

The image displays a grid of eight identical cards, arranged in four rows and two columns. Each card is enclosed in a dashed-line border and features a decorative border of small black diamonds. The text on each card is as follows:

- Top-left corner: \$ 10,000
- Top-right corner: \$ 10,000
- Bottom-left corner: \$ 10,000
- Bottom-right corner: \$ 10,000
- Center: Mining in a Nutshell

\$50,000 \$50,000

Mining
in a Nutshell

\$50,000 \$50,000

\$50,000 \$50,000

Mining
in a Nutshell

\$50,000 \$50,000

\$50,000 \$50,000

Mining
in a Nutshell

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Mining
in a Nutshell

\$50,000 \$50,000

\$50,000 \$50,000

Mining
in a Nutshell

\$50,000 \$50,000

\$50,000 \$5,000

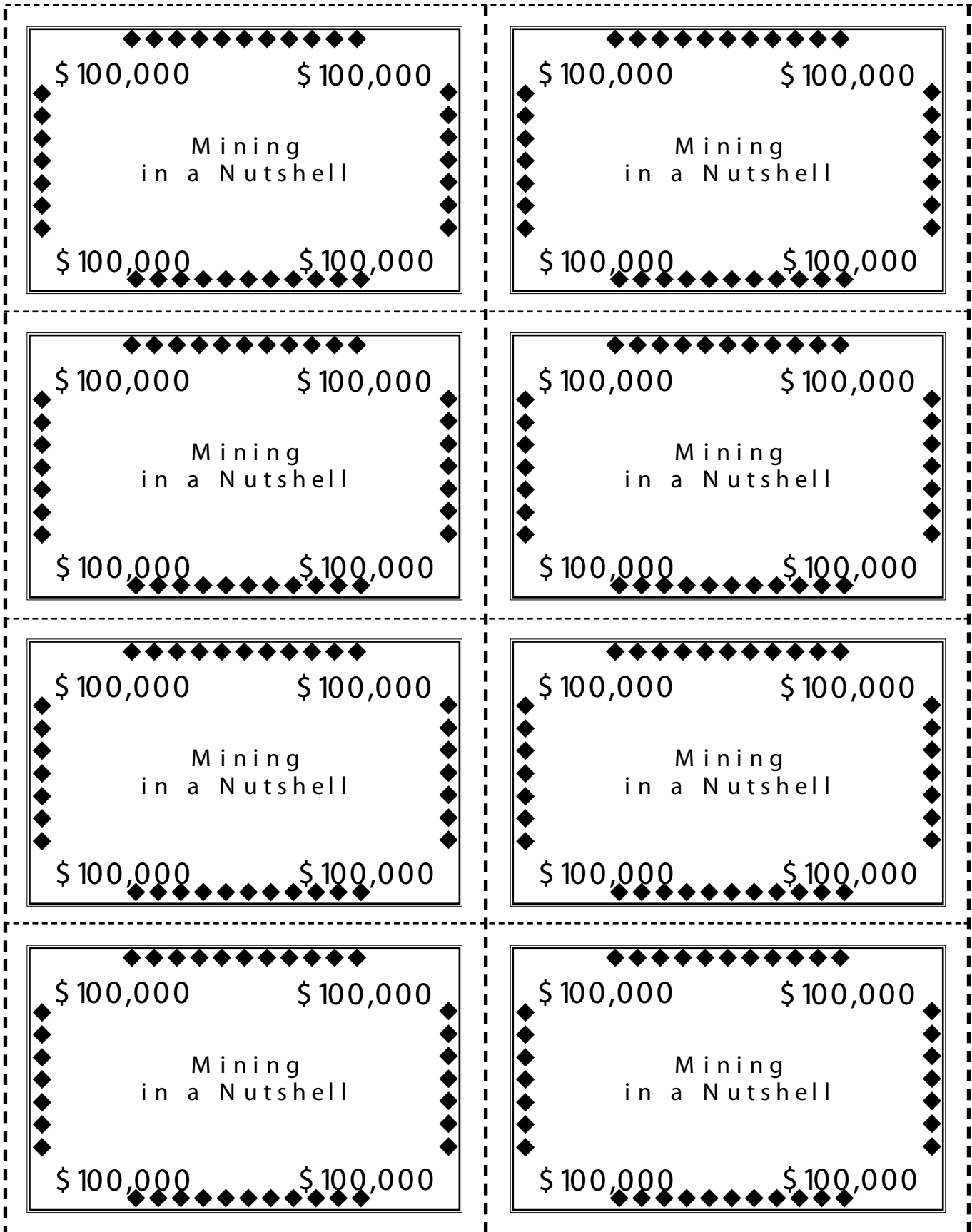
Mining
in a Nutshell

\$50,000 \$5,000

\$50,000 \$50,000

Mining
in a Nutshell

\$50,000 \$5,000



The Geologist's Dilemma

OBJECTIVE:

Students will explain the relationship between supply and demand and its impact on energy resources.

CONCEPTS:

- There are renewable and non-renewable energy sources.
- These energy sources have costs and benefits associated with them.
- Demand for energy sources is shaped by supply and cost.

SKILL REINFORCEMENT:

Critical thinking
Math-number manipulation
Cooperative learning
Evaluation of multiple factors

GRADE LEVEL:

4-12

TIME NEEDED:

One or two class periods

MATERIALS:

- chalkboard or graph paper for recording
- glass jar
- five different colors of beads or types of beans
- rice in same quantity as beads

About 31 percent of the beads should be black (or black beans), 27 percent white (or navy beans), 19 percent blue (or kidney beans), 13 percent green (or rice) and 10 percent red (or lentils).[1] Since the beads represent our energy sources, which are unknown to all, do not attempt to count all the beads or beans. NOTE: Any resources not found the first time are waiting to be recovered the next time the game is played.

[1] Percentages from EIA Total U.S. Energy Production figures, 1996.

PROCEDURE:

1. Throw the beads high into the air, letting them scatter over the room. Divide the class into five exploration companies. Each of the companies will search for one of our energy resources represented by one color bead.

Company #1:	black bead/black bean = coal
Company #2	blue bead/kidney bean = oil
Company #3	white bead/navy bean = natural gas
Company #4	red bead/lentil = nuclear
Company #5	green bead/rice = solar/other

NOTE: Do not interfere or comment if any company starts to collect all colors.

2. Allow the exploration companies to search for one minute. Each company counts its resources. Keep the resources in separate piles. Record the totals for each group for each round on the chalkboard or on graph paper. (See graph.)

The Geologist's Dilemma

(Continued)

		<u>TRIAL</u>		
		1	2	3
SOURCE	Coal			
	Oil			
	Natural Gas			
	Nuclear			
	Solar/Other			

3. Start a second search for one minute. Each company must search for resources still missing. Record totals.
4. Do the same for a third one-minute round.
5. Discuss the following questions:
 - a. Which energy sources were easier to collect? Why? Which were the most difficult? Why?
 - b. What makes them easy or difficult to find? Is it the availability of the beads or the skill of the searchers?
 - c. Looking at the piles of energy from each of the different rounds, which is greater? Why? Which round is the smallest? Why?
 - d. Did anyone collect more than one energy resource? Is it realistic to collect more than one?
 - e. As energy resources become more scarce and demand continues to increase, what should happen to the price or cost of energy resources?

ACTIVITY DEVELOPED BY

Mary Rose Cameron, Alabama Teacher