

# 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.

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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.

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## 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?

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## 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

The image displays a 4x2 grid of eight identical cards. Each card is enclosed in a dashed-line border and contains the following text and graphics:

- 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
- Border: A decorative border of small black diamonds.

\$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  
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\$50,000 \$5,000

