

## **Lesson 1: How Do We Mine Iron Ore?**

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**Target 4<sup>th</sup> grade, Michigan History**

### **Lesson Overview**

Students will learn about the mining process including its transportation by water. The focus will be on an iron ore mine called Empire in Ishpeming Michigan. The students will learn the cycle of iron ore going from the ground to arriving at a steel mill including all the steps in between appropriate for the fourth grade level.

### **Objectives**

- Students will be able to describe the site where hematite is mined.
- Students will be able to describe the process of hematite being turned into iron ore pellets and transported to a steel mill.
- Students will be able to discuss transportation systems used in this process.

### **State Standards**

#### **II. Geography Perspective, Content Standard 1**

Describe how people use the environment to meet human needs and wants

#### **II. Geography Perspective, Content Standard 3**

Identify locations of significance in their immediate environment and explain reasons for their location

Identify people, goods, services and ideas in their local community which have come from other places and describe why they moved

#### **IV. Economic Perspective, Content Standard 1**

Identify ways families produce and consume goods and services

#### **IV. Economic Perspective, Content Standard 1**

Select a particular good or service and describe the types of resources necessary to produce and distribute it

### **Extension State Standards**

#### **I. Historical Perspective, Content Standard 1**

Distinguish among the past, the present and the future

#### **I. Historical Perspective, Content Standard 1**

Describe the past through the eyes and experiences of those who were there as revealed through their records

### **Materials**

One copy of each for each student:

Folded File Folder page

Iron Process Page (to save paper, copy process page on back of folded file folder page)

Persuasive letter instruction page

Persuasive letter rubric

### **Room Arrangements**

No special room arrangements are necessary for this project

### **Vocabulary**

hematite	steel	freighter
iron ore	magnetite	
taconite		

### **Background**

Contact Cleveland-Cliffs Michigan Operations for video and booklets and possibly a tour  
906-475-3400

[www.cleveland-cliffs.com](http://www.cleveland-cliffs.com)

Contact Michigan Iron Industry Museum for brochures and information  
906-475-7857

[www.sos.state.mi.us/history/history.html](http://www.sos.state.mi.us/history/history.html)

Contact Lake Carriers' Association for brochures and information  
216-861-0592

[www.lcaships.com](http://www.lcaships.com)

### **Pre-assessment – Folded File Folder**

1. Pass out a blank piece of 8 ½ by 11 colored paper or construction paper
2. Students turn the paper so the 8 ½ side is the top and label it “Mining Process”
3. Have students fold the paper in half hamburger style, or top to bottom.
4. Ask students to write down anything they know or can connect to mining iron ore in the top section of the page.
5. Then have some students share their prior knowledge of the subject, but other students do not need to record classmate’s prior knowledge.

### **Focus Questions**

Have students draw a box under their prior knowledge notes. The box should be approximately 2 inches by 8 inches. Put the numbers 1-4 in the box. Read the focus questions to the students and have them make guesses to answer these questions.

1. What things are made of steel?
2. What is steel made of?
3. What is iron ore?

4. How does the iron ore get mined and transported to the steel mill?

### **Attention Getter - Prepare**

Have 5 items sitting in front of the class and ask what they have in common.

Items may include hammer, screw driver or other tools, silver wear, garbage can, etc.

### **Classroom Activity**

1. Students watch the video and try to record interesting information including the steps of mining hematite on lower section of the pre-assessment and focus question Folded File Folder page.
2. Discuss the steps with students and allow students to fill in missing information to their notes in another color or ink/pencil.
3. Pass out Iron Ore Process page and have students fill in all steps of the iron ore process. Option – have students draw and color a picture with each step in the process.
4. Pass out Persuasive letter instruction and rubric page. Discuss persuasive writing and allow time for students to write letter.
5. Share letters with others in the class.

# Iron Ore Process

(answer key)

## Explosions

drills blast holes in carefully engineered patterns giving about 550,000 tons of material

## Shoveling

electric shovels load blasted ore into trucks

## Moving

trucks move the ore and other materials to crusher

## Crushing

crushers break ore into chunks smaller than 9 in.

## Grinding

ore is moved to a grinder to make a powder-fine consistency.

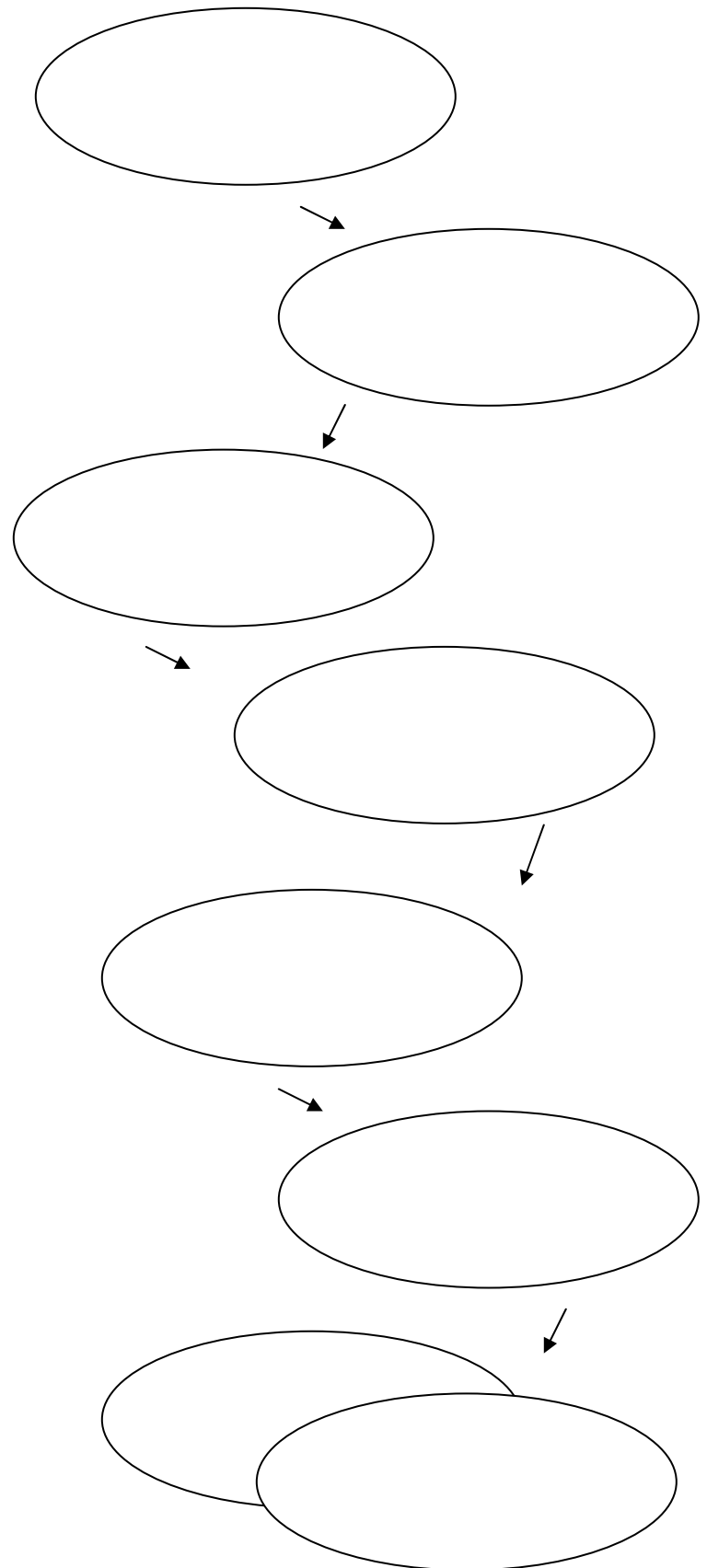
## Processing

\*magnetic cobbles remove the silica waste

\*large magnets attract the iron while

waste is washed away

\*then material is floated so waste goes to the top and iron to the bottom



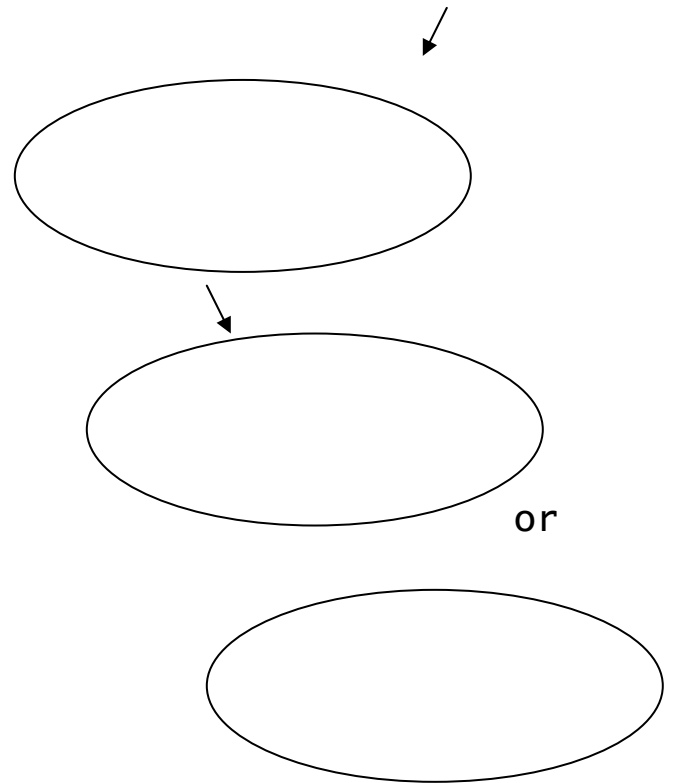
- \*limestone and dolomite is added
- \*water is removed

### **Pelletizing**

- \*the powdery iron ore concentrate must be made into pellets so it can be shipped
- \*the material is rolled into big drums that roll it into pellet balls
- \*the pellets are dried, preheated, then put into a kiln to harden

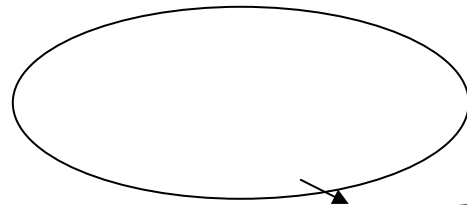
### **Shipping**

- \*pellets are carried from the plant and placed into a bin to be loaded into a railroad car freighter
- \*freighters travel along Lake Superior to a steel mill

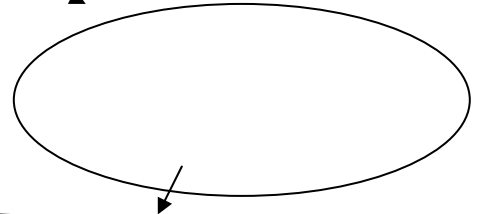


# Iron Ore Process

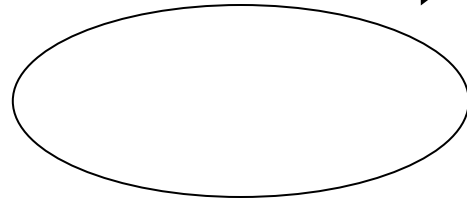
Explosions



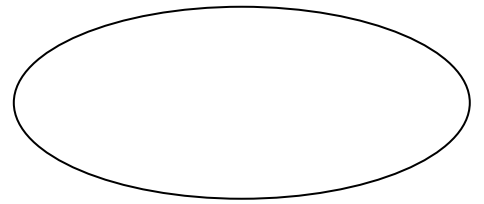
Shoveling



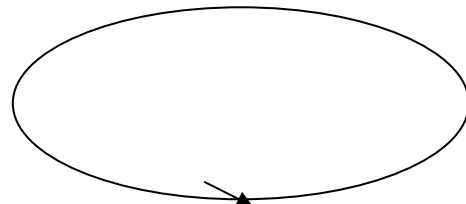
Moving



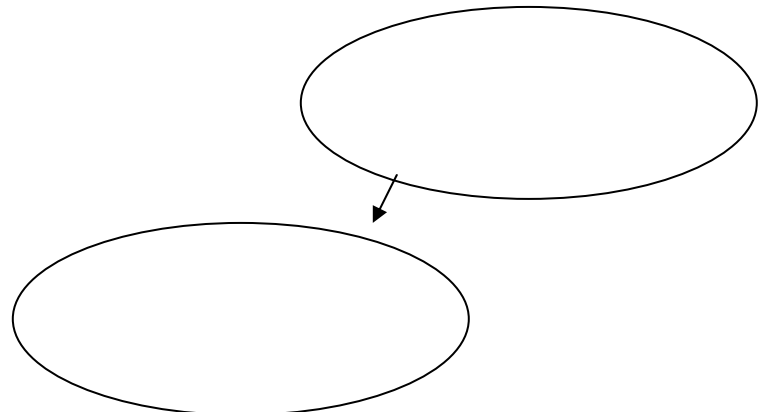
Crushing



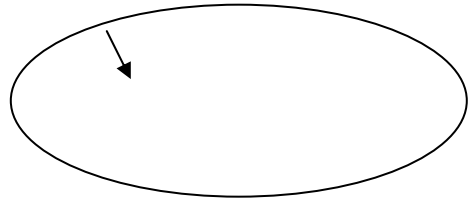
Grinding



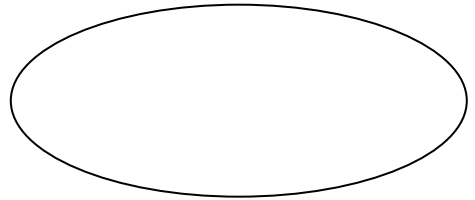
Processing



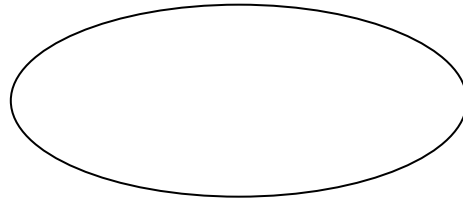
**Processing continued**



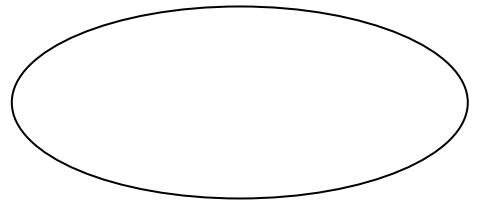
**Pelletizing**



**Shipping**



or



## Persuasive Letter Instruction Page

**Background:** You have just learned the steps involved in mining and transporting iron, including how it is removed from the ground, how it is prepared into iron ore pellets, and how it is transported to a steel mill.

**Task:** You will write a persuasive letter about being employed for any part of this process. You may choose miner, iron processor, or first mate on a freighter.

**Audience:** You will write your persuasive letter to a perspective boss or captain of a vessel.

**Purpose:** The goal of your letter is to convince your audience, your perspective boss to hire you for this job.

**Procedure:**

1. Review all the steps in the mining process that you have written as interesting facts on your Folded File Folder. Also review the process steps on the back of your Folded File Folder. You may also look at the booklet from the Empire Mining Company to review the mining process again.
2. Analyze this process and break it down into three possible job opportunities:
  - a. managing the mining field which involves coordinating the blasting procedure, operating the crane to remove the taconite, the trucks to drive it to the mill, maintaining safety at all times on the site
  - b. processing the taconite to iron involving operating machinery, fixing machinery, monitoring technology of machines, maintaining safety at all times in the mill
  - c. first mate assists in loading of iron ore onto the ship, securing the ship, maintains the deck, maintaining safety at all times on board the ship
3. Select one job that you feel you should be considered and hired to do. State that below:

I should be hired to do the job of

---

4. List the aspects of that job and why you would do a good job:
  - 
  - 
  - 
  - 
  -
5. Address this letter correctly to reflect a business letter including address, date, and opening salutation.
6. Write opening paragraph to introduce yourself, state your position and a brief description or overview of the characteristics you poses that are right for this job.
7. Turn each aspect listed above and the reasons why you should be hired for this job into a paragraph.
8. Write a concluding paragraph stating the most important reasons why you should be considered for this job.
9. Close the letter with proper closing salutation and signature.

\*Look on the back of this page at assessment rubric before, during and after writing your persuasive letter for guidance.

Rubric for Persuasive Letter “To Be Hired for a Job in the Mining Field”	
TRAIT 1 Understand one of the three areas of the mining process	
<p>_____ All aspects of job included</p> <p>_____ Description of aspects of jobs include many details</p>	<p>4 Exceptional understanding of the selected job that includes all detailed aspects of that job</p> <p>3 Good understanding of the selected job and includes all aspects, but not all the details</p> <p>2 One to two aspects of the job is not included or some details are left out</p> <p>1 More than two aspects of the job are not included and many details are left out</p>
TRAIT 2 Develops convincing arguments for all aspects of that job	
<p>_____ States point of view</p> <p>_____ Offers clear reasons for each job aspect</p> <p>_____ Includes reasons that include details of the job</p> <p>_____ Uses a strong organization strategy</p> <p>_____ Is aware of audience</p>	<p>4 Exceptional development and organization of your point of view, reasoning and word choice for your opinion about your ability to do details of the job. You are clearly writing to a future employer.</p> <p>3 Word choice for reasons are not as strong, or reasons for details of the job are not included. Organization may be stronger and/or not clearly written to a boss.</p> <p>2 Reasoning is missing support and details are not included. Audience is too general and organization could be stronger.</p> <p>1 Reasoning is not clear or not one sided, many details of position are missing. No audience or organization are clear.</p>
TRAIT 3 Correct conventions or writing	
<p>_____ correct sentence structure</p> <p>_____ correct spelling</p> <p>_____ capitalization and punctuation guide reader</p> <p>_____ organized and indented paragraphs</p> <p>_____ no editing needed</p>	<p>4 Exceptional control of writing conventions: mechanics are at an advanced level.</p> <p>3 No editing needed, correct sentence structure, spelling, capitalization and punctuation and at average level.</p> <p>2 Some errors in the areas of sentence structure, spelling, capitalization, and punctuation.</p> <p>1 Many errors in the areas of sentence structure, spelling, capitalization, punctuation and editing.</p>

## **Assessment**

1. Have students turn in Folded File Folder. Assess students (+ or -) on attempting to write prior knowledge, predictions to focus questions, notes taken on film, additions added in another color, cycle of iron ore mining process.
2. Students turn in Process Page
3. Assess persuasive letter according to rubric

## **Extensions**

1. Add information about mining in 1800's and compare and contrast processes on the File Folder Page while reading resources listed below and write persuasive letter or compare and contrast essay.
2. Students can research the following topics: history of mining and compare and contrast processes, shipwrecks of Lake Superior, or life on a freighter.

## **Resources**

### Extension

Vinyard, Dr. Joellen McNergney. Michigan Adventures in Time and Place. Macmillan McGraw-Hill Publishers; New York. pgs. 151-154

McConnell, David B. Michigan's Story. Hillsdale Educational Publishers; Hillsdale. pages 101-107, 132-139, 161-167

Deur, Lynne and Sara Michel. The Making of Michigan. River Road Publications, Inc; Spring Lake. pgs. 16, 179-191

Killoran, James, Stuart Zimmer and Mark Jarrett. Michigan Its Land and Its People. Jarrett Publishing Company; Lafayette. pgs. 124-125, 240-241, 247-254, 252, 255-259

Mitchell, John and Tom Woodruff. Great Lakes and Great Ships. Suttons Bay Publications; Suttons Bay.