**Cookie Mining Lab**

**Introduction**

The purpose of the activity is to provide an introduction to the economics of mining. This is accomplished through purchasing land areas and mining equipment, as well as paying for mining operations and reclamation, or restoring the land to near its original condition. In return the “miners” receive money for the ore mined. One of the goals is to make as much money as possible.

The general definition of ore is a naturally occurring material from which minerals of economic value can be extracted at a profit. The chocolate chip cookie represents land area to be mined. The chocolate chip is the ore. The worthless rock that is associated with the ore and must be separated from the ore is the gangue (pronounced “gang.”) The rest of the cookie is the gangue.

**Materials**

Graph paper, chocolate chip cookies, pencils, electronic balances, toothpicks, paper clips

**Procedure**

1) Each mining company is responsible for keeping track of all mining costs, which includes cost of cookies, mining equipment rental, mining and reclamation time, and reclamation costs.

2) **Cookie Cost:** Mines and values may vary. Each mining company is expected to purchase and excavate TWO cookies. Record cookie brand name in **Data Table 1**.

* *Ralph’s Brand (generic) $5.00*
* *Nabisco Chips Ahoy! $6.00*
* *Keebler Chips Deluxe $6.00*
* *Nabisco Chewy Chips Ahoy $8.00*

3) Following the purchase of a cookie (land area), the miner places the cookie on the graph paper and traces the outline of the cookie. The miner then counts each square that falls inside the circle. Each partial square counts as a full square. The total number of squares is recorded in the **Data Table 1**.

Miners will attempt to reclaim the land to the original shape after the ore has been removed.

4) **Mass of Cookie**: Each cookie is massed on the balance, and the mass is recorded in the **Data Table 1**.

5) **Rental Equipment and Fees:** Record information in **Data Table 2**.

* *Round toothpick $4.00*
* *Paper clip $6.00*

\*\*\* If any of the above is returned broken, an extra fee of double the rental price will be charged.

Record any damage fees assessed in **Data Table 2**.

\*\*\* No miner may use their fingers to hold the cookie. Any miner who violates this procedure loses the contract entirely. The only items which can touch the cookie are the mining tools and the paper on which the cookie is sitting.

\*\*\* Someone in the group must record the duration of mining time.

6) **Mining Time Costs**: $2.00/min. Record in **Data Table 2**.

7) **Mass of Ore**: When mining is completed, count and mass the chips (ore). Record in **Data Table 1**.

8) **Value of Ore Chips:** Record information in **Data Table 1**.

* *Normal ore (chips) $10 per gram*
* *25 - 50% impurities $5 per gram*
* *50% impurities $1 per gram*

9) After the cookie has been mined, the remaining rock (gangue) must be placed back into the circled area on the graph paper. This can only be done using the mining tools.

10**) Reclamation Costs**: Count up the number of squares covered by the gangue. If the gangue covers more squares than the original cookie, a reclamation cost of $1.00 per extra square will be charged. Record information in **Data Table 2**.

11) **Total Profits**: Calculate the profits and enter information in **Data Table 3**.

**Pre-Laboratory Questions**

1. What does each aspect of the cookie represent?
2. What is gangue? What do you need to do with it once you are finished mining? Why is this important in real life?
3. What is ore? From your notes, name two methods in which ore is minded or excavated.
4. What sorts of qualities about a cookie do you think determines its value?
5. Of the choices above, which cookie do you think will turn in the highest profit? Why do you think so?

**DATA TABLE 1: Value of Chocolate Chip Ore**

|  |  |  |
| --- | --- | --- |
|  | **COOKIE #1** | **COOKIE #2** |
| **GENERAL INFO** |  |  |
|  Cooke Brand Name | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  Cookie Area (# graph paper squares) | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  Gangue Area (# graph paper squares) | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **MASS** |  |  |
|  Mass of cookie, unmined (g) | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  Mass of ore (g) | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |
|  **VALUE OF ORE CHIPS ($)** | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |

**DATA TABLE 2: Total Mining Fees**

|  |  |
| --- | --- |
|  |  |
|  | **COOKIE # 1** | **COOKIE # 2** |
| **COOKIE/EQUIPMENT** |  |  |
|  Cookie Cost ($) | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  Equipment Pieces Used | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  Total Rental Fees ($) | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  Breakage Fees ($) | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **MINING** |  |  |
|  Time Cost ($) | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  Reclamation Penalty Cost ($) | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |
|  **TOTAL MINING EXPENSES ($)** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |

**DATA TABLE 3: Measuring Profits**

|  |  |  |
| --- | --- | --- |
|  | **COOKIE #1** | **COOKIE #2** |
| VALUE OF ORE ($) | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| TOTAL MINING EXPENSES ($) | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |
| **PROFITS (VALUE – EXPENSES)** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Post-Lab** **Questions**

1. If valuable ore was discovered in a city or town, should a mining company be allowed to harvest the ore? Defend your opinion.
2. How can a mine be beneficial a town or community? How can a mine be detrimental to a town or community?
3. Based upon your calculations, can the landscape be restored to its original topography? Explain why this is or is not possible.
4. Would it be better to mine in a wilderness area than a developed area? State the pros and cons for mining in each area.
5. Were the minerals evenly distributed throughout the cookie mines? Do you think this a good model for a real mine? Why or why not?
6. Did you leave any chips behind in the cookie? Why or why not?
7. Do you think the mining process is faster when you know in advance that the land must be restored? Explain.
8. What changes in your mining technique would have resulted in more profit?
9. Calculate the % ore in your mine. Show all work