



# MINING YOUR FUTURE

CHALLENGE, ADVENTURE, TRAVEL, GOOD PAY, GREAT OPPORTUNITY

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## About This Resource

The development of this resource has been undertaken by the BC Mineral Exploration and Mining Industry Labour Shortage Task Force as a result of input from educators from around the province following an Educators/Miners Conference held in March 2010. The resource is intended to bring mining occupations and the opportunities that exist in BC's mining sector into the classroom through supporting teachers with easy to use and understandable support materials. The focus of this student driven resource is to be used in Planning 10 classes at the secondary level. The intention is for the teacher to learn along side of the students.

It has been designed to suit your needs as a secondary teacher by making it easy to use and fully understandable. Activities and worksheets have been developed to save you time and to help students effectively explore careers in the minerals industry and the abundance of career opportunities available to them. This resource is intended to educate students about the mineral industry, a place for everyone to find work, at the entry level or with a post secondary education.

## Why This Resource?

### *Wanted: 15,000 employees for BC's Mineral and Mining Sector*

The BC Mining industry, the safest heavy industry in the province, includes 20 major operating coal, metal and aggregate mines. The BC Mineral Exploration and Mining sector directly, and indirectly, is responsible for over 100,000 jobs in the province – almost 1 in every 20 jobs.

A perfect storm of economic expansion, declining birth rates, and aging of the workforce has hit the Mineral Exploration and Mining sector hard, just as it is experiencing significant growth. A lack of skilled workers threatens the significant economic contributions from the BC Mineral Exploration and Mining sector.

As a result of the labour shortage, the BC Mineral Exploration and Mining Industry Labour Shortage Task Force created an Education Sub Committee whose focus was to develop and deliver curriculum and resources across BC.

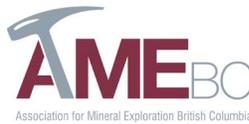
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## **BC Mineral Exploration and Mining Industry Labour Shortage Task Force:**

The major stakeholders associated with the mining industry in B.C. recognized the need to work together to address the human resource challenges identified above. To that end the “BC Mineral Exploration and Mining Industry Labour Shortage Task Force” (Task Force) was formed in 2008 and supported at that time through Federal Government funding and industry in-kind contributions. The Task Force developed the “British Columbia Mineral Exploration and Mining Industry Human Resources Strategy” (the Strategy) and commenced implementation activities.

The Task Force is supported by the Aggregate Producers Association of British Columbia (APABC), the Association for Mineral Exploration of British Columbia (AME BC) and the Mining Association of British Columbia (MABC).



### **Aggregate Producers Association of British Columbia (APABC)**

APABC is a not-for-profit association representing members comprised of aggregate producers, suppliers, and associates throughout the province of British Columbia. The APABC was registered as an Association in 1988 and has grown to be an important entity serving the people of British Columbia.

### **Association for Mineral Exploration BC (AME BC)**

AME BC is the predominant voice of mineral exploration and development in British Columbia. Established in 1912, AME BC represents thousands of members including geoscientists, prospectors, engineers, entrepreneurs, exploration companies, suppliers, mineral producers, and associations who are engaged in mineral exploration and development in BC and throughout the world. Through leadership, advocacy, and partnerships, AME BC promotes a healthy environment and business climate for the mineral exploration industry.

### **Mining Association of BC (MABC)**

MABC represents companies involved in the exploration and development, mining and smelting of minerals, metals, coal and industrial minerals in British Columbia. MABC is the pre-eminent voice of mining in the province. In doing so, it has come to be regarded as the predominant voice of mining in British Columbia. The Mining Association of BC also provides our member companies with a wide variety of services such as: participation in key government/industry committees, updates on regulatory change, access to meetings that provide the opportunity to exchange information among members, joint industry action on issues of common concern, and the availability of staff expertise on the areas of greatest interest.

# OVERVIEW

Unit	Title	Activities	Objectives	Planning 10 Learning Outcomes	Time (approx.)
1	Opportunities	British Columbia Mining - A Career for Me?	In this lesson the students will see the 'modern' face of mining and all it has to offer.	The students will be able to... <ul style="list-style-type: none"> <li>• Relate personal attributes and interests to education and career planning.</li> <li>• Relate labour market information to careers of interest.</li> <li>• Identify support networks and resources for pursuing their education and career goals.</li> </ul>	1 hour
2	Variety	Sell a Career (Career Fair)  Modified Interviews  Guest Speaker/Panel  Video –Careers in Mining	In these lessons the students will begin to explore the variety of careers available, job descriptions, salaries, lifestyles, beneficial attributes, education and training as well as advancement opportunities	The students will be able to... <ul style="list-style-type: none"> <li>• Relate personal attributes and interests to education and career planning.</li> <li>• Compare a variety of post-secondary education and training institutions/ programs.</li> <li>• Demonstrate an understanding of employability skills.</li> <li>• Identify support networks and resources for pursuing their education and career goals.</li> </ul>	4 hours
3	Travel & Adventure	Mining in BC: Map Game  Optional Activity: Resources for our Communities	This lesson will look at BC's currently operating mines and the world stage.	The students will be able to... <ul style="list-style-type: none"> <li>• Relate labour market information to career of interest.</li> <li>• Relate personal attributes and interests to education and career planning.</li> <li>• Identify support networks and resources for pursuing their education and career goals.</li> </ul>	1 hour
4	Products	What's mined is yours	This lesson will uncover many of the products that mining supports.	The students will be able to... <ul style="list-style-type: none"> <li>• Relate personal attributes and interests to education and career planning.</li> </ul>	1 hour
	Extension Activities	1) Cookie Mining Engineers	To introduce students to the economics of mining. The students will know that mining requires investment before mining begins, plus costs of permits and environmental monitoring.	The students will be able to... <ul style="list-style-type: none"> <li>• Relate personal attributes and interests to education and career planning.</li> <li>• Demonstrate an understanding of employability skills.</li> </ul>	1 hour
		2) Drift Away	To introduce students to the basic concepts that of an Underground Miner would be required to understand, the safety procedures taken and the terminology used.	The students will be able to... <ul style="list-style-type: none"> <li>• Relate personal attributes and interests to education and career planning.</li> <li>• Demonstrate an understanding of employability skills.</li> </ul>	1 hour
		3) Metallurgist	Students will understand the basic concepts involved in being a Metallurgist by extracting valuable minerals from the rock containing the mineral.	The students will be able to... <ul style="list-style-type: none"> <li>• Relate personal attributes and interests to education and career planning.</li> <li>• Demonstrate an understanding of employability skills.</li> </ul>	1 hour

## TEACHER BACKGROUND

With new mineral deposits being discovered regularly, the economic potential of the British Columbia mining industry is enormous.

Finding and developing a mine can take years and cost hundreds of millions of dollars. However, if done right, the social and economic benefits can be huge.

The opening of mines in BC, Canada and around the world creates a positive labour market within the mining industry.

### **6 Facts:**

- Products from mining are used daily by everyone.
- Sustainability has become the top priority for the industry.
- BC is home to more mining projects than anywhere in Canada.
- Mining offers many employment opportunities.
- Reducing the environmental footprint is a main goal.
- Micro nutrients are an essential provided by mining.

Mining is one of the highest paying industrial sectors in Canada. The average salary for BC's mining industry in 2009 was \$110,800. It pays...

- 30% higher than construction
- 29% higher than manufacturing
- 24% higher than forestry
- 22% higher than finance/insurance

### **Best Opportunities:**

- Geologists
- Mining Engineers
- Accountants
- Heavy Duty Equipment Mechanics
- Electricians (surface)
- Metallurgical Engineers
- Millwrights
- Maintenance Supervisors
- Chiefs, Managers & Superintendents
- Mechanical Engineers
- Mining Supervisors

## **The BC Industry...**

- is high tech, providing (state of the art technology, robotics and other advanced tools).
- is continually implementing environmentally and socially conscious business practices.
- is the safest heavy industry in BC.
- is the leading employer and contractor of Aboriginal Peoples.
- employs over 85,000 people.
- contributes \$7 billion in annual economic activity.
- contributes \$5 billion annually to the province's economy.
- has spent \$322 million in 2010 on mineral exploration.
- has spent \$1.3 billion on mine development and expansion.
- has 20 mining projects under government review.
- is providing a huge multi-generational economic opportunity to communities.
- is using less than 0.045% of BC's total land base for mining.
- has reclaimed and returned more than 18,000 hectares of previously mined land to its natural state.
- is Canada's largest producer of copper.
- is Canada's only producer of Molybdenum (mainly used as an alloy to strengthen steel used in aircraft, industrial tubing, bike frames and as a dry lubricant in space vehicles).
- is Canada's largest exporter of steel-making coal.
- has numerous quarries that supply sand, gravel, crushed aggregate.
- is home to 60% of Canadian exploration companies.

## **The Canadian Industry...**

- is highly competitive on the world stage and is a major player in the nation's economy.
- ranks 1st in the world for potash and uranium.
- ranks 3rd in the world for diamonds.
- ranks in top 5 in the world for the production of nickel.
- diversity of commodities is a reflection of the complex rich geology.
- contributes nearly 5% of the country's GDP.
- employs over 200,000 people.
- has made their top priorities, long term talent attraction, recruitment and retention.
- will require 100,000 new workers by 2020 due to retirement rates and new mines.

# UNIT ONE: OPPORTUNITIES

## Description

The current situation in British Columbia's mining industry can be described in one word, "opportunity". There are many opportunities in the mining field for our youth entering the workforce. Knowledge of these options can give them a more enjoyable lifestyle and career. The mining industry has changed drastically over the years and students need to discover what this dynamic industry has to offer them. In this lesson the students will see the 'modern' face of mining and all it has to offer.

## Planning 10 Learning Outcomes

The students will be able to...

- Relate personal attributes and interests to education and career planning.
- Relate labour market information to careers of interest.
- Identify support networks and resources for pursuing their education and career goals.

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## **ACTIVITY: British Columbia Mining - A Career for Me?**

- Review Teacher Background
- Distribute Student Activity: "Mining: A Career for Me?" (Pages 9/10).
- Have students complete page one of the Student Activity – remind them that the check mark spot in the first section are to be completed while watching the blog videos after they have completed the first page.
- Access to Internet: 'Mining Blogs & Mining in Action'.
- Watch the three video blogs and complete the remainder of the questions.
- Distribute Student Handout: "Top 10 Benefits of a Career in Mining".
- Class discussion reflecting on the various opportunities that mining gives us.

# UNIT ONE: OPPORTUNITIES

## TOP 10 BENEFITS OF A CAREER IN MINING

### 1. Challenge

The minerals field has no shortage of challenging problems. In the field, when finding solutions involving complex geologic materials, you must often work with incomplete and uncertain data. You must devise a creative solution and persuade others that your solution is the best one.

### 2. Adventure

Whether you are flying in a helicopter or traversing tundra. Whether you are in your own backyard or in South Africa, there are many exciting adventures awaiting you. So many choices, so many opportunities.

### 3. Travel

Working in the mining industry can take you all over the world. You can work locally or globally.

### 4. Financial Benefits

The mining industry is one of the highest paying industrial sectors in Canada. In 2007, the average weekly earnings in the metal industry were \$1200.

### 5. Dynamic

The minerals industry is extremely diverse. Its activities include exploration for mineral deposits, developing new mine sites, underground or surface mines, processing minerals to extract the commodity, the transportation and marketing of mineral products and the reclamation of the land. Your work environment can be outside or inside, at a remote location or in a city, locally or globally...the choices are endless.

### 6. Advancement Opportunities

Promotion is the name of the game. As you demonstrate that you have more to offer the team you work with, there will be recognition and rewards. Mining is an equitable employer and is open to Aboriginal people, woman and people of all backgrounds.

### 7. Safe

British Columbia's mining industry's safety record is solid. In fact, there is an entire set of safety regulations just for the mining industry. It is now recognized as one of the safest industrial sectors.

### 8. High tech

Mining is an excellent and ever-evolving field. Today's miners can drill 2400 feet through solid rock – that's almost twice the height of the CN Tower! This industry is a technologically advanced and welcomes highly skilled workers.

### 9. Sustainable

In 2005, the Mining Association of Canada was recognized with the Globe Foundation's "Industry Association Award for Environmental Performance." This award recognizes associations whose industry improves environmental performance through research, development and education, beyond regulatory compliance. This strong commitment to sustainable development practices that protects the natural environment and responds to the needs of local communities has given Canada a worldwide reputation for this commitment.

### 10. Stability

The British Columbian mining industry is experiencing rapid growth and prosperity. In fact, it is forecasting the need for thousands of additional workers each year.

# UNIT ONE: OPPORTUNITIES

## MINING: A CAREER FOR ME?

### Section 1: Self Assessment

Create a career/lifestyle 'wants' list. Envision your life in 10 years. What kind of lifestyle are you leading? What is important to you? (good pay, adventure, job security) Check mark is for Section 2.

	Check
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____
6. _____	_____
7. _____	_____
8. _____	_____

When you think about 'mining' what thoughts/visions come into your head?

# UNIT ONE: OPPORTUNITIES

## Section 2: Watch the following videos

Check off the traits in Section 1 as you see them represented in the following videos.

[www.youtube.com/user/bcminingblog](http://www.youtube.com/user/bcminingblog)

1. Explore for More: Culture of BC's Mining Industry
2. Careers in Mining Industry

[www.acareerinmining.ca/en/onlineresources/explore\\_more\\_video.asp](http://www.acareerinmining.ca/en/onlineresources/explore_more_video.asp)

3. Mining in Action – Two parts
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## Section 3: Reflection

What are your thoughts about mining now? How are these thoughts different from what you wrote down in Section 1?

What other interesting information did you get from these blogs?

# UNIT TWO: VARIETY

## Description

The extensive variety of career options within the mining industry can meet anyone's needs. In this lesson the students will begin to explore the variety of careers available, job descriptions, salaries, lifestyles, beneficial attributes, education and training as well as advancement opportunities.

## Planning 10 Learning Outcomes

The students will be able to...

- Relate personal attributes and interests to education and career planning.
- Compare a variety of post-secondary education and training institutions/programs.
- Demonstrate an understanding of employability skills.
- Identify support networks and resources for pursuing their education and career goals.

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## **ACTIVITY #1: SELL A CAREER; (CAREER FAIR)**

- Access [www.acareerinmining.ca](http://www.acareerinmining.ca)
- Go to 'Careers in Mining' (top tab)
- Go to 'Career Paths in Mining' (side tab)
- Print & laminate for the students OR view on computer all 12 careers
- Divide the class into 12 groups and give each group a 'Career Profile' that they have to sell to the class.
- Each group will require time to research and prepare a presentation which they will use as a selling pitch to the rest of the class (power point presentations, web pages, posters, brochures etc).
- Selling pitches can be made into a competition with the winner being decided by a class vote and awarded a prize.
- The following mining 'Career Profiles' are featured...
  - Electrical Engineer
  - Electrical Technologist
  - Geologist
  - Health and Safety Coordinator
  - Mining Engineer
  - Mineral Process Engineer
  - Mineral Processing Operator Technician
  - Supervisor
  - Surface Miner
  - Surveyor
  - Trainer
  - Underground Miner

## ACTIVITY #2: MODIFIED INTERVIEWS

- Access [www.acareerinmining.ca](http://www.acareerinmining.ca)
- Go to 'Careers in Mining' (top tab)
- Go to 'Mining Employment Profiles' (side tab)
- Print & laminate for the students OR view on computer all 24 careers
- Have students get into pairs (an interviewer and an interviewee).
- Each pair chooses four Employment Profiles that they are unfamiliar with.
- Each student will be the interviewer for two of the careers and an interviewee for two careers.
- Have the students create their own interview questions as part of the assignment
- The following 'Mining Employment Profiles' are included:
  - Engineer
  - Metallurgical Engineer
  - Mechanical Engineer
  - Civil Engineer
  - Millwright (Apprentice)
  - Millwright (Journeyperson)
  - Millwright (Certified)
  - Estimator
  - Underground Miner
  - Environmental Technician
  - Environmental Biologist
  - Mine Designer
  - Health & Safety Coordinator
  - Training Instructor / Group Leader
  - Training Coordinator
  - Diamond Driller
  - Minerals Processing Operator
  - Prospector
  - Geological Modeler
  - Geological Technician
  - Geomatics Specialist
  - Exploration Geologist
  - Community Affairs Manager
  - Heavy Duty Mechanic

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## ACTIVITY #3: GUEST SPEAKER/PANEL

- Access [www.acareerinmining.ca](http://www.acareerinmining.ca)
- Access the 'Speaker's Bureau' under 'Resources' on the website.
- Book a speaker or a panel of speakers to come into your class.
- Have the class prepare 'good' questions for the speakers.

Option #1: Traditional Guest Panel

Option #2: If the teacher does not have access to guest speakers another option is to have the students become the 'experts' on the panel. This is a good activity if the students did NOT complete the 'Selling a Career' in lesson two!

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## ACTIVITY #4: VIDEO – CAREERS IN MINING

- Access [www.bcminerals.ca/s/CareerVideos.asp](http://www.bcminerals.ca/s/CareerVideos.asp)
- Distribute three copies of the Lesson Four Student Activity Worksheet: "Careers in Mining" (page 11) to EACH student to be completed.

## UNIT TWO: VARIETY

### VIDEO “CAREERS IN MINING” RESEARCH

At [www.bcminerals.ca/s/CareerVideos.asp](http://www.bcminerals.ca/s/CareerVideos.asp) choose 3 videos and answer the following questions.

Career Video: \_\_\_\_\_

<p>What is the title of your job? What do you do?</p>	<p>What is your daily work routine?</p>
<p>What kind of shifts do you work?</p>	<p>How physically demanding is your job?</p>
<p>How did you choose this career?</p>	<p>What kind of education or training do you need?</p>
<p>What kind of personality traits would you recommend?</p>	<p>What are the advancement potentials in this career?</p>
<p>What do you like best about your job?</p>	
<p>Is this career an option for you? Why or why not?</p>	

# UNIT THREE: TRAVEL & ADVENTURE

## Description

Mining can be much more than just a career. It can provide individuals with travel and adventure opportunities. Operating mines can be found around the globe which creates a variety of experiences and challenges due to every country's unique geography and culture. If BC is where it's at for you, there are many operating mines found throughout the province. This lesson will look at BC's currently operating mines and the world stage.

## Planning 10 Learning Outcomes

The students will be able to...

- Relate labour market information to career of interest.
- Relate personal attributes and interests to education and career planning.
- Identify support networks and resources for pursuing their education and career goals.

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## **ACTIVITY : MINING IN BC MAP GAME**

**Teacher Preparation:** Order maps at [www.bcminerals.ca](http://www.bcminerals.ca) (teachers- teacher resources - Mining in BC Poster).

- Divide the class into three or more teams.
- Give each team 20 minutes to study the map and come up with ten 'thoughtful' questions that the other two teams will have to compete to answer.
- While one team is asking a question, the other teams are competing against each other for the answer.
- The first team to answer the opposing team's question receives points (teacher chooses scoring).
- If the teams are unable to answer the question within 2 minutes, the questioning team receives the points.
- The game proceeds to ensure that all the teams get a chance to do both the questioning and answering.
- The team with the most points after 40 minutes of play wins.

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## **OPTIONAL ACTIVITY: VIDEO – GROUND RULES**

- This is an optional activity.
- Access <http://www.cat.com/groundrules>.
- This is a 20 minute video that covers international mining careers, adventure and challenges. (Download OR order your own copy if you have problems getting internet access).
- Distribute Lesson Five Student Activity Sheet (page 15).
- Have the students complete the video worksheet while watching the video.

# UNIT THREE: TRAVEL & ADVENTURE

## VIDEO: GROUND RULES INTRODUCTION TO THE MINING INDUSTRY

Name 10 career options shown in this video.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_
10. \_\_\_\_\_

What places were visited in this video?

A career in mining brings challenge, adventure, travel, good pay and great opportunity. After watching the video explain what is meant by each of the following...

Challenge:

Adventure:

Travel:

Good Pay:

Great Opportunity:

Describe the different atmospheres in surface mining vs. underground mining.

Name some of the challenges a mine faces?

# UNIT FOUR: PRODUCTS

## Description

The future of mining is solid because we will always need the products which mining gives us. Almost everything around us uses products derived from mining. This lesson will uncover many of the products that mining supports.

## Planning 10 Learning Outcomes

The students will be able to...

- Relate personal attributes and interests to education and career planning.

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## **ACTIVITY: WHAT'S MINED IS YOURS**

- Class Discussion: talk about the mineral products in the classroom. 'CHALK' is a mineral, so is the metal in the desks and the glass in the windows. Pencil LEAD is actually graphite. What other mineral products are there in the classroom?
- Show students the BC Mining Blog – Importance of the Mining Industry [www.youtube.com/user/bcminingblog](http://www.youtube.com/user/bcminingblog).
- Distribute Student Handout "What's it Made of?" for students to see a list of the minerals that makes up basic items.
- Distribute Student Worksheet "What's Mined is Yours". Ask students to log their activities from the day before and come up with the mineral products that they used in each activity.
- Use the end of class, or the beginning of the next to choose one of the common activities, such as eating breakfast, and write a master list on the board of mineral products used by everyone during this activity.

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## **OPTIONAL ACTIVITY: RESOURCES FOR OUR COMMUNITIES**

**Teacher Preparation:** Order maps at [www.bcminerals.ca](http://www.bcminerals.ca) (teachers- teacher resources - Mining in BC Poster).

- This can be used as a research project (internet).
- Have the students research the uses of the listed minerals and locate where they can be mined in BC using the Mining in BC Posters.
- Distribute "Resources for Our Communities" (one per student)
- Internet for students (for research)

# UNIT FOUR: PRODUCTS

## WHAT'S MINED IS YOURS

Log your activities from the day before and come up with the mineral products that you used in each activity.

ACTIVITY	MINERAL PRODUCTS USED
ie. Woke up, ate breakfast	alarm clock, room (walls), light, carpet refrigerator, spoon, knife, microwave, toaster, plate, bowl

# UNIT FOUR: PRODUCTS

## WHAT'S IT MADE OF?

**Batteries:** cadmium, lithium, nickel, cobalt

**Surgical Instruments:** stainless steel

**Building Construction:** clay, gypsum, limestone, sand & gravel

**Sunscreen and Medical Ointment:** zinc

**Computer/TV Screens:** silicon, boron, lead, phosphorous, indium

**Eyeglasses:** limestone, feldspar and soda ash

**Cosmetics:** zinc, titanium dioxide

**Jewelry:** gold, diamonds, iron oxide, zinc, titanium dioxide

**Vehicles:** (76% of a car is made up of mining products) steel, copper, zinc, barium, graphite, sulphur, iodine, nickel

**Bikes:** (80% of a bike is made up of mining products)

**Gears and Seat Posts:** steel, aluminum

**Handlebar:** aluminum, titanium

**Brakes:** aluminum, steel, magnesium

**Frame:** steel, aluminum, chromoly steel, titanium, and /or carbon fibre

**Tires:** sulphur, bromine, iodine

**Helmets:** calcium carbonate, talc, clays, sulphur, mica

**Zippers:** chrome-plated zinc

**Fertilizers:** phosphate, nitrogen, sulphur, potash

**Nutritional Supplements:** iron, calcium

**Cell Phones:**

**Screen:** silica, indium, tin

**Speaker:** iron oxide, strontium copper, ceramic clays

**Capacitors:** tantalum manganese

**Battery:** lithium, cobalt, silicon

**Case:** stainless steel, iron, chromium, carbon

**Circuit Boards:** silicon, copper, gold, silver, platinum, clays

**Buttons:** petroleum products and plastics

**Electricity:** coal, uranium

**Coins:** copper, nickel, silver, iron, zinc

**Drinking Glass:** boron, silica

# UNIT FOUR: PRODUCTS

## OPTIONAL STUDENT ACTIVITY

### RESOURCES FOR OUR COMMUNITIES

MINERAL	WHAT BC CITY IS IT MINED IN?	MAIN USES
Copper		
Coal		
Gold		
Zinc		
Molybdenum		
Silver		
Aggregate		

# UNIT FOUR: PRODUCTS

## OPTIONAL STUDENT ACTIVITY

## ANSWER KEY

## RESOURCES FOR OUR COMMUNITIES

MINERAL	WHAT BC CITY IS IT MINED IN?	MAIN USES
<b>Copper</b>	<ul style="list-style-type: none"> <li>• Williams Lake</li> <li>• Quesnel</li> <li>• Kitimat</li> <li>• Kamloops</li> <li>• Princeton</li> </ul>	Electrical wire, coins, medical equipment, medicine, plumbing roofing, solar panels, alloys (brass, bronze, pewter)
<b>Coal</b>	<ul style="list-style-type: none"> <li>• Tumbler Ridge</li> <li>• Campbell River</li> <li>• Fernie</li> </ul>	Metallurgical coal for stainless steel, carbon steels used in structural steel, railway rails, nails & paperclips; thermal coal for electricity generation
<b>Gold</b>	<ul style="list-style-type: none"> <li>• Quesnel</li> <li>• Williams Lake</li> <li>• Campbell River</li> </ul>	Jewelry, coins, ornamentation, electrical wire, & contacts, heat reflective plating on spacecraft foil, water purification
<b>Zinc</b>	<ul style="list-style-type: none"> <li>• Campbell River</li> </ul>	Galvanizing steel, soap, tires, baby ointment & sunscreen, batteries, TV screen, paint, plastics, printing inks
<b>Molybdenum</b>	<ul style="list-style-type: none"> <li>• Williams Lake</li> <li>• Kitimat</li> <li>• Fraser Lake</li> <li>• Kamloops</li> <li>• Invermere</li> </ul>	Special alloy steels for gears, jet engines, wind turbines, pipelines, space vehicles, armour plating & electrodes; high temperature lubricant, catalyst
<b>Silver</b>	<ul style="list-style-type: none"> <li>• Williams Lake</li> <li>• Quesnel</li> <li>• Campbell River</li> </ul>	Photography, mirrors, silverware jewelry, electrical wires, coins, dental work, specialty fabrics, batteries, solar panels
<b>Aggregate</b>	<ul style="list-style-type: none"> <li>• Sechelt</li> <li>• Port Hardy</li> <li>• Stewart</li> </ul>	Construction, agriculture, other chemical and metallurgical industries

# EXTENSION ACTIVITIES

## ACTIVITY ONE

### COOKIE MINING ENGINEERS

Used with permission from Women in Mining.org

#### Purpose

To introduce students to the economics of mining. The students will know that mining requires investment before mining begins, plus costs of permits and environmental monitoring.

#### Introduction

The introduction of the economics of mining is accomplished through the players' buying their "properties", purchasing the "mining equipment", playing for the "mining operation", and finally paying for the "reclamation". In return the player receives money for the "ore" mined. The objective of the game is to make as much money as possible.

#### Materials Required

- Play money
- Data sheet
- Graph paper
- Various cookies
- Various toothpicks
- Paper clips
- Timer

#### Instructions

1. Each player starts with \$19 of play money.
2. Each player receives a Cookie Mining data sheet and a sheet grid paper.
3. Each player must buy his/her own "mining property", which is a cookie. One "mining property" allowed per player. Cookies for sale are:
  - Dad's Chocolate Chip - \$3
  - Chips Ahoy - \$5
  - Chips Ahoy Triple Chocolate - \$7

*or any chocolate chip cookies that you can find – making the cookie with the most chocolate chips the most expensive to buy for the students.*
4. Once the cookie is bought, the player places the cookie on the grid paper and using a pencil, traces the outline of the cookie. The player must then count each square that falls inside the circle. Note: count partial squares as a full square.

5. Each player must buy his/her own “mining equipment”. More than one piece of equipment may be purchased. Equipment may not be shared between players. Mining equipment for sale is:
  - Flat toothpick - \$2
  - Round toothpick - \$4
  - Paper clips - \$6
6. Mining costs are: \$1/minute
7. Sale of a chocolate chip mined from a cookie brings \$2 (broken chocolate chips can be combined to make 1 whole chip).
8. Reclamation: After the cookie has been mined, it should be placed back in the circled area on the grid paper, using the mining tools. No fingers or hands allowed.
9. Reclamation costs: \$1/square over original count.

### **Rules**

1. No player can use their fingers to hold the cookie. The only things that can touch the cookie are the mining tools and the paper on which the cookie is sitting.
2. Players should be allowed a maximum of five minutes to mine their chocolate/rainbow chip cookie. Players that finish mining before the five minutes are up should only credit the time spent mining.
3. A player can purchase as many mining tools as the player desires and the tools can be of different types.
4. If the mining tools break, they are no longer useable, and a new tool must be purchased.
5. The players that make money by the end of the game win.
6. All the players win at the end of the game because they get to eat the remains of their cookie!

### **Review**

The game provides each player an opportunity to make the most money that a player could make with the resources provided. Decisions are made by each player to determine which properties to buy and which piece or pieces of mining equipment should be purchased.

# COOKIE MINING DATASHEET

1. Name of cookie \_\_\_\_\_

2. Price of cookie \_\_\_\_\_ (A)

3. Size of cookie \_\_\_\_\_ (squares covered)

4. Equipment:

Flat toothpick \_\_\_\_\_ x \$2 = \_\_\_\_\_

Round toothpick \_\_\_\_\_ x \$4 = \_\_\_\_\_

Paper clip \_\_\_\_\_ x \$6 = \_\_\_\_\_

Total equipment cost \_\_\_\_\_ (B)

5. Mining time: \_\_\_\_\_ minutes x \$1 = cost of removing chips = \_\_\_\_\_ (C)

6. Total cost of mining (cookie (A) + equipment (B) + mining time (C) = \_\_\_\_\_ (E)

7. Income from chips:

Number of chips \_\_\_\_\_ X \$2 = \_\_\_\_\_ (D)

## How much did I make?

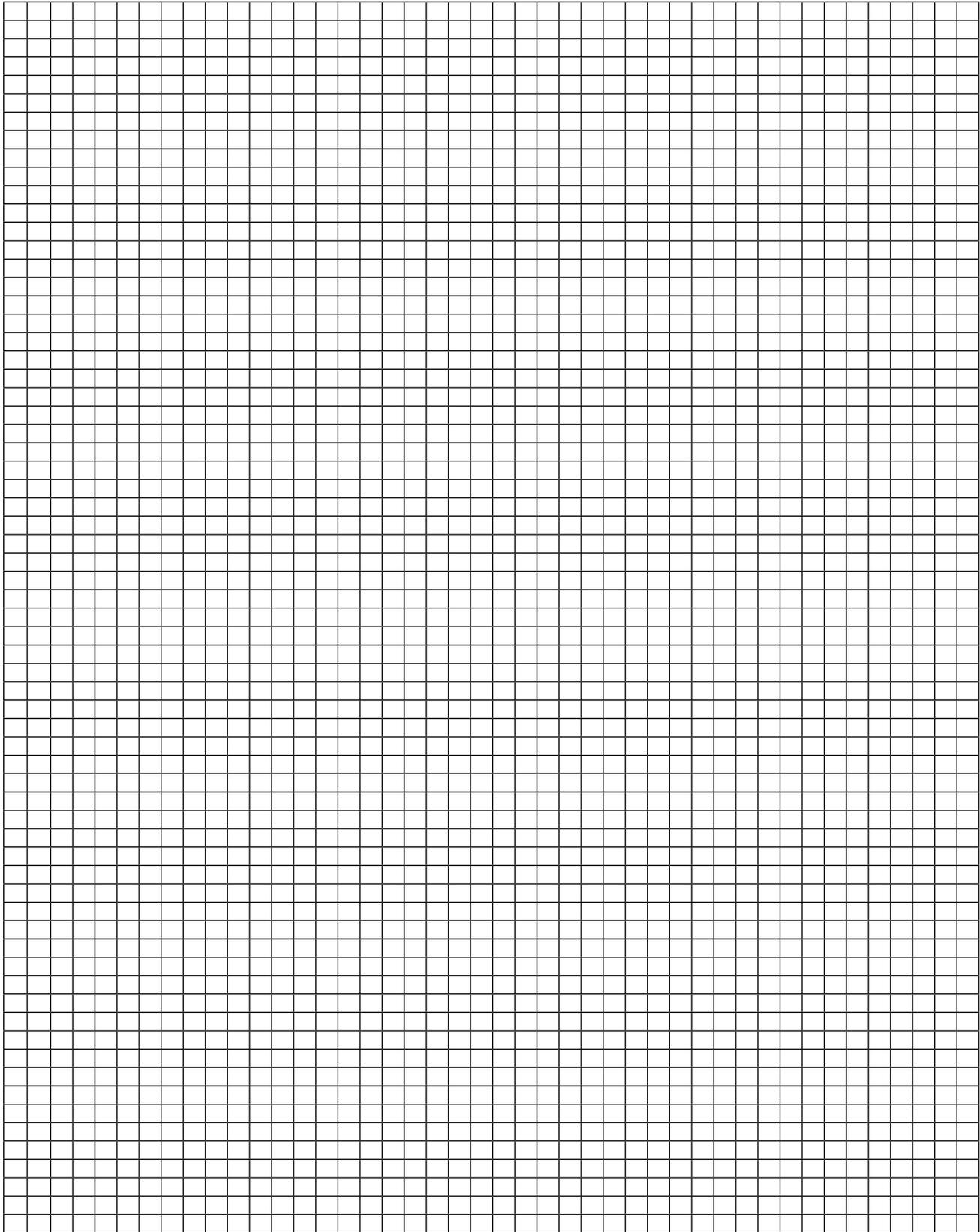
Value of chips \_\_\_\_\_ (D)

Total cost of mining \_\_\_\_\_ (E)

Reclamation \_\_\_\_\_ squares x \$1 \_\_\_\_\_ (F)

PROFIT/LOSS (D - E - F): \_\_\_\_\_

# COOKIE MINING GRID SHEET



# EXTENSION ACTIVITIES

## ACTIVITY TWO

### DRIFT AWAY - AN UNDERGROUND MINING EXERCISE

Used with permission from Women in Mining.org

#### Purpose

To introduce students to the basic concepts that an underground miner would be required to understand, the safety procedures taken and the terminology used.

#### Materials Required

- Paper towels
- Whole wheat loaf of bread  
per 4-5 students
- Whipped cream cheese
- Long handled plastic spoons
- Plastic knives
- Pretzel sticks
- Cut out template

#### Instructions

1. The group will determine who will take the specific jobs: Tunneling, Mucker, Roof Bolter, Shotcreter and Holder. The Roof Bolter or Shotcreter can also act as the mucker, who will remove all the loose muck that drops to the sill.
2. Place the paper on the table and put the loaf of bread on it. The Holder will sit on the opposite side of the bread to stabilize the loaf as the work is being done.
3. Place the template on the heel of the loaf and using the knife, begin opening the portal.
4. Once the portal is done and stabilized sufficiently with bolts, the tunneling will continue with the spoon, a couple of slices at a time.
  - The Mucker will then clean out the muck in the drift.
  - The Bolter will then place the roof bolts as progress warrants (follow the tunneling – mucking – bolting cycle).
  - It is recommended that you tunnel and bolt as far through the loaf as possible before beginning to add the shotcrete (cream cheese) from end of drift back to front. The object is to go through the loaf of bread, keeping the drift as even as possible, without going through the sill and maintaining enough on the back to prevent a collapse.

#### Terminology Used

Portal: main opening drive in  
Collar: top of shaft opening  
Rib: side wall  
Sill: floor  
Back: roof overhead  
Drift: horizontal mine passage  
Face: part of drift you are drilling for next round

## Evaluation

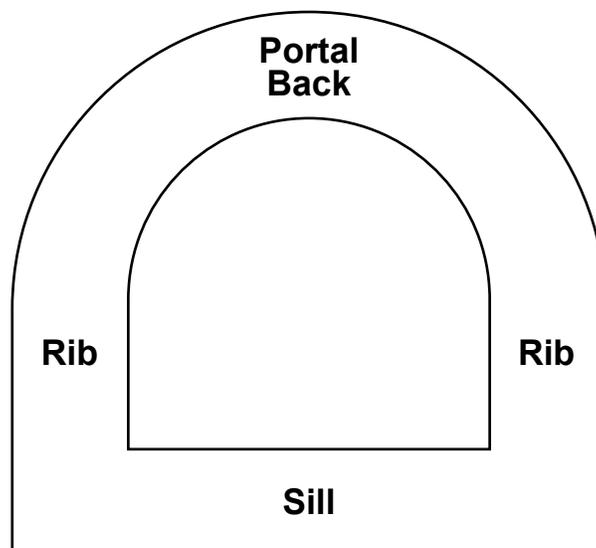
- What safety measures were used before and during the process?
- Summarize the steps involved in underground mining, including the safety procedures.
- Did the roof bolting methods you used work properly or could another method have worked better?

## Other Options

1. Weigh the bread before beginning and then weigh the amount mined to determine the efficiencies of each team's mining.
2. Use a marbled loaf and when mining try to mine only the marbled core. After mining, separate dark from light and determine the percentage of dilution (ie. how much unwanted waste relative to marbled core was mined).
3. Place cardboard platform over mined loaf and begin adding weight, until it starts to collapse, to determine which team had the sturdiest or safest drift.
4. Use Raisin bread and count the raisins mined as ore (note: raisin bread comes in smaller loaves so will be harder to get hands in).

## Teacher Tips

Compare each group's drift to the size of the opening in the template and explain the importance of keeping the drift the right size. Underground mining is costly. Keeping waste to a minimum is important. If your drift is driven to follow an ore zone and is engineered to a certain size, it is important to maintain that size to prevent dilution of the ore you are removing. Generally, the material on either side of the ore zone is waste (has little or no value). Also, it costs more in time, fuel consumption, and equipment used to "muck" out the excess rock material.



# EXTENSION ACTIVITIES

## ACTIVITY THREE

### METALLURGIST

Used with permission from Women in Mining.org

#### Introduction

Some minerals in a sample of ore contain elements of interest, while other minerals are merely part of the rock. The minerals of interest need to be concentrated, usually by mechanical or chemical means.

#### Purpose

Students will understand the basic concepts involved in being a Metallurgist by extracting valuable minerals from the rock containing the mineral.

#### Materials Required

- Iron fortified cereal (Total)
- Hot water
- Clear drinking glass
- White magnetic stirring bar or popsicle stick with magnet strip glued to one side and painted.

#### Instructions

1. Have a variety of cereals available for students so they can test their procedures on various “ores” (This models the situation where the extraction method works with differing efficiency for different ores).
2. Have students test on one type of cereal, the effect varying the temperature of the slurry water has on recovery of the iron. (Test the effect of stirring time)
3. Have students propose the test changes in the variable, including the type of cereal, temperature and stirring times (as noted above), remembering to change only one variable at a time. By assigning various groups various values of the variables, the testing of several variables can be distributed throughout the class so the experiments will take less time.

#### 4. Background information

- Cold cereals are fortified with vitamins and minerals for health.
- Metallic iron is added to fortified cereal and this form of iron is magnetic.
- In this experiment, the magnet collects the iron.
- In other processing methods for metals, such as copper, uranium, and gold, acidic or caustic water, gravity separation or floatation might be used to separate the element of interest from the waste rock.
- An example of gravity separation is gold panning...when a gold pan is agitated, the heavier mineral drops to the bottom of the pan and the lighter rocks wash away.
- The crushing of the cereal models the crushing of the ore rocks to make the grains that contain the element of interest accessible to the processing solutions.
- Similarly, the stirring makes new parts of the ore accessible to the processing solution.
- Changing the temperature of the added water could model the situation frequently encountered in the processing of actual ores in which the ore needs to be oxidized in order for the element of interest to be available for reaction with the processing solution. That step takes place in an autoclave in which the ore plus an extraction solution are heated. Oxidation does not take place in this cereal model.
- Making use of the magnetic property of iron metal for separation reflects the general concept of extraction in which properties of the element or mineral in which the element is contained are used for extraction. For example, in flotation (see “Flotation and Separation”), the sulfide mineral of the element of interest (often copper sulfide) is attracted to bubbles of a detergent and these bubbles are pushed off the top of the solution of crushed rock and flotation fluid.

#### **PROCEDURE** *(student directions)*

1. Select a sample of cereal that is fortified with iron and weigh the sample.
2. Add water to make a slurry and stir with the magnetic stirrer until the cereal is soggy.
3. Once the cereal is soggy, remove the magnetic stirrer and note the dark slivers on the ends. These are particles of metallic iron.
4. Dry the iron by separating the iron slivers from the magnet and let dry by sitting overnight or heating in an oven. The drying procedure and time will depend on the humidity in the air.
5. Weigh the iron particles to determine the fraction of iron in the cereal.

**EVALUATION**

1. How is the iron removed from the cereal?
  - What property about iron makes it possible that iron can be separated in this way?
2. Fine tune the extraction procedure by varying (one at a time) the conditions of extraction. Quantify all variables, repeat the same conditions more than once, and change the variables more than once.
  - What effect does stirring have on separating the iron
    - Is stirring necessary?
    - Is more iron recovered with longer stirring?
  - Test the temperature of the water added to see if that makes a difference on the iron recovery.
  - Test the amount of water added to see if that makes a difference on the iron recovery.
3. Relate the model of extraction of a metal from “ore” to the actual extraction.
  - How is the cereal similar to actual ore?
  - How are the variables in the model procedure similar to actual variables in metal extraction?
  - How is the model different from real ore?
  - How is the extraction method different from a real extraction method? *Some research may be necessary here.*

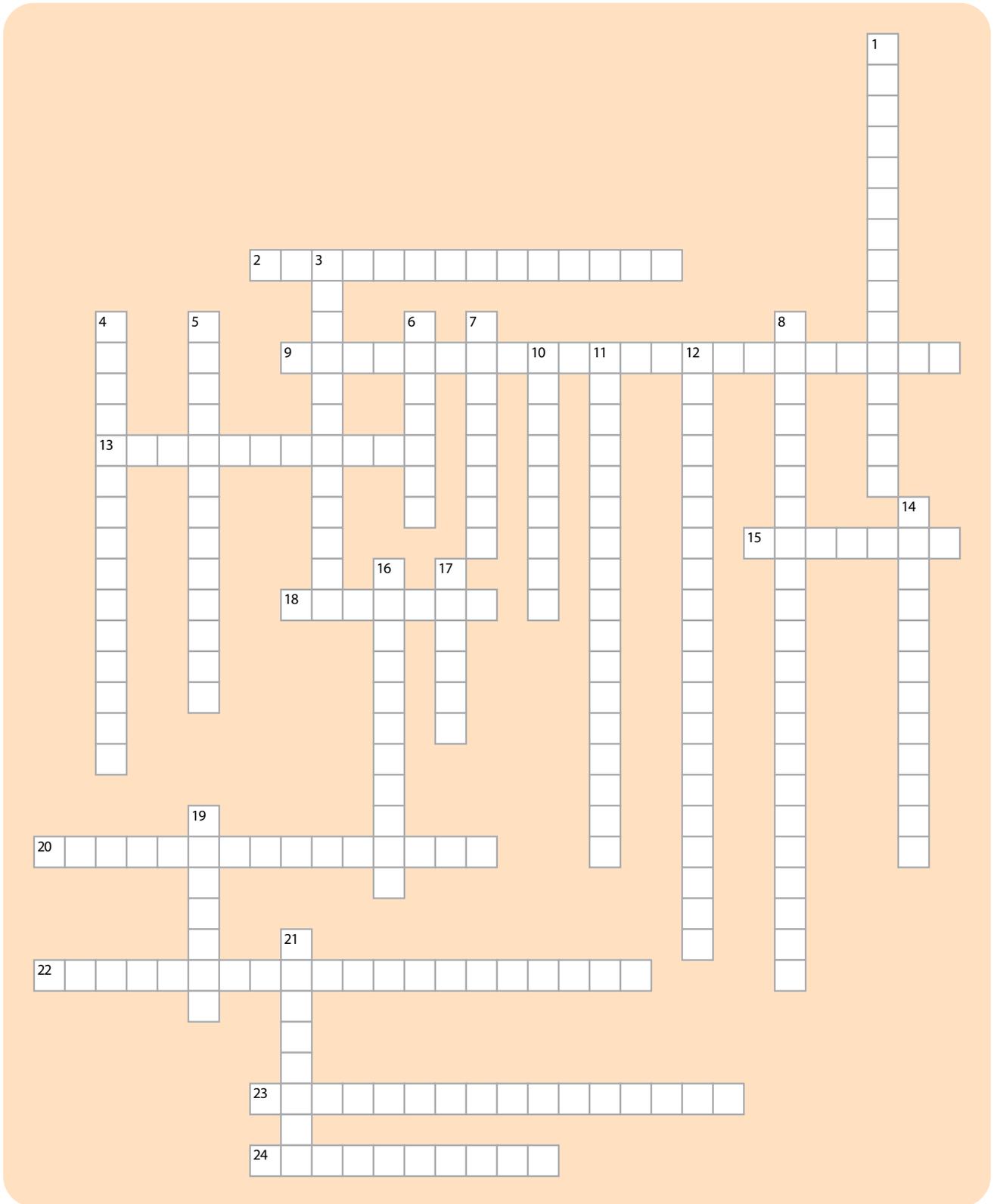
**OPTIONS** (*student directions*)

1. What other fortified food product could be used instead of cold cereal?
  - Try an iron rich drink or a cooked hot cereal.
2. Crush the cold cereal before adding the water.
  - Does this improve the recovery time?
  - Does it make a difference if the cereal is crushed in a separate container and then transferred to the drinking glass?
3. Weigh the recovered iron to make comparisons of recovery methods.
  - Compare the recovered iron with the stated amount of iron added to the cereal.
4. How did people in earlier times, before there were “enriched” cereals, get the iron their bodies need?

# CROSSWORD PUZZLE

Name: \_\_\_\_\_

Date: \_\_\_\_\_



**Across:**

- 2 - assists in training and development of employees, interviews prospective employees and coordinates benefit programs
- 9 - monitors processing to maintain or increase production while keeping costs at a minimum
- 13 - studies groundwater at a mine site and study the relationship of geology to groundwater
- 15 - responsible for mixing fluxes, extracting the product, operating the furnace and pouring and marking the bars,
- 18 - drills holes to designated depth, collects cutting samples, changes bits and fill out reports
- 20 - responsible for the safe and productive use of all process equipment
- 22 - responsible for processing samples from the mines by splitting, drying crushing and pulverizing them
- 23 - cuts channels to facilitate blasting, operates power drills to bore the blast holes in the walls, and operates special heavy equipment
- 24 - provides cost information for the mine site

**Down:**

- 1 - collects mine samples and splits, dries, crushes and pulverizes the samples.
- 3 - optimizes mine operations through mine design, planning and modeling, equipment selection and production reporting
- 4 - stores and issues supplies
- 5 - protects mine site employees, secures company assets and records entry and departures of all individuals to the site
- 6 - creates blast patterns and calculates the tons of rock broken and quantities of explosives used
- 7 - locates ore and waste, buildings fences, or power lines
- 8 - conducts water, soil and air monitoring activities
- 10 - maps ore deposits, and monitors ore grade during mining
- 11 - performs workplace inspections, reviews material safety data sheets, and conducts industrial hygiene monitoring
- 12 - responsible for water, soil, and air monitoring procedures and reporting.
- 14 - receives, interprets and applies information concerning production
- 16 - works on electrical construction, instrumentation, and all electrical repairs on mine equipment
- 17 - fixes heavy mobile and stationary equipment
- 19 - performs analysis that determines the quantity of elements in a sample
- 21 - diagnose, document and repair all mobile equipment on the mine site

**Possible Answers:**

Accountant, Assay Technician, Assayer, Blaster, Driller, Electrician, Environmental Technician, Environmental Manager, Geologist, Human Resources, Hydrologist, Mechanic, Metallurgist, Metallurgist Technician, Mine Engineer, Process Operator, Refiner, Safety Coordinator, Sample Prep Technician, Security Guard, Surveyor, Underground Miner, Warehouse Person, Welder

# CROSSWORD PUZZLE

The crossword puzzle contains the following words:

- Across:**
  - 11: HUMAN RESOURCES
  - 13: METALLURGIC TECHNICIAN
  - 15: DRILLER
  - 17: OPERATOR
  - 19: SAMPLE PREP TECHNICIAN
  - 21: UNDERGROUND MINER
  - 23: ACCOUNTANT
- Down:**
  - 1: WAREHOUSE
  - 2: SUIT
  - 3: SON
  - 4: HYDROLOGIST
  - 5: OIL
  - 6: USE
  - 7: SEPER
  - 8: R
  - 9: S
  - 10: A
  - 12: IN
  - 14: B
  - 16: E
  - 18: C
  - 20: Y
  - 22: I
  - 24: A

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# RESOURCE LIST

## 1. Explore for More

<http://www.acareerinmining.ca/en/>  
<http://www.acareerinmining.ca/en/careers/index.asp>  
<http://www.acareerinmining.ca/en/Career%20Profile%20Salary/employmentprofiles.asp>  
<http://www.acareerinmining.ca/en/careers/careerpaths.asp>  
<http://speakers.acareerinmining.ca/Default.aspx?lang=en>  
[http://www.acareerinmining.ca/en/onlineresources/video\\_gallery.asp](http://www.acareerinmining.ca/en/onlineresources/video_gallery.asp)  
<http://www.acareerinmining.ca/en/industry/everydayproducts.asp>  
<http://www.acareerinmining.ca/en/industry/factsfigures.asp>  
<http://www.acareerinmining.ca/en/industry/mythsrealities.asp>

## 2. Minerals Resources Education Program of BC

<http://www.bcminerals.ca/s/Home.asp>  
<http://www.bcminerals.ca/s/Catalogue.asp#MinBCBookmarks>  
<http://www.bcminerals.ca/s/Catalogue.asp#MinBCPoster>

## 3. BC Mining Blog

<http://www.youtube.com/user/bcminingblog>  
<http://www.youtube.com/user/bcminingblog#p/a/u/1/O1c1YLizFe4>  
[http://www.youtube.com/user/bcminingblog#p/a/u/0/fucQT7L\\_Xcg](http://www.youtube.com/user/bcminingblog#p/a/u/0/fucQT7L_Xcg)  
<http://www.youtube.com/user/bcminingblog#p/a/u/2/NXVb3rxRtyQ>

## 4. Mining Association of British Columbia

<http://www.mining.bc.ca/>  
[http://www.mining.bc.ca/min\\_careers\\_consider.htm](http://www.mining.bc.ca/min_careers_consider.htm)

## 5. Association for Mineral Exploration British Columbia

[www.amebc.ca](http://www.amebc.ca)

## 6. Mining Matters

<http://www.pdac.ca/miningmatters/educators/resources.aspx>  
<http://www.pdac.ca/miningmatters/students/secondary-careers.aspx>

## 7. Mining Industry Human Resources Council

<http://www.mihrc.ca/en/>

## 8. Online Job Fair

<http://www.infomine.com/careers/JobFair/>

## 9. British Columbia Aboriginal Mine Training Association

[www.bcamta.ca](http://www.bcamta.ca)

## 10. Aggregate Producers Association of BC

[www.gravelbc.ca](http://www.gravelbc.ca)  
<http://www.gravelbc.ca/education/teachers.html>

## 11. Caterpillar

<https://mining.cat.com/groundrules>

## 12. Women in Mining – Education Foundation

[www.womeninmining.org](http://www.womeninmining.org)  
[http://www.womeninmining.org/activities/COOKIE\\_MINING.pdf](http://www.womeninmining.org/activities/COOKIE_MINING.pdf)  
[http://www.womeninmining.org/activities/Drift\\_Away.pdf](http://www.womeninmining.org/activities/Drift_Away.pdf)  
<http://www.womeninmining.org/activities/Extraction.pdf>

## 13. Medioplanet – Independent Section to the Vancouver Sun, September 2010 and May 2011



KOMATSU

SMS

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COMET