MINING IN A NUTSHELL - Advanced Version

INTRODUCTION

Minerals are used by people and societies to produce goods. These minerals are found in the Earth and must be extracted in order to be used.

PURPOSE:

This activity will model the steps that are taken to find, extract, process and use mineral resources.

OBJECTIVE:

The students will be able to describe the major steps that a company must follow from initial discovery of a mineral deposit through consumption of a finished mineral product. The students will also be able to formulate ideas on ways to use waste products generated during mineral processing.
Skills utilized in this activity include: mapping, mathematics, economics, decision-making and teamwork.

MATERIALS:

- Roasted peanuts **in the shell** - 3 to 4 pounds
- Assorted colors of enamel paint and brushes
- "Mining in a Nutshell" currency or play money (enough so each group has $1,000,000.00 in various denominations).
- 8 ½" x 11" graph paper

- Optional:
  - Food processor or blender
  - Scale for weighting in grams or ounces
  - Vegetable oil, salt, and honey
  - Celery sticks and crackers
  - Plastic knives

TEACHER'S NOTE:

Before class, make the following preparations:

1) Paint a spot of color on the unshelled peanuts using the paint. Use several colors, each of which will represent a different mineral. Example: Yellow = Gold, Blue = Silver, Green = Copper, Red = Iron, Black = Lead. Paint 25 to 30 of each color.
2) PHASE 1:
   a) Have each student prepare a **base map** of the room where this activity will be done. It should show all major features like doors, windows, desks, tables, cabinets, etc. Make sure students indicate north on their map. (To increase the precision difficulty, the map may be drawn to scale.
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).

a) Keep track of how many peanuts of each color are used in each cluster. (Refer to diagram for an example of ore-bodies).

b) Have approximately 25% 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.

INSTRUCTIONS:

1) Divide students into groups of 4 to 5. Identify each group by a company name. Each company is given a budget of $1 million to bring a mine "on-line".

2) PHASE 2: EXPLORATION (RECONNAISSANCE) PHASE
   a) Have 2 representatives from each company look around the room and mark on the base map where the colored and unknown (uncolored) peanuts are located. **(DO NOT TOUCH OR REMOVE THE PEANUTS AT THIS TIME!)**
   b) 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 peanut contains the useful nut within its shell). By locating peanuts, the students have completed the EXPLORATION phase.

3) PHASE 3: DRILLING PHASE:
   a) Each company must decide where to proceed with exploration drilling based on their preliminary geologic assessment (mapping).
   b) Have each company pick a **target** site and **claim** it.
      i) 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).
      ii) The winner of the bid will control that property and the loser(s) must find another property.
   c) Each company can drill **up to six** holes on their property.
      i) Drilling consists of **turning over** a peanut to see if it represents valuable ore.
      ii) Calculate the cost of drilling (Worksheet 3A).
   d) **(Optional)** If a company decides not to mine their property based on their drilling results, they may opt for another property, but the costs they incurred for the first property are added to the costs of the second property.

4) PHASE 4: MINING PHASE:
   a) Now that each company has mapped and drilled their property, it is time to put the information to the test by **mining.**
   b) At this point each company will mine by turning over each unknown peanut to see whether it is part of an ore body.
      i) Students will count the number of peanuts in their ore body and use that number in Phase 4 of the Worksheet.
      ii) Mined peanuts will include the ones, which were originally "face-up" or were turned over during drilling.
         (1) The exposed peanuts are counted because they need to be taken out of the ground.

5) PHASE 5: MINE VALUATION:
   a) Have each mining company tally the number of peanuts representing each mineral mined (Phase 5 of the Worksheet).
      i)   Also, calculate the number of "**waste**" peanuts and their cost. The waste rock must be disposed of as part of the mining operation.
      ii) Calculate the value of each group of colored peanuts using the worksheet. This is the **gross profit**.
      iii) Calculate the cost of reclaiming the mine at 10% of the gross profit.
   b) Determine whether each group has a profit or a loss for the activity.
6) PROCESSING PHASE (OPTIONAL):
   a) In order to actually recover the valuable part of the ore, the edible peanuts themselves, students can weigh the peanuts for each color group.
   b) Then the students shell their peanuts. The peanuts and shells should be kept in separate piles at each table.
   c) Then the students weigh the peanuts separately from the shells. Shelling the peanuts represents one step of the processing phase.
   d) Students can calculate the percent recovered product by dividing the mass of the ore peanuts without shells by the mass of shells + waste peanuts with shells.
   e) In a deviation from the model in which only the marked peanuts represent the ore, in order to make a usable product, the students can combine the "ore" peanuts with the formerly "waste" peanuts.
      i)   Students then shell all remaining peanuts.
         (1) Make peanut butter
            (a) Put the peanuts in the food processor/blender, along with vegetable oil, salt (if desired), and a little honey.
            (b) Turn on the blender so the ingredients become peanut butter. This is the second step of the PROCESSING phase.
7) MANUFACTURING PHASE:
   a) Using plastic knives spread the peanut butter on celery or crackers. This is the MANUFACTURING phase. Minerals are used to make useful products, which we purchase as consumers.
8) CONSUMPTION PHASE:
   a) Eat the above manufactured items. This is the CONSUMPTION phase and the part that students will like the most!
9) RECYCLING PHASE:
   a) 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.

OTHER OPTIONS

This game can go for additional rounds until all 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 (Worksheet 3C). This information may be used to interest a company in becoming a **joint venture partner.**

MINING IN A NUTSHELL - ADVANCED VERSION WORKSHEET

Company Name _____

PHASE 1: MAP MAKING (BASE MAP)
      COST OF MAP: $15,000 PER MINUTE (MAXIMUM 5 MINUTES)
      _____ Minutes X $15,000/Min = $ _____

PHASE 2: EXPLORATION MAPPING (EXPLORATION PHASE)
      COST: $15,000 PER MINUTE (MAXIMUM 8 MINUTES)
      _____ Minutes X $15,000/Min = $ _____

PHASE 3: DRILLING PROGRAM (DRILLING PHASE)
A)   IF NON-COMPETITIVE BID:
      COST: $30,000 PER TARGET (PEANUT) MAX. 6 PER SITE
           _____ Targets X $30,000 = $ _____

B)   IF COMPETITIVE BID:
      AMOUNT OF WINNING BID ($20,000 INCREMENTS) = $ _____

C)   (OPTIONAL) DRILLING INFORMATION EXCHANGE IF
      GEOLOGIC INFO SOLD/PURCHASED PRICE   +/- $ _____

PHASE 4: MINE DEVELOPMENT (MINING PHASE)
   CHOOSE AREA(S) FOR MINE TO BE SITUATED

   MINING COSTS: $5,000 PER PEANUT
      _____ Peanuts X $5,000 = $ _____

             EXPENSES SUB-TOTAL = $ _____

PHASE 5: MINE VALUATION:
   VALUE OF MINERALS (1 PEANUT EQUALS) :

GOLD	-	$400,000	X	= $ _____
SILVER	-	$ 50,000	X	= $ _____
COPPER	-	$ 20,000	X	= $ _____
LEAD	-	$ 10,000	X	= $ _____
IRON	-	$ 5,000 X	_____	= $ _____

                       GROSS PROFIT = $ _____

PHASE 6: WASTE (RECLAMATION)   -   - $5,000 X _____ = -$ _____

NET PROFIT   **$ _____**