MINING IN A NUTSHELL - Advanced Version!
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PURPOSE:	This activity will demonstrate 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 the following: Mapping, mathematics, economics, decision-making, and teamwork.
ITEMS NEEDED:	! Roasted peanuts **in the shell** -- 3-4 pounds ! Assorted colors of enamel paint and brushes, or permanent markers (4 colors minimum) ! Advanced Mining In A Nutshell Worksheets (2 pages) ! "Mining in a Nutshell" currency in denominations of $1,000, $5,000, $10,000, $50,000, and $100,000 ! 8 1/2" x 11" graph paper to map room showing doors, tables, and other major features
OPTIONAL ITEMS:	! Food Processor or Blender ! Scale for weighing in grams or ounces ! Vegetable oil, salt, and honey ! Celery sticks and crackers ! Plastic knives
TEACHER'S NOTE:	**Before class**, make the following preparations: 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=Lead. For each color used, paint 25-30 peanuts.

INSTRUCTIONS:
1. **MAP MAKING PHASE:** 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 1/2 by 11-inch graph paper should be sufficient. To increase the (precision) difficulty, the map may be drawn to scale. **Clock the amount of time each team takes (maximum 10 minutes) to complete their base map and record the number of minutes in Phase 1 on the Worksheet.**
   a. While students are out of the room, put the peanuts in clusters in various locations around the room and number each ore body using the number sheets provided with the lesson. 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 "Suggested Ore Body Layout" diagram for an example of how to set-up "ore bodies"). Place approximately 25% of the colored peanuts "face up" and the rest "face down" so that the students <u>cannot</u> see the color on the shell.

b. 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.

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

2. **EXPLORATION (RECONNAISSANCE) PHASE:** 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!)** 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. The EXPLORATION phase should be limited to a maximum of 8 minutes. Record the actual time spent exploring in Phase 2 on the worksheet.

3. **DRILLING PHASE:** Each company must decide where to proceed with **exploration drilling** based on their preliminary geologic assessment (mapping).
   a. Step 1 - Have each company pick a **target** site and **claim** it.
   b. Step 2 - If two or more companies want the same property a **competitive bid** will take place (Worksheet, 3B), 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.
   c. Step 3 - Each company can drill **up to six** holes on their property at $30,000 per drill hole. Drilling consists of **turning over** a peanut to see if it represents valuable ore. Calculate the cost of drilling (Worksheet, 3A).
   d. Optional Step - 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. **MINING PHASE:** Now that each company has mapped and drilled their 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 your ore body and use that number in Phase 4A of the Worksheet. Mined peanuts **will include** the ones which 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. Also, calculate the number of **"waste"** peanuts and their cost and use that number in Phase 4B of the Worksheet. The waste rock must be disposed of as part of your mining operation.

5. **VALUING THE MINE:** Calculate the value of each group of colored peanuts using

the worksheet (Phase 5 of the Worksheet). This is your **gross profit**.

6. **RECLAMATION:** Calculate the cost of reclaiming your mine at 10% of the gross profit.

7. **PROFIT/LOSS:** Determine whether each group has a profit or a loss for the activity.

<u>**OPTIONAL ACTIVITIES:**</u>
!   **PROCESSING PHASE:**
    "   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. Then 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:** 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.

!   **CONSUMPTION PHASE:** Eat the above manufactured items. This is the CONSUMPTION phase and the part that students will like the most!

!   **RECYCLING PHASE:** 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.

<u>**SUGGESTIONS:**</u>
This game can go 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**.

Company Name _____

Mine Name _____

PHASE 1: MAP MAKING (BASE MAP)
COST OF MAP: $10,000 PER MINUTE (MAXIMUM 10 MINUTES)

_____ Minutes X $10,000/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 WINNING OF BID ($20,000 INCREMENTS) = $_____

PHASE 4: MINE DEVELOPMENT (MINING PHASE)
CHOOSE AREA FOR MINE TO BE SITUATED
A) MINING COSTS: $5,000 FOR EACH PEANUT IN ORE BODY

_____ Peanuts X $5,000 = $_____

B) WASTE COSTS: $5,000 FOR EACH WASTE PEANUT IN ORE BODY

_____ Peanuts X $5,000 = $_____

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

GOLD (YELLOW)   - $400,000   X   _____ peanuts   = $_____

SILVER (BLUE)   - $50,000   X   _____ peanuts   = $_____

COPPER (GREEN)   - $20,000   X   _____ peanuts   = $_____

LEAD (BLACK)   - $10,000   X   _____ peanuts   = $_____

IRON (RED)   - $5,000   X   _____ peanuts   = $_____

GROSS PROFIT = $_____

PHASE 6: RECLAMATION   10% OF GROSS PROFIT   = $_____

PHASE 7: PROFIT/LOSS
     GROSS PROFIT (FROM 5A) . . . . $_____

     EXPENDITURES
          BASE MAP (FROM 1)   _____

          EXPLORATION MAP (FROM 2)   _____

          DRILLING (FROM 3A)   _____

          BIDS (FROM 3B)   _____

          MINE COSTS (FROM 4A)   _____

          WASTE COSTS (FROM 4B)   _____

          RECLAMATION (FROM 6)   _____

          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
        PEANUTS IN SHELL) . . . . _____

     7) DISCUSS HOW THIS RELATES TO ORE MINERAL RECOVERY FROM
        ROCK (ORE VS. WASTE)

RECLAMATION:
     1) DISCUSS NECESSITY OF RECLAMATION.

     2) DISCUSS RECYCLING OF PEANUT SHELLS. CAN THEY HAVE OTHER
        (POST-CONSUMER) USES?

```
Ore Body #7
4   AG   (2,2)
3   CU   (1,2)
11  PB   (3,8)
7   FE   (2,5)
21  WASTE
```
GROSS VALUE $415,000

```
Ore Body #6
1   AU   (1,0)
2   AG   (0,2)
18  CU   (6,12)
2   PB   (0,2)
3   FE   (1,2)
14  WASTE
```
GROSS VALUE $895,000

```
Ore Body #8
3   AG   (1,2)
10  PB   (3,7)
3   CU   (1,2)
10  FE   (2,8)
14  WASTE
```
GROSS VALUE $360,000

```
AU  =  GOLD
AG  =  SILVER
CU  =  COPPER
PB  =  LEAD
FE  =  IRON
```

```
Ore Body #2
2   AU   (1,1)
6   AG   (2,4)
3   CU   (1,2)
1   PB   (0,1)
28  WASTE
```
GROSS VALUE $1,170,000

```
Ore Body #3
4   AU   (2,2)
5   AG   (0,5)
1   CU   (0,1)
30  WASTE
```
GROSS VALUE $1,870,000

```
Ore Body #4
5   AU   (0,5)
2   AG   (1,1)
33  WASTE
```
GROSS VALUE $2,100,000

```
Ore Body #1
2   AG   (1,1)
3   CU   (1,2)
6   PB   (2,4)
7   FE   (2,5)
22  WASTE
```
GROSS VALUE $ 255,000

```
Ore Body #5
1   AU   (1,0)
2   AG   (1,1)
2   PB   (1,1)
2   FE   (0,2)
33  WASTE
```
GROSS VALUE $530,000

MINING IN A NUTSHELL! ADVANCED VERSION
SUGGESTED ORE BODY LAYOUT

NOTE: 2 AG (1,1) MEANS 2 SILVER PEANUTS, 1 UP, 1 DOWN

1

2

3

4

5

6

7

8

9

10

11

12

$5,000.00 Mining In a Nutshell

$10,000.00 Mining In a Nutshell

$50,000.00 Mining In a Nutshell

$100,000.00 Mining In a Nutshell

$1,000,000.00 Mining In a Nutshell

$5,000,000.00 Mining In a Nutshell

$10,000,000.00 Mining In a Nutshell

$100,000,000.00 Mining In a Nutshell

Mining in a Nutshell - Advanced Version
Teacher's Master Game Sheet

Company Number	Company Name	Mine Name	Ore Body Number	Bid (if competitive)	Gross Value of Mine	Net Value of Mine
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						