*Name:*_____ *Date:*_____

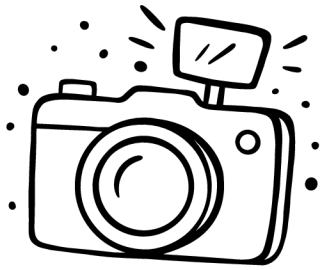
Mining Operations Lab

Section 1: Current Mining Operations

Research each of the following current mining operations using the links in the Section 1 folder on Schoology. Complete the lab and determine which mine extracts the natural resource found in your biome.

Name of Mine	Location	Type of Resource Collected	Type of Mining
Escondida Mine			
Tenke Fungurume Mine			
Weipa Bauxite Mine			
Balama Mine			
The Niobrara in the Denver-Julesburg (DJ) Basin			
Kings Mountain Mine			
Kanawha Eagle Mine			
Which mine fits your biome and resource?			

Section 2: Pre-Mining Survey



1. Take several photographs of your model before you begin extraction.
2. Make sure you get close-up photographs of the following:
   - Plants (flora)
   - Animals (fauna)
   - Soil structure and landforms
   - Water sources
3. Submit the photos to the Pre-Mining Survey album on Schoology. Make sure to comment on each photo with a brief description and the name of your biome. You must submit at least 4 photos.

Section 3: Mine Building

Step 1: Choose a location.

Clear a small section of your "native flora." In a real mine, this is called stripping. Set these materials aside to represent "reclamation" later.

HINT: *Try to select a location that you think will have the least negative impact on the ecosystem but the best chance at extraction the natural resource*

Step 2: Machinery

Select two construction vehicles and one other accessory for your mining operation

Step 3: Construct the Extraction Point

If Underground Mining is Required for the Resource:
Use a cardboard tube to create an entrance. Use popsicle sticks to create a "timber set" (the wooden frame) to prevent "collapses."

If Surface Mining is Required for the Resource:
Cut a tiered "crater" into your diorama base. Use thin layers of different colors of playdough to show different rock strata.

Step 4: Building the Infrastructure

The Mill: Build a multi-level cardboard structure. This should be the largest building.
The Power Grid: Use wire or black string to run "power lines" from a generator building to the mine entrance.
Transport: Use gravel to create a haul road leading from the mine to the processing plant.

Step 5: Environmental Controls

Tailings Pile: Create a mound of gray gravel near the mill.
Settling Pond: Use aluminum foil to create a pond at the lowest point of the site to show where runoff is collected.

Once you have completed your set-up take some new photographs of your model highlighting the changes you made to accommodate the mining operation.

Submit these photos in the Section 3: Mine Building Photographs album on Schoology.

Make sure to comment on each photo with a brief description of the changes and the name of your biome.

You must submit at least 4 photos.

Tip for Authenticity

Use a 1:1 scale. If you have a "native animal" (fauna) in the diorama, the mine buildings should be sized appropriately relative to that animal to show the **massive scale** of industrial equipment.

Section 4: Resource Extraction

1. Select the mining tool you would like to start with.
2. Set an extraction timer on your iPad for 20 minutes.
3. Start the timer and begin resource extraction! Use the extraction tools to “mine” for as much of your resource as you can. You may not use your hands!
4. You must balance efficiency of resource removal with environmental protection.
5. The more resource your extract the more money you make.
6. The more mining you do the more likely you are to damage the ecosystem and its biodiversity. Minimize damage to the following factors during your mining operation:
    - Plants (flora)
    - Animals (fauna)
    - Soil structure and landforms
    - Water sources

7. Stop when time is up! All mining activities must stop immediately and no additional natural resources may be removed from the ecosystem.

Section 5: Data Collection

Mass Data Table:

Weigh the total mass of the resource you collected. Record the initial and final masses of your resource on the data table below.

Initial Mass (g)	Final Mass (g)

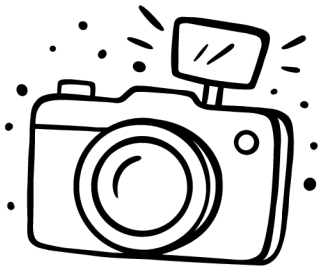
Percent Recovery Calculations:

Use the formula provided to calculate percent recovery.
Show your work and record your answer in the space below.

$$\text{Percent Recovery} = \left(\frac{\text{Mass of Resource Collected}}{\text{Total Available Resource Mass}} \right) \times 100$$

Section 5: Data Collection cont.

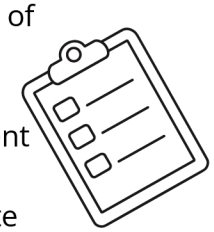
- Take several photographs of your model and all damages after extraction is complete.
- Make sure you get close-up photographs of the following:
  - Any damage to plants (flora)
  - Any damage to animals (fauna)
  - Any evidence of erosion
  - Any soil structure or landform damage
  - Damage to any water sources



- Submit these to the Section 5: Data Collection album on Schoology. Include a brief description and the name of your biome with each photo.

Section 6: Post-Mining Environmental Impact Assessment

Prepare for the Post-Mining Environmental Impact Assessment! Your results will be evaluated based on the amount of resource you extracted, your calculated percent recovery, and the condition of your ecosystem after mining.



1. First complete the self evaluation section of the Post-Mining Environmental Impact Assessment document.
2. Next find a peer who is ready to act as an "Environmental Assessor" and ask them to complete the Peer Review section of the Post-Mining Environmental Impact Assessment document.
3. Mrs. Villier will evaluate using the PEIA during the EPA and review process.

Section 7: Introduction to Reclamation

The next phase of the lab is to begin the Reclamation Process. After the EPA finishing reviewing your mining site they will provide a list of next steps towards reclaiming the land. Today you will get a brief introduction into the process before you conduct it on your own biome!

Go to the link on Schoology called Aim to Reclaim! or scan the QR code above to learn about the reclamation phase. Complete the entire virtual lab. Once successfully completed you should receive a certificate. Print your certificate of completion in the library, fill it out with your name, and sign/date the bottom. Staple the certificate to this packet.

Section 8: Submission to the EPA for Review

Make sure ALL directions have been read and that ALL sections of this lab packet are complete. Submit your findings to the EPA (green turn in bin) for further review. You should hear back from them by Friday 1/ 9 with Reclamation Plan next steps.

Post-Mining Environmental Impact Assessment (PEIA)

Student Being Evaluated: _____

Peer Evaluator Name: _____

Resource Mined: _____

Biome: _____

Date: _____

SECTION 1: SELF EVALUATION

(Completed by the student who conducted the mining operation)

A. Compliance With Mining Rules

□ Mining stopped on time
□ Only assigned resource was extracted
□ Approved tools were used correctly
□ Ecosystem disturbance was minimized

Score: □ 4 □ 3 □ 2 □ 1

B. Environmental Condition After Mining

Land & Soil

□ Stable surface
□ Pits filled or minimized
□ Little to no erosion

Water (if present)

□ Clear and unobstructed
□ No visible pollution

Flora & Fauna

□ Plants mostly intact or replanted
□ Animal habitats mostly intact

Score: □ 4 □ 3 □ 2 □ 1

C. Responsibility & Reflection

□ Data recorded accurately
□ Percent recovery calculated correctly
□ Environmental impacts acknowledged

Brief Reflection (2–3 sentences):

Score: □ 4 □ 3 □ 2 □ 1

Self-Evaluation Total: _____ / 12

SECTION 2: PEER EVALUATION

(Completed by a peer acting as an environmental assessor)

A. Post-Mining Environmental Inspection

Land & Soil

□ Stable
□ Minor damage
□ Major damage

Water

□ No impact
□ Minor impact
□ Severe impact

Flora

□ Fully restored
□ Partially restored
□ Not restored

Fauna

□ No impact
□ Moderate impact
□ Severe impact

B. Compliance Determination

□ Meets environmental standards
□ Partially meets standards
□ Does not meet standards

C. Required Restoration Tasks

(Check all that apply)

□ Fill and stabilize pits
□ Replace soil
□ Replant native vegetation
□ Restore habitats
□ Improve water quality
□ Remove waste or tailings

D. Peer Scoring

Category	4	3	2	1
Rule Compliance	□	□	□	□
Ecosystem Protection	□	□	□	□
Data Accuracy	□	□	□	□

Peer Evaluation Total: _____ / 12

Peer Comments:

SECTION 3: TEACHER EVALUATION

A. Scientific Accuracy & Procedure

□ Correct mining procedures followed
□ Accurate mass and percent recovery
□ Appropriate scientific reasoning

Score: □ 4 □ 3 □ 2 □ 1

B. Environmental Impact & Restoration

□ Minimal ecosystem damage
□ Restoration attempted where needed
□ Realistic post-mining condition

Score: □ 4 □ 3 □ 2 □ 1

C. Overall Compliance & Understanding
□ Demonstrates understanding of mining impacts
□ Understands environmental regulation and responsibility

Score: □ 4 □ 3 □ 2 □ 1

Teacher Evaluation Total: _____ / 12

Teacher Comments:

FINAL SCORE SUMMARY

Self Evaluation _____ / 12
Peer Evaluation _____ / 12
Teacher Evaluation _____ / 12

Final Total _____ / 36

Final Determination

□ Environmentally Responsible
□ Minor Improvements Needed
□ Significant Environmental Impact

SECTION 4: PEIA CHECKLIST
Post-Mining Assessment & Action Plan

I. Terrain & Physical Safety (The "Earthworks" Phase)

- Focus: Is the land stable and safe for the biome to return?

□ Highwall Hazard: Identify any vertical cliffs created by digging.

Action: Use foam/clay to grade these into 3:1 slopes.

□ Subsidence Risk: Check for hollow areas in underground tunnels.

Action: Represent "grouting" or backfilling with sand/gravel.

□ Erosion Vulnerability: Locate areas where bare dirt might wash away into the river.

Action: Mark these for "erosion blankets" (felt/burlap).

□ Haul Road Decommissioning: Decide if roads stay for park access or are "ripped" (broken up).

Action: Cover unused roads with "topsoil" (brown flocking).

II. Hydrology & Water Chemistry (The "Toxicology" Phase)

- Focus: Is the water flowing correctly, and is it "clean"?

□ Acid Mine Drainage (AMD) Check: Identify "orange" water or low pH areas.

Action: Build a "Limestone Channel" (white gravel) to neutralize it.

□ Settling Pond Efficiency: Ensure the pond is at the lowest point of the mine.

Action: Add "reeds" (painted bristles) to create a wetland filter.

□ Groundwater Monitoring: Identify where the aquifer might be.

Action: Place "monitoring wells" (painted straws) near the tailings pile.

III. Soil & Biological Health (The "Ecological" Phase)

- Focus: Can the "native" flora and fauna survive here again?

□ Overburden vs. Topsoil: Ensure gray "waste rock" is buried under brown "nutrient soil."

Action: Apply a distinct layer of brown material over gray material.

□Native Seed Bed: Verify if chosen plants are "native" or "invasive."

Action: Place moss or lichen that matches the pre-mining biome.

□ Habitat Connectivity: Ensure animals can walk across the site without being blocked by fences.

Action: Remove "industrial" fencing and create "wildlife corridors" (clear paths).