MODELING MINING PROCESSES

TRADE-OFFS AND THE SUPPLY CHAIN

Explore: How does the extraction of minerals affect the safety and sustainability of surrounding communities and ecosystems? You will plan and carry out investigations to observe impact of mining processes on surrounding communities and ecosystems. Apply what is observed to a problem definition, and then work through the engineering cycle to ideate, prototype, and construct an argument in support of possible solution(s).

Procedure: Part A – Establishing the Environment

Gather, obtain, and evaluate information about a mining community that matters to you. This could be somewhere local, connected to your family, or an area that you simply find interesting. The information you gather needs to inform you about the space's **biotic** (living) and **abiotic** (non-living) factors. Consider using a graphic organizer to support your success in this research. For example:

Location (City, State, Country)		Available Resource(s) & their uses	
Biome Category: (e.g., rainforest, deciduous forest, desert)		Pre-Mining Human Social Factors (nearby communities, land use, cultural significance)	
Pre-Mining Biotic Factors (animals, plants, fungi)		Pre-Mining Abiotic Factors (land features, water/air quality)	
Mining Process		Specific details associated with the mining process at this location	
Post-Mining Biotic Factors		Post-Mining Abiotic Factors	

Why does this matter to you?

Procedure: Part B – Simulating the Environment (Prior to Mining)

Based on the information you have gathered, you will create a diagram of your mining community before mining. Then, you will create a 3-dimensional model of that pre-mining environment. Consider what materials you will use to represent different biotic and abiotic aspects of the mining community.

Things to consider: Where are the minerals located? What is around the minerals?

1. Sketch your initial set-up for the simulation:

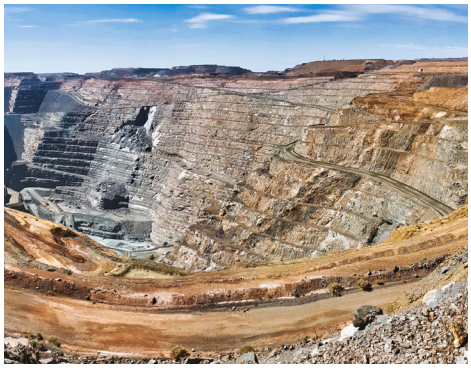
Environment **Before** Mining

2. Pause for Sense-Making:

I chose to use…	to represent….	because….	I predict it will _____ during the mining

3. Based on your decisions, use the provided supplies to develop a 3-dimensional model of the community you have diagrammed. Position all biotic and abiotic factors in your model within the plate provided by your teacher.

Procedure: Part C – Reclamation Plan (What happens when the mining stops?)



Prior to granting a company permission to mine, a land reclamation plan must be submitted to the city, county, and/or state for approval. This plan informs the community stakeholders of **how the company plans to restore the environment to something similar or better than its original state.**

The reclamation plan typically maximizes **self-sustainable solutions**, meaning that once the solution is put in place it is permanently successful and stable in the environment.

Develop a reclamation plan below. This reclamation plan must be approved by the state. The reclamation plan includes two parts:

1. Outline of potential environmental risks and how these risks will be minimized:

Potential environmental risk	How this risk will be minimized in your plan

2. Visual representation of the environment after mining:

Environment **After** Mining (prediction)

Procedure: Part D – Expenses for Extraction Simulation

To ensure that you can extract resources, you will purchase land consistent with where your minerals are typically deposited and use mining techniques appropriate for the land and ore.

Land Type/Mineral Location	Investment Cost
Sandy	$10,000
Underground	$15,000
Mountains, rolling hills	$12,000
Ribboned underground	$14,000

1. Which type of land will you be mining? _____

2. What is this investment cost? _____

3. What mineral(s) are you mining for? List based on greatest to least value.

_____ x $300/gram _____ x $200/gram _____ x $100/gram

4. What mining process is best for this land and mineral? (see Part A) _____

5. You will simulate your selected mining process using the tools below. (Note: You can consider additional tools. They - and their cost - need to be approved by your teacher.) Changing tools is allowed. The following expenses should be considered when choosing tools:

Representation	Cost Per Day
Metal straws	$200
Toothpicks	$100
Pipe cleaners	$150
Bottle of water (purifying)	$200
Toothbrush (purifying)	$100

6. Purifying, or isolating the desired mineral, is a process. How complex will your process be in this simulation? Any tools needed to purify your mineral will be part of your expenses.

   a) Which tools do you anticipate using in your purifying process? _____

   b) Approximate your tool expense per day: _____

7. Mining is shift work. A miner might work a day shift of 11:00 a.m. to 7:00 p.m., Monday through Friday. A miner is estimated to earn $160 day. (This will equal $20 for every 10 seconds in our simulation).

   a) How many miners (people from your group) will you employ? _____

   b) Approximate your labor expenses per day: _____

Procedure: Part E – Mining Records

1. Simulate the progress of one mining team in a 10-day period.

- You have 80 seconds for each day to extract as many minerals as possible. At the end of yeach day, purify the minerals
- Record any supplies used for mining and purifying and record the related expenses.
- Then, record the mass of pure minerals collected.
- Keep a record of any other events that occur in your environment as well.
- Consider: How will miner safety be monitored during extraction?

Consider delegating roles and responsibilities on your team during the simulation.

Miner(s): Use agreed upon tools to extract minerals, engage in safe practices to minimize environmental impact, and stay focused. Miners also collaborate with environmentalists to anticipate labor needs for land reclamation.

Quality Control: Purifies the minerals once extracted, measures their mass, and reports this data to the financial officer. Collaborates with the environmentalist to anticipate needs for land reclamation.

Financial Officer: Maintains all financial records. Analyzes financial records to determine labor and tool expenses, and money earned from minerals. Collaborates with environmentalist to record environmental impact and anticipated expenses for land reclamation.

Environmentalist: On site during extraction and purification process to assess and report on daily environmental impact. Once site is inactive, collaborates with all stakeholders to assess potential for land reclamation.

Day at Work	Labor Expense	Tools Required	Tool Expenses	Quantity of Purified Minerals	Value of Mineral	Environmental Impact
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Pause for Sense-Making: What is the impact of the mining process?

Miner(s): What was observed during extraction and purification that affects the reclamation plan? How was miner safety affected during mineral extraction and purification? Report your findings and then support the environmentalist in developing a revised reclamation plan.

Quality Control: What was observed during extraction and purification that affects the reclamation plan? How was miner safety affected during mineral extraction and purification? Report your findings and then support the environmentalist in developing a revised reclamation plan.

Financial Officer: Based on current expenses and profits, was the mineral extraction profitable? How will the cost of land reclamation possibly affect any profit? Analyze and interpret all financial data. Report your findings back to the company.

Environmentalist: How do the events that unfolded during extraction and purification affect the potential for land reclamation as outlined in the land reclamation plan? Work with all company team members to revise the reclamation plan to meet the current needs of the mining area.

Post-Mining Report

Prepared by _____ , an expert _____
name role