NUNAVUT MINING WEEK

- ACTIVITY BOOK -

Mining North Works!

IN PARTNERSHIP WITH

NWT & NUNAVUT CHAMBER OF MINES

Nunavut

SEPTEMBER 18-25, 2022

EXPLORE AND DISCOVER NWT METALS, MINERALS & MINING

Packed with puzzles, this Activity Book includes codes to crack, things to spot, word searches, crosswords and more. Activities in this booklet have been developed with resources from Yukon Women in Mining, Mining Matters, Mining Association of Canada, NWT & Nunavut Chamber of Mines, and Northwest Territories and Nunavut governments. Thanks!

For more information, resources and activities visit:

MININGNORTHWORKS.COM

ACTIVITY: DISCOVER NUNAVUT MINING CAREERS

WHAT DO I DO? COLOUR THE PICTURE

GRADES K-3

Illustration Credit: Jessica Prentice | Developed by: Yukon Women in Mining

WHO AM I?

A mining engineer ensures the safe and efficient development of mines and other surface and underground operations. Mining engineers are involved at all stages of a project. Before a new site is developed, they assess its viability and assist with planning the mine's structure. They also manage and oversee mining production processes and are involved in the final closure and rehabilitation process. Engineer's with a lot of experience can become CEO of the company and be a part of a project from beginning to end.

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ACTIVITY: DISCOVER NUNAVUT MINING CAREERS

WHAT DO I DO? COLOUR THE PICTURE

GRADES K-3

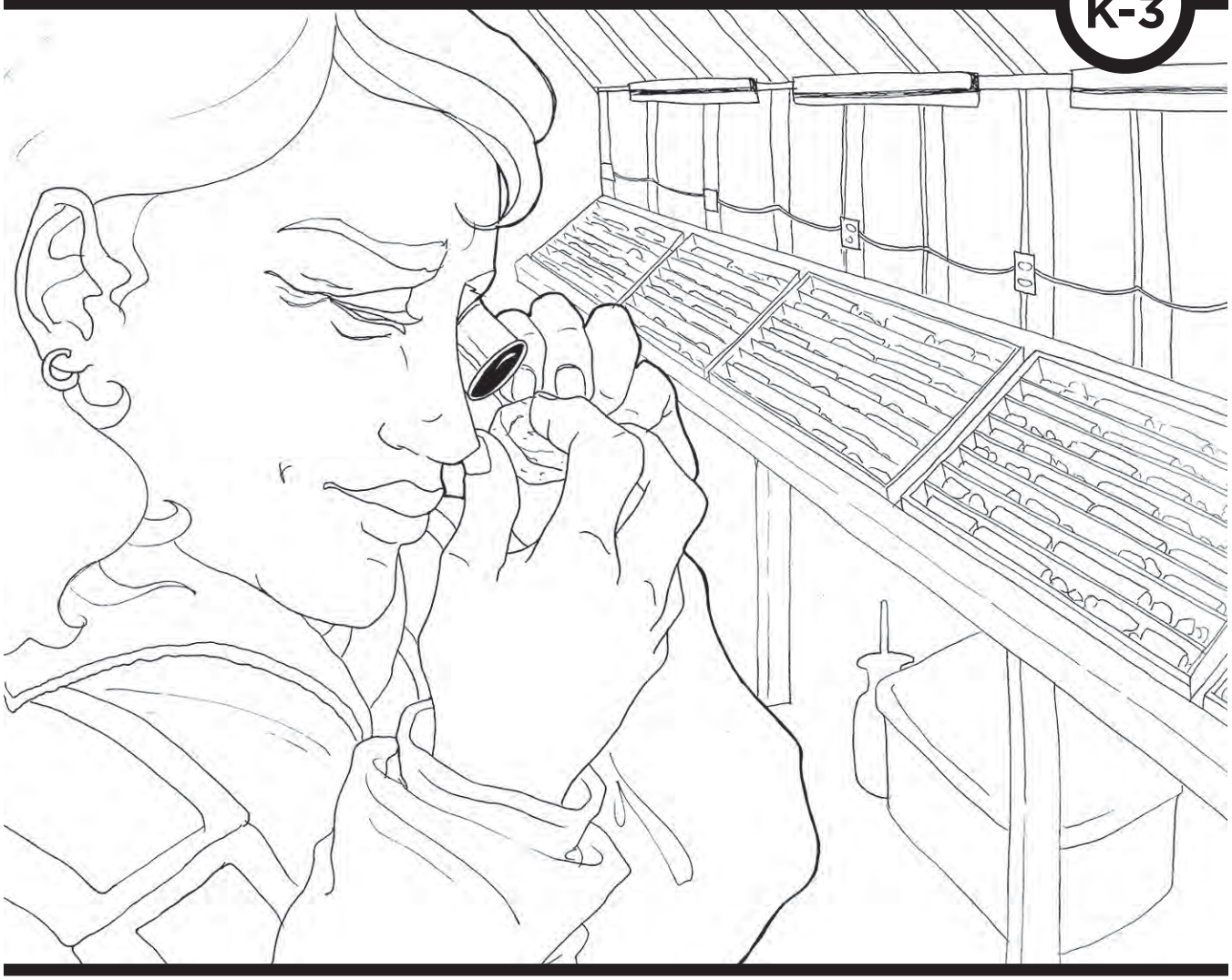


Illustration Credit: Jessica Prentice | Developed by: Yukon Women in Mining

WHO AM I?

Geologists perform many specialized jobs that relate to the mining industry. They can study issues such as erosion, watershed management and mineral resource exploration. If working on a mine site, they could be collecting and analyzing rock, cores and soil samples; conducting geological surveys and field studies; or recording, interpreting and analyzing geological information from satellite images, maps and geochemical surveys. Geologists often travel the world and work on many different types of projects and sometimes advance right to the Management Team! To learn about the over 150 different careers in mining and exploration go to miningnorthworks.com/careers/

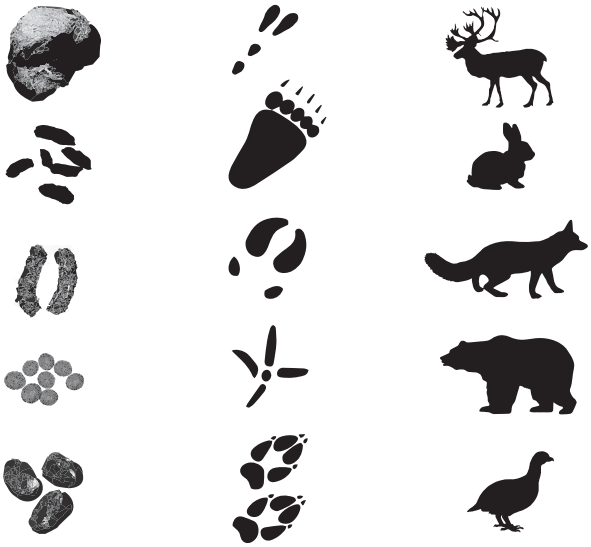
ACTIVITY: EXPLORE MINERALS, METALS & MINING

WHAT DO I DO? GRAB YOUR HARD HAT AND GET READY TO DIG INTO A MINE LOAD OF FUN!

GRADES K-3

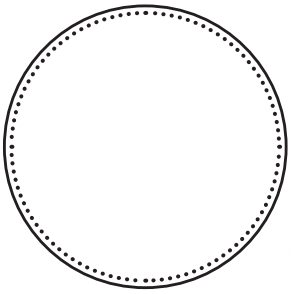
1: WHO POOPED & WHERE DID THEY GO?

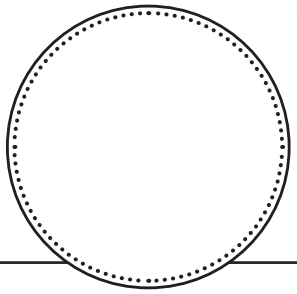
You are doing a wildlife survey at an exploration project and need to monitor which animals are living and travelling through the area. Match the wildlife to their scat (poop) and tracks!



2: MAKE YOUR OWN MINT

For generations coins have been used as currency and for trade. Many countries have their own currency or money, with images of people, animals and places. Design your own coin!



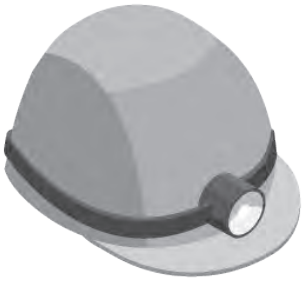


Coins can be made out of gold, platinum, silver, copper and nickel.

WHAT METAL IS YOUR COIN?

3: SAFETY DRESS UP

Canada is a world leader in the mining industry. Safety is the industry's most important practice. Help Jane get dressed for a day at the underground mine site in her Personal Protective Equipment (PPE). Match the correct words with the safety equipment, and then match the equipment to Jane.



Resource Credit: Mining Matters

Safety Gloves

Hearing Protection

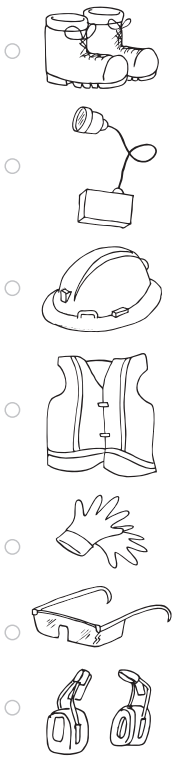
Hard Hat

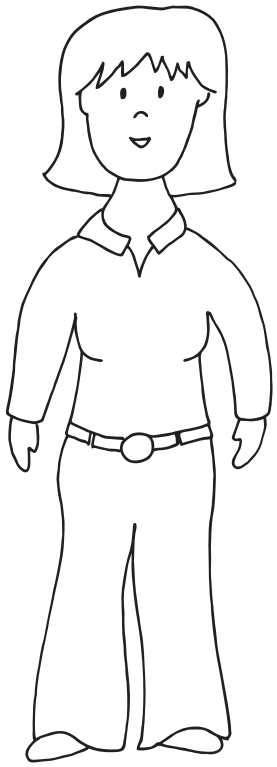
Head Lamp and Battery Pack

Safety Glasses

Safety Boots

Safety Vest





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ACTIVITY: EXPLORE MINERALS, METALS & MINING

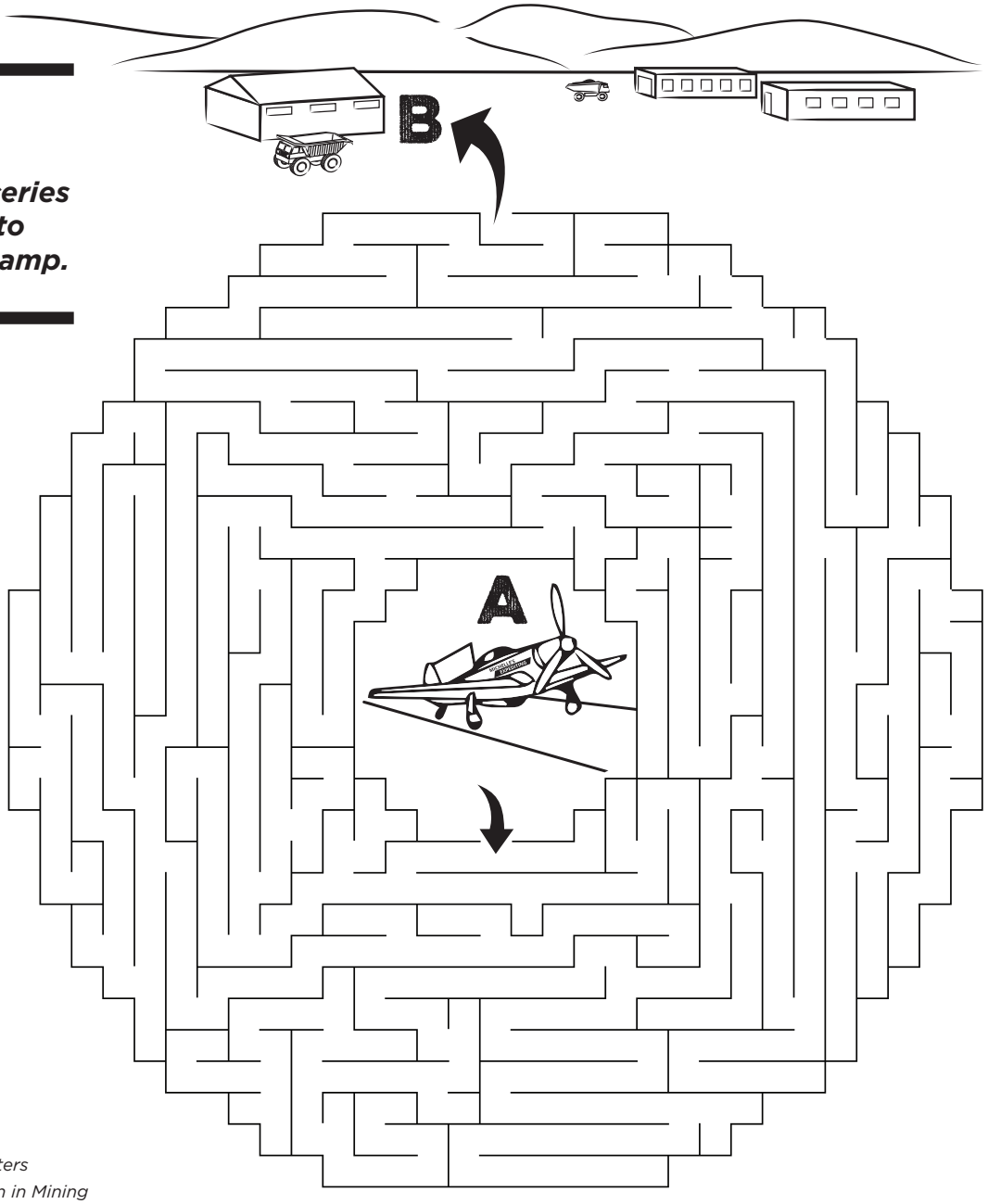
WHAT DO I DO? GRAB YOUR HARD HAT AND GET READY TO DIG INTO A MINE LOAD OF FUN!

GRADES K-3

4: EXPEDITING FOR EXPLORATION: A GROCERY RUN!

An Expediter, which can be a person or company, is someone who connects supplies, products or people from where they are, to where they need to go. Expediting is an important part of the minerals industry, as it takes a lot of materials, resources and people to keep operations running smoothly – and when something or someone is needed – they are usually the fastest path between "**Point A**" and "**Point B**".

Help expediter Michelle get a shipment of groceries from the airport to the exploration camp.



Resource Credit: Mining Matters
Developed by: Yukon Women in Mining

ACTIVITY: EXPLORE MINERALS, METALS & MINING

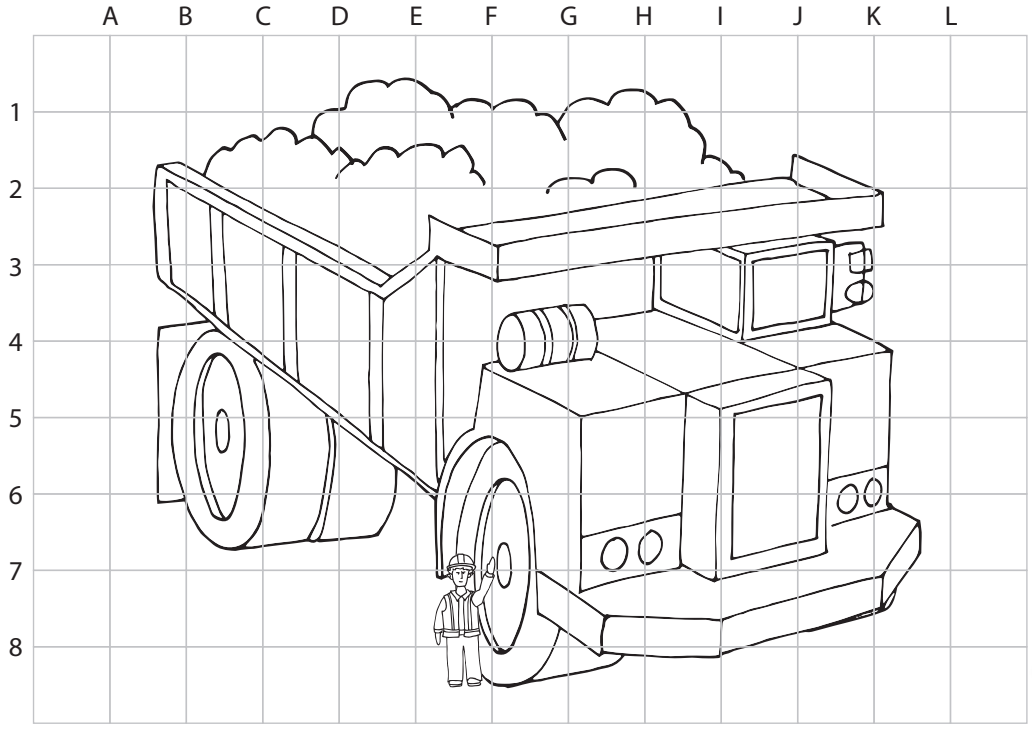
WHAT DO I DO? GRAB YOUR HARD HAT AND GET READY TO DIG INTO A MINE LOAD OF FUN!

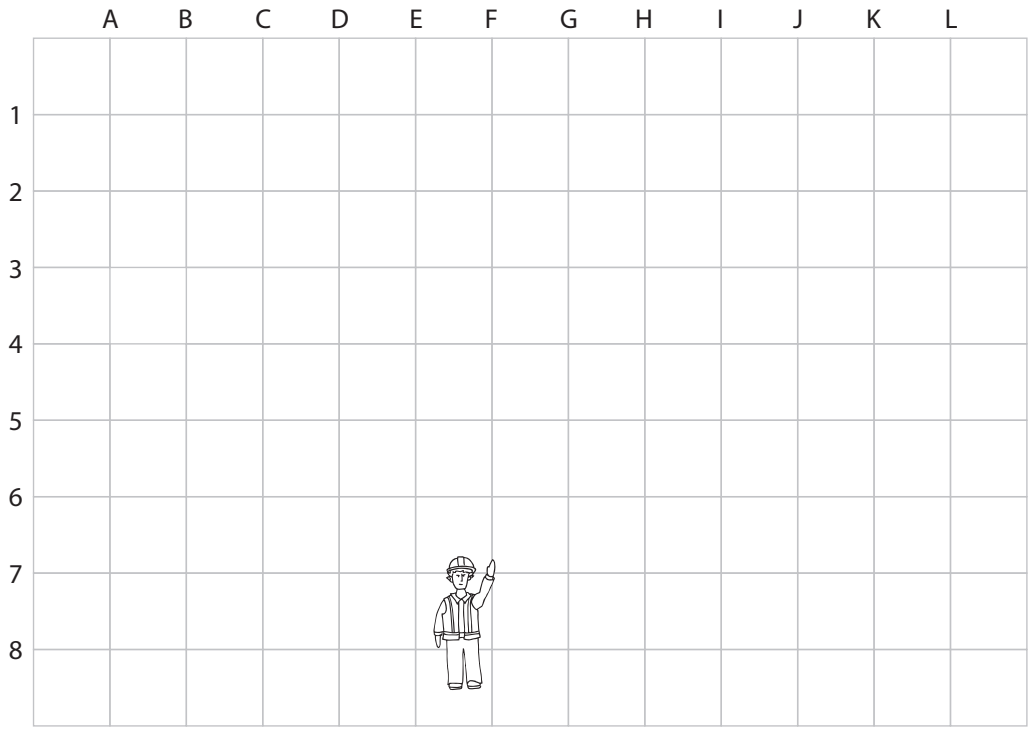
GRADES 4-6

5: DRAW THE MINING TRUCK

Mining trucks can hold up to 450 tonnes of ore. That is approximately the weight of 250 cars! The tires can be up to 3.5 metres tall. It takes a lot of power to move these trucks. Some wheels are so big that there is a motor for each one.

Draw and colour the mining truck using the grid below.





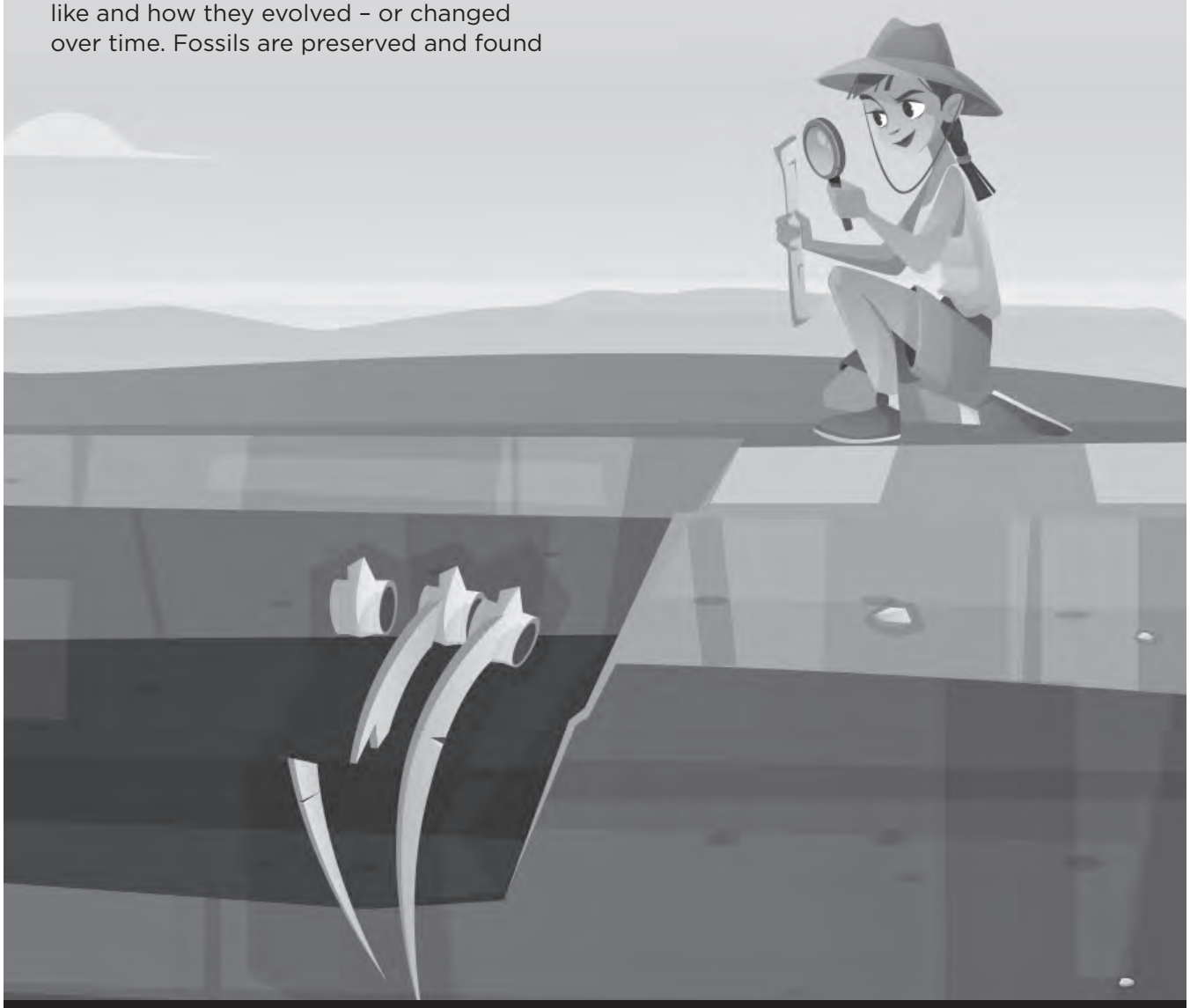
Resource Credit: Mining Matters

RESOURCE TOOL FOR FOSSIL TREASURES

RESOURCE TOOL

PALAEONTOLOGY

I am a Palaeontologist! I am a scientist who studies plants and animals that lived millions of years ago. I study the remains of these ancient organisms or living things. Fossils are the imprint or remains of something that lived long ago. They are usually of animals that are now extinct, which means they no longer exist today. It is very important to study these plants and animals as I can learn about where they lived, what they looked like and how they evolved – or changed over time. Fossils are preserved and found in rocks or permafrost. Permafrost is any ground that remains completely frozen – 0˚C or colder – for at least two years straight. Sometimes there isn't even snow on top of it. In the Northwest Territories, the ground has been frozen for thousands of years in many places where these creatures are found.



RESOURCE TOOL FOR FOSSIL TREASURES

RESOURCE TOOL

As a Palaeontologist, I get to work with students, elders and our communities, to support the preservation, enrichment, and protection of Indigenous heritage and identity, and to do that I need to follow the rules for exploring, documenting and sharing our past. I use special tools to carefully remove the creatures from the rock or permafrost, but they can be very hard to find, so it takes a lot of research, especially the help of our elders in understanding the land.

A bison fossil – named Tsiigehtchic steppe bison – was found in 2007, frozen in the permafrost in a hillside at the junction of the Mackenzie and Arctic Red Rivers, and is estimated to have lived 13,000 years ago. This creature can help us learn more about the environment when glaciers were leaving the area, and may mean that humans might have lived here at this time as well.

Fossils in Nunavut can also be found in sedimentary rock formations like Fossil Creek Trail and Kanguk Formation in both NWT and Nunavut. The fossils found here lived 390 MILLION YEARS AGO!

Fossils tell us lots about what the land was like at the time they were alive, so scientists can learn how the Earth has changed.

Illustration Credit: Jessica Prentice

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ACTIVITY: FOSSIL TREASURES

WHAT DO I DO? FOLLOW THE INSTRUCTIONS BELOW

GRADES 4-6

1: MIX & MATCH

Match the vocabulary word to the definition.

FOSSIL	Any ground that remains completely frozen for at least 2 years
PALEONTOLOGIST	Material remains from the past, like stone tools
ORGANISM	When a plant or animal no longer exists
PERMAFROST	Imprint or remains of something that lived long ago
EXTINCT	Any living thing
ARTIFACTS	Scientist who studies fossils and the past

2: FOSSILS CAN TAKE A VERY LONG TIME TO FORM

Can you put the steps in the correct order?

4
2
1
3

- ◯ The animal's bones get buried by sand, dirt, mud and ice
- ◯ Minerals seep into the bones
- ◯ The bones harden into rocks that look just like the bones
- ◯ An animal or plant dies

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ACTIVITY: PATTY THE PROSPECTOR

WHAT DO I DO? FOLLOW THE INSTRUCTIONS BELOW

GRADES 4-6

Patty is an observant woman. She recently took a prospector course and obtained a prospector licence. Learn about Patty's job as a prospector by filling in the blanks with the correct words from the word bank.

WORD BANK

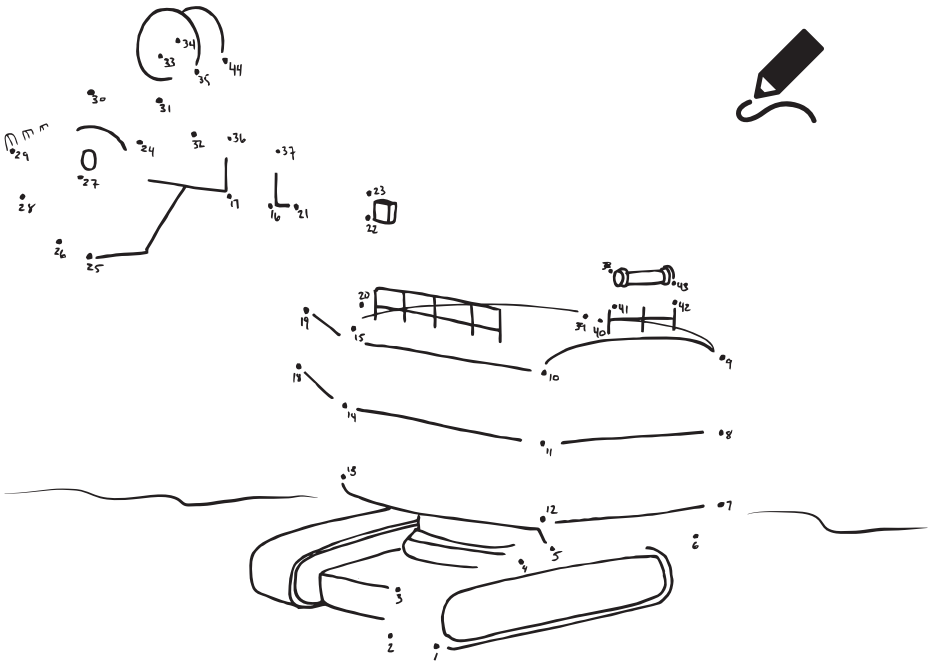
ADVENTURE	WOODS
DETECTIVE	GPS
EARTH	ROCK HAMMER
GOLD	SAFETY GLOVES

As a prospector, Patty explores different regions of the _____, acting as a _____, trying to discover valuable mineral deposits such as copper, _____, or even diamonds. She uses her _____ to help find her way through the _____. She uses her _____ to break rock to collect samples. Patty always wears her safety boots, safety glasses and _____ to protect her from nature's elements. A day in the life of Patty the Prospector is always an _____.

CONNECT THE DOTS

Connect the dots to reveal this piece of mining equipment.

Resource Credit: Mining Matters



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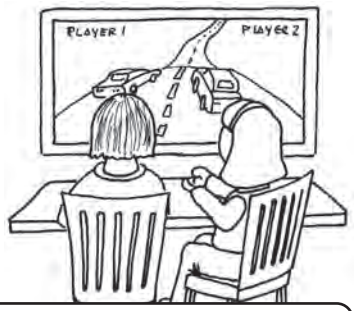
ACTIVITY: WHAT'S IN YOUR COMPUTER?

WHAT DO I DO? FOLLOW THE INSTRUCTIONS BELOW

GRADES 4-6

Did you know we use minerals every day? The products of mining provide many essential items, including highways, electrical and communications networks and housing.



In the puzzle below, can you find the metals and minerals that make up computers, cell phones and most other high-tech gadgets?

WORD BANK

ALUMINUM	COBALT	GALLIUM	GOLD	LITHIUM	SILVER	TIN	TUNGSTEN
CHROMIUM	COPPER	GERMANIUM	LEAD	NICKEL	TANTALUM	TITANIUM	ZINC

J Z D W P J M C S I L V E R D B T B
L O C R I U S R T T U O N N S I U J
Q Z C H I J E B J I L M D S T B N R
D X B L R C A R G E T V F L X T G U
N T L X O O O G E R M A N I U M S X
I A G I P B M F A T D V N D S P T B
G N M O W R M I H M J U R I M B E C
M T X X L M E M U Q L D W O U Z N O
U A D O D D B P U M V K V R K M F B
N L T L L O Y X P I N I C K E L H A
I U L E A D W V J O C C J P U J N L
M M G Z X K G C P H C G P C S I L T
U O L E U S N D Y N H F P C T H E D
L B Q F B I H L A Q I N S T B E L X
A K T G Z O J V L I T H I U M I R V

Resource Credit: Mining Matters

ACTIVITY: SYMBOL SUDOKU

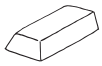
WHAT DO I DO? FOLLOW THE INSTRUCTIONS BELOW

GRADES 4-6

Fill in the grid so that every row, every column and every 3 x 3 box contains each of the nine symbols below **ONLY ONCE**.

SYMBOLS


Safety Glove


Gold Bar


Diamond


Ore Cart

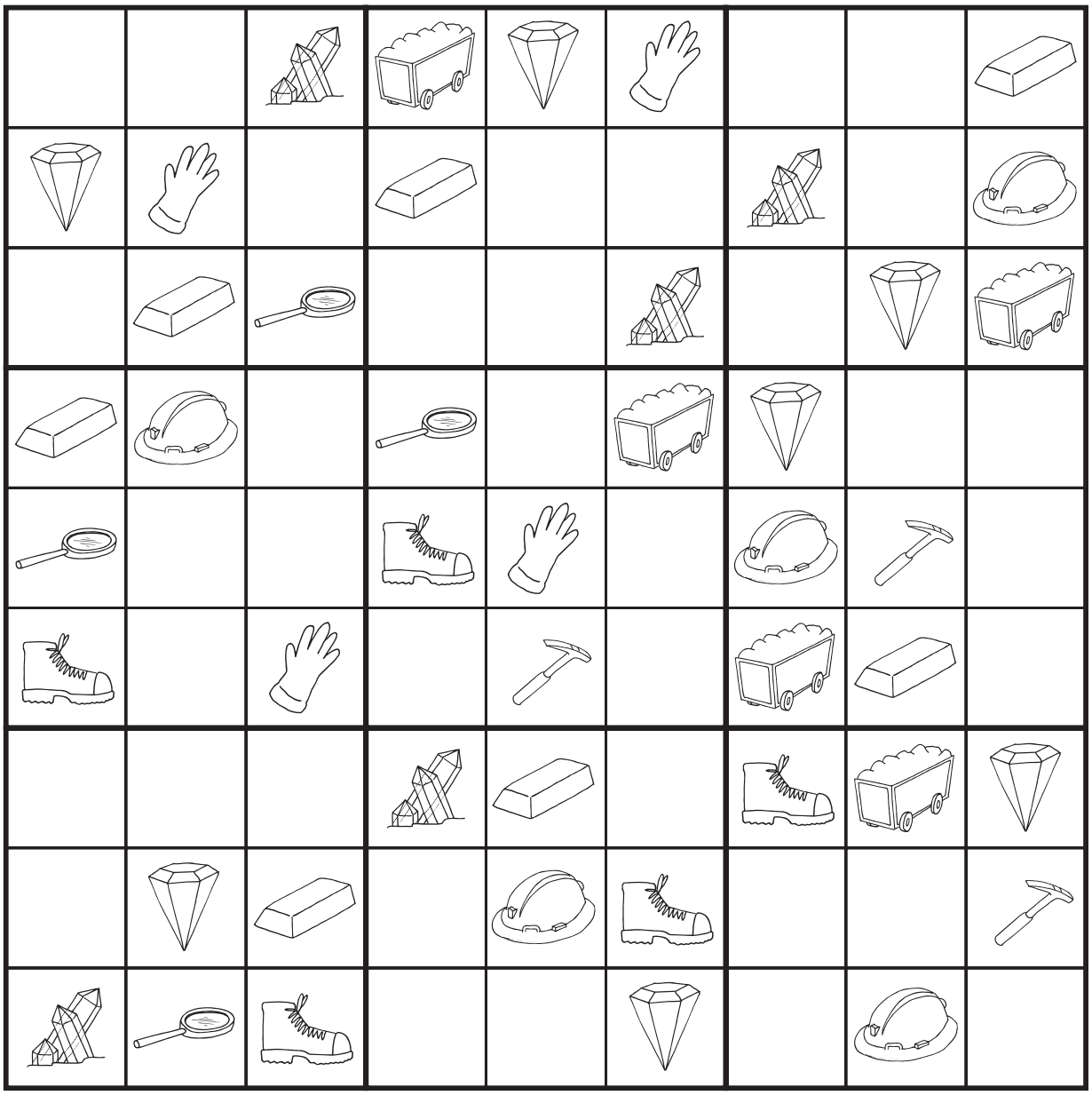

Safety Boot


Hard Hat


Rock Hammer


Magnifying Glass


Quartz



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Resource Credit: Mining Matters

PERIODIC TABLE OF ELEMENTS

Before you go online, please check with your parents or guardians.
To learn more about Internet safety, please visit: http://www.justice.gov.yk.ca/2404.html

GRADES 7-9 RESOURCE TOOL

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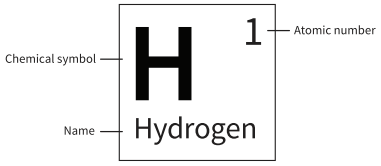
H 1 Hydrogen																	He 2 Helium
Li 3 Lithium	Be 4 Beryllium											B 5 Boron	C 6 Carbon	N 7 Nitrogen	O 8 Oxygen	F 9 Fluorine	Ne 10 Neon
Na 11 Sodium	Mg 12 Magnesium											Al 13 Aluminium	Si 14 Silicon	P 15 Phosphorus	S 16 Sulfur	Cl 17 Chlorine	Ar 18 Iron
K 19 Potassium	Ca 20 Calcium	Sc 21 Scandium	Ti 22 Titanium	V 23 Vanadium	Cr 24 Chromium	Mn 25 Manganese	Fe 26 Iron	Co 27 Cobalt	Ni 28 Nickel	Cu 29 Copper	Zn 30 Zinc	Ga 31 Gallium	Ge 32 Germanium	As 33 Arsenic	Se 34 Selenium	Br 35 Bromine	Kr 36 Krypton
Rb 37 Rubidium	Sr 38 Strontium	Y 39 Yttrium	Zr 40 Zirconium	Nb 41 Niobium	Mo 42 Molybdenum	Tc 43 Technetium	Rh 44 Ruthenium	Ru 45 Rhodium	Pd 46 Palladium	Ag 47 Silver	Cd 48 Cadmium	In 49 Indium	Sn 50 Tin	Sb 51 Antimony	Te 52 Tellurium	I 53 Iodine	Xe 54 Xenon
Cs 55 Caesium	Ba 56 Barium	Lu 71 Lutetium	Hf 72 Hafnium	Ta 73 Tantalum	W 74 Tungsten	Re 75 Rhenium	Os 76 Osmium	Ir 77 Iridium	Pt 78 Platinum	Au 79 Gold	Hg 80 Mercury	Tl 81 Thallium	Pb 82 Lead	Bi 83 Bismuth	Po 84 Polonium	At 85 Astatine	Rn 86 Radon
Fr 87 Francium	Ra 88 Radium	Lr 103 Lawrencium	Rf 104 Rutherfordium	Db 105 Dubnium	Sg 106 Seaborgium	Hs 107 Bohrium	Bh 108 Hassium	Mt 109 Meitnerium	Ds 110 Darmstadium	Rg 111 Roentgenium	Cn 112 Copernicium	Uut 113 Ununtrium	Fl 114 Flerovium	Uup 115 Ununpentium	Lv 116 Livermorium	Uus 117 Ununseptium	Uuo 118 Ununoctium

La 57 Lanthanum	Ce 58 Cerium	Pr 59 Praseodymium	Nd 60 Neodymium	Pm 61 Promethium	Sm 62 Samarium	Eu 63 Europium	Gd 64 Gadolinium	Tb 65 Terbium	Dy 66 Dysprosium	Ho 67 Holmium	Er 68 Erbium	Tm 69 Thulium	Yb 70 Ytterbium
Ac 89 Actinium	Th 90 Thorium	Pa 91 Protactinium	U 92 Uranium	Np 93 Neptunium	Pu 94 Plutonium	Am 95 Americium	Cm 96 Curium	Bk 97 Berkelium	Cf 98 Californium	Es 99 Einsteinium	Fm 100 Fermium	Md 101 Mendelevium	No 102 Nobelium



ACTIVITY: ELEMENTAL DEDUCTION

GRADES 7-9

WHAT DO I DO?

Can you find the element symbol to match the product made by mining? Colour in as many elements as you can and submit to win!

WHAT DO I NEED?

The Periodic Table Online Research

More than **40** mined metals and rare earths are used to produce a single smartphone.

BATTERY

13	3	27
Aluminium	Lithium	Cobalt

TOUCH SCREEN

14	50	19
Silicon	Tin	Potassium
49	13	31
Indium	Aluminium	Gallium

EARBUDS*
PHONE CASES*

6	1
Carbon	Hydrogen

SOUND

60	5	28	59
Neodymium	Boron	Nickel	Praseodymium

ELECTRONICS

79	29	47	73	74
Gold	Copper	Silver	Tantalum	Tungsten

**Oil for these products can also be from non-mined sources.*

Resource Credit: Mining Association of Canada | Developed by: Yukon Women in Mining

MINING IS ESSENTIAL FOR INNOVATIVE TECHNOLOGY

Canada's mining industry is providing the responsibly-sourced minerals and metals that power the technologies of today and of the future.

QUESTION 1:

What is the Periodic Table?

QUESTION 2:

List items in your house that have metals in them that were mined – How many can you find?

1	6
2	7
3	8
4	9
5	10

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ACTIVITY: ELEMENTAL DEDUCTION

GRADES 7-9

STANLEY CUP

47	28
Silver	Nickel

ZAMBONI

26	13
Iron	Aluminium

HOCKEY SKATES

24	26
Chromium	Iron
6	
Carbon	

Resource Credit: Mining Association of Canada
Developed by: Yukon Women in Mining

Mining is responsible for the most highly coveted hockey trophy in the world.

STANLEY CUP

Named after the former Governor General of Canada, Lord Stanley of Preston was first awarded to the Montreal Hockey Club in 1893. The original Cup was made of silver, while the current Cup is made of a silver and nickel alloy.

QUESTION 3:

Which of the following is an element?

(Circle the correct answer)

A) WATER **B) HEAT** **C) VOLUME** **D) GOLD**

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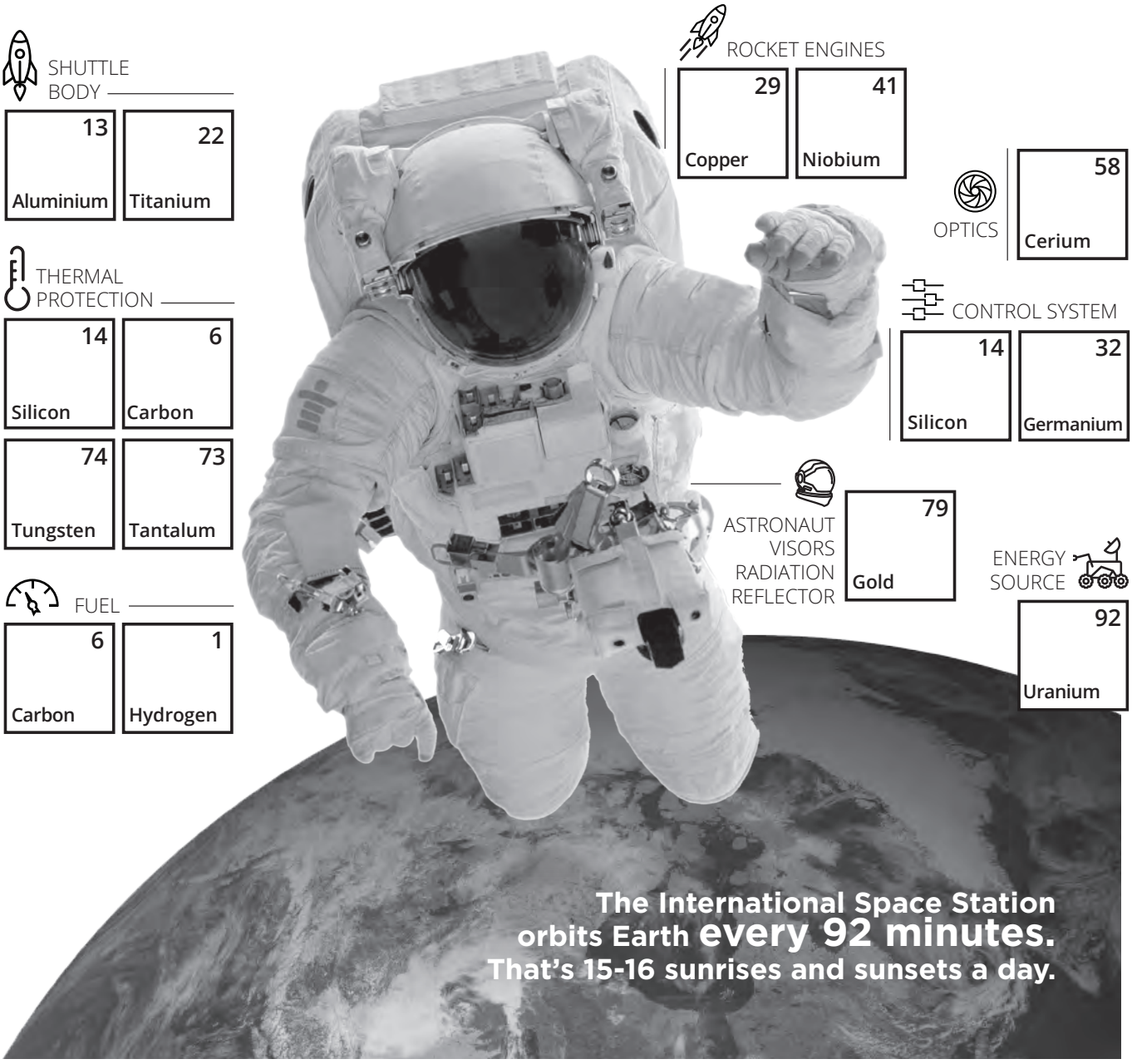
ACTIVITY: ELEMENTAL DEDUCTION

GRADES 7-9



SHUTTLE BODY

13 Aluminium	22 Titanium

THERMAL PROTECTION

14 Silicon	6 Carbon
74 Tungsten	73 Tantalum

FUEL

6 Carbon	1 Hydrogen

ROCKET ENGINES

29 Copper	41 Niobium

OPTICS

58 Cerium

CONTROL SYSTEM

14 Silicon	32 Germanium

ASTRONAUT VISORS RADIATION REFLECTOR

79 Gold

ENERGY SOURCE

92 Uranium

The International Space Station orbits Earth every 92 minutes. That's 15-16 sunrises and sunsets a day.

GOLDEN RECORDS OF LIFE ON EARTH

NASA launched the Voyager Golden Records – two gold-plated copper phonograph records containing sounds and images from Earth – into space in 1977. Intended for future spacefarers or intelligent lifeforms, the records contain greetings in 55 languages and sounds ranging from rain and thunder to birds, frogs, laughter and children.

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ACTIVITY: MINING FOR ENERGY

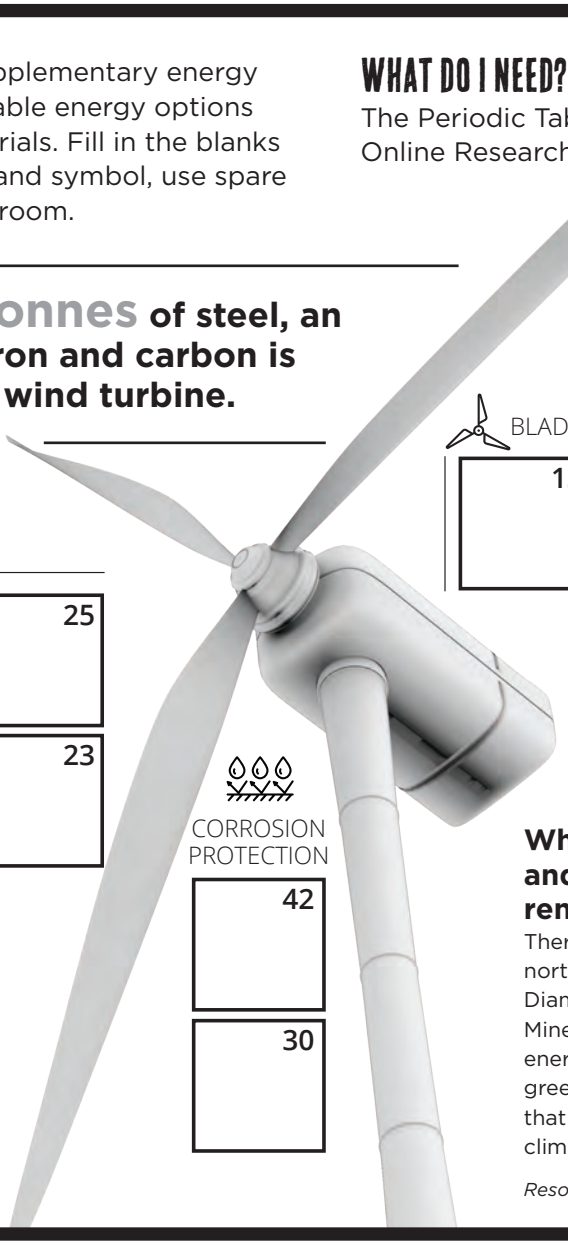
GRADES 7-9

You are interested in supplementary energy using one of two renewable energy options made from mining materials. Fill in the blanks with the element name and symbol, use spare paper if you need more room.

WHAT DO I NEED?

The Periodic Table
Online Research

More than 335 tonnes of steel, an alloy made from iron and carbon is needed to build a wind turbine.



WINDMILL

BLADES
13

CONTROLS
29 | 14

MAGNET GENERATION
26 | 60
5 | 66

BATTERY ENERGY STORAGE
3 | 28 | 25
27 | 6 | 23

CORROSION PROTECTION
42
30

STEEL USED TO BUILD TURBINES
26 | 6

Developed by: Yukon Women in Mining

When we explore for minerals and metals we are finding renewable sources of energy too:

There are two wind farms operating at remote northern Canadian mines; one at the Diavik Diamond Mine in NWT and one at the Raglan Mine in northern Quebec. These renewable energy facilities help reduce the mines' greenhouse gas emissions and demonstrate that wind farms are viable in remote cold climate zones in Canada's North.

Resource Credit: Mining Association of Canada

QUESTION 1:

What year was the periodic table first developed and by who?

QUESTION 2:

Name a NWT mining company that has a wind farm?

QUESTION 3:

What metals are required for battery energy storage for wind farms?
(Circle the correct answer)

A) Copper, Silicon, Cobalt, Boron

B) Molybdenum, Zinc, Iron, Aluminum

C) Carbon, Zinc, Dysprosium, Iron

D) Nickel, Lithium, Magnesium, Cobalt

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ACTIVITY: MINING FOR ENERGY

GRADES 10-12

SOLAR PANELS

48	52	42
4	32	31
49	47	14

SOLAR PANELS

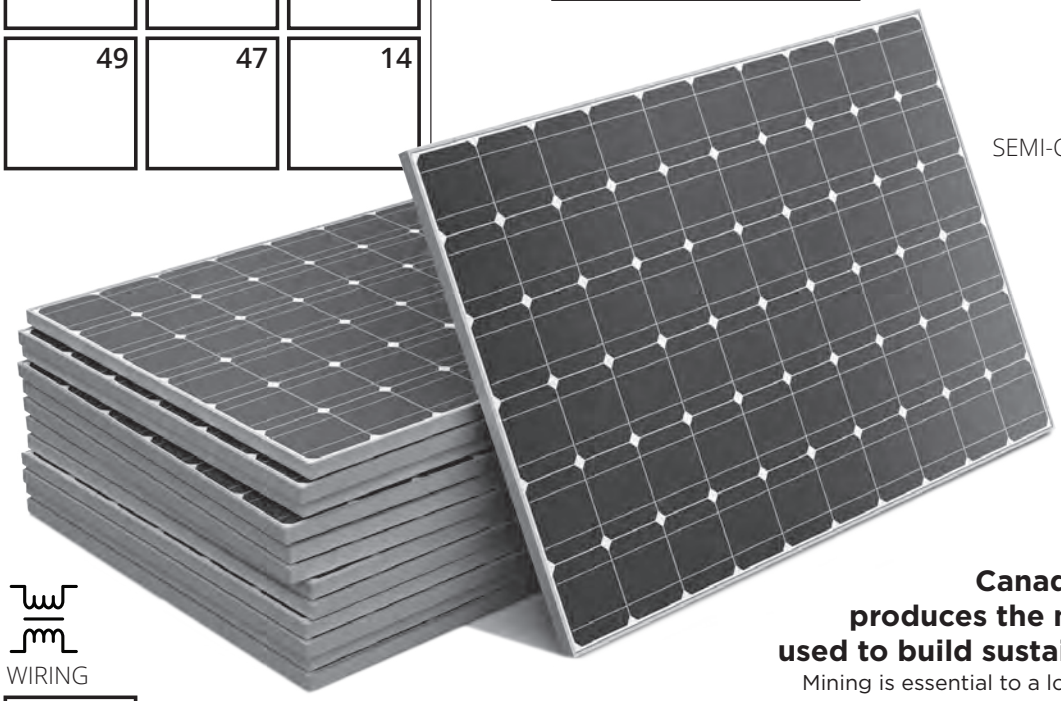
14 of the 19 minerals and metals used in solar Photovoltaics (PV) panels come from Canadian mines

FRAME

13	22
30	12

SEMI-CONDUCTOR

5
15



WIRING

29

Canada's mining industry produces the minerals and metals used to build sustainable technologies

Mining is essential to a low-carbon future with clean energy and "green" products requiring metals and minerals as building blocks.

Resource Credit: Mining Association of Canada | Developed by: Yukon Women in Mining

QUESTION 4:

Which side (left or right) of the periodic table are the metals?
(Circle the correct answer)

A) Left

B) Right

QUESTION 3:

How many of the 19 minerals and metals used in solar PV panels come from Canadian mines?
(Circle the correct answer)

A) 11 B) 16

C) 14 D) 19

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ACTIVITY: MINING MAKES IT POSSIBLE

GRADES 10-12

WHAT DO I NEED? The Periodic Table & Online Research

Explore in your house or yard to find a product made from mining elements, minerals and metals that makes your life possible. Create your own guide!

BUT... THERE IS 1 RULE!

You must do your own research! Examples from Activity One and Two cannot be used, nor any of the samples found in Mining Association of Canada's 30 Things.

COMPLETE THE TEMPLATE, OR DRAW YOUR OWN:

How To:

1. Pick a Product
2. Fill in the template or create your own
3. Minimum Number of Elements: 10
4. Name a Nunavut mining or supply/service company connected to your product
5. Have fun!

NWT Company: **DeBeers Canada**

MONITOR — 29 Cu — Copper

MONITOR — 79 Au — Gold

MONITOR — 13 Al — Aluminium

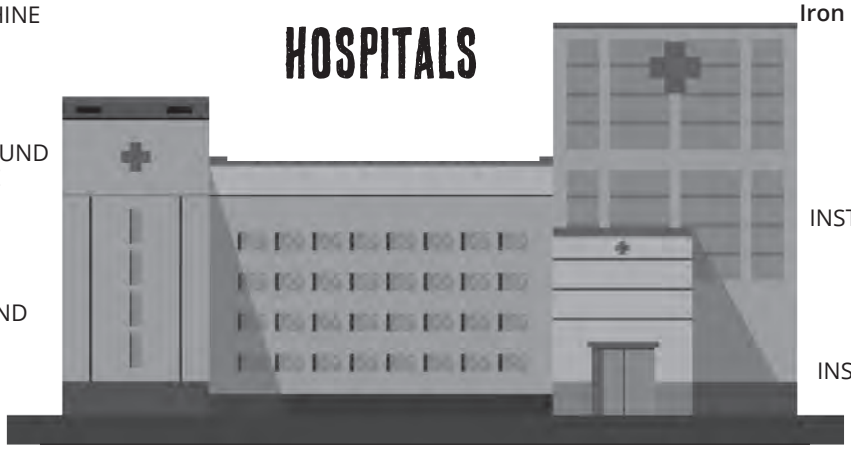
HOSPITAL BED — 6 C — Titanium

HOSPITAL BED — 26 Fe — Iron

40 Zr — Zirconium — ULTRASOUND MACHINE

SURGICAL INSTRUMENTS — 24 Cr — Chromium

HOSPITALS



22 Ti — Titanium — ULTRASOUND MACHINE

SURGICAL INSTRUMENTS — 14 Si — Silicon

29 Cu — Copper — ULTRASOUND MACHINE

SURGICAL INSTRUMENTS — 28 Mn — Manganese

ULTRASOUND MACHINE — 82 Pb — Lead

SURGICAL INSTRUMENTS — 26 Fe — Iron

MINING'S ROLE IN PREVENTING INFECTIOUS DISEASE

Hospitals have a potent new tool in their mission to improve patient health and safety. It also happens to be one of the oldest metals known to man – copper. Increasingly, health facilities are using Antimicrobial Copper to prevent Hospital Acquired Infections, as not only does it continuously kill 99.9% of infectious bacteria, but it also has the potential to significantly reduce the costs of infection control.

Resource Credit: Mining Association of Canada | Developed by: Yukon Women in Mining

COVID-19 MESSAGE:

If you are exploring beyond your home:

- Ask a parent or guardian for permission and assistance.
- Practice physical / social distancing: explore in your house or yard
- Avoid touching your face when you are out exploring
- Sneeze or cough into your sleeve
- Wash your hands when you get home with soap and water for 20 seconds

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ACTIVITY: MINING MAKES IT POSSIBLE

GRADES 10-12

NWT COMPANY: _____

PRODUCT:

_____

_____

_____

SLOGAN: _____

_____

PARAGRAPH

Explain the connection with mining.

_____

_____

_____

_____

_____

_____

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ACTIVITY: TABLE SPELLING BEE

GRADES 10-12

Elements are the basic building blocks of everything around us. They can be found either in their pure form or chemically combined with other elements to make compounds. Minerals are elements or compounds that occur naturally in the Earth's crust. Rocks are mixtures formed of minerals.

How many words can you spell from the 114 elements symbols? Challenge yourself to make three-letter, four-letter, five-letter and even six-letter words.

Resource Credit: Mining Matters

1 H Hydrogen																	2 He Helium
3 Li Lithium	4 Be Beryllium											5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon
11 Na Sodium	12 Mg Magnesium											13 Al Aluminium	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Iron
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Rh Ruthenium	45 Ru Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon
55 Cs Caesium	56 Ba Barium	71 Lu Lutetium	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
87 Fr Francium	88 Ra Radium	103 Lr Lawrencium	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Hs Bohrium	108 Bh Hassium	109 Mt Meitnerium	110 Ds Darmstadium	111 Rg Roentgenium	112 Cn Copernicium	113 Uut Ununtrium	114 Fl Flerovium	115 Uup Ununpentium	116 Lv Livermorium	117 Uus Ununseptium	118 Uuo Ununoctium

57 La Lanthanum	58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium
89 Ac Actinium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium

THREE LETTERS

C | At

FOUR LETTERS

K | I | Te

FIVE LETTERS

S | Po | O | N

SIX LETTERS

Cl | O | U | Dy

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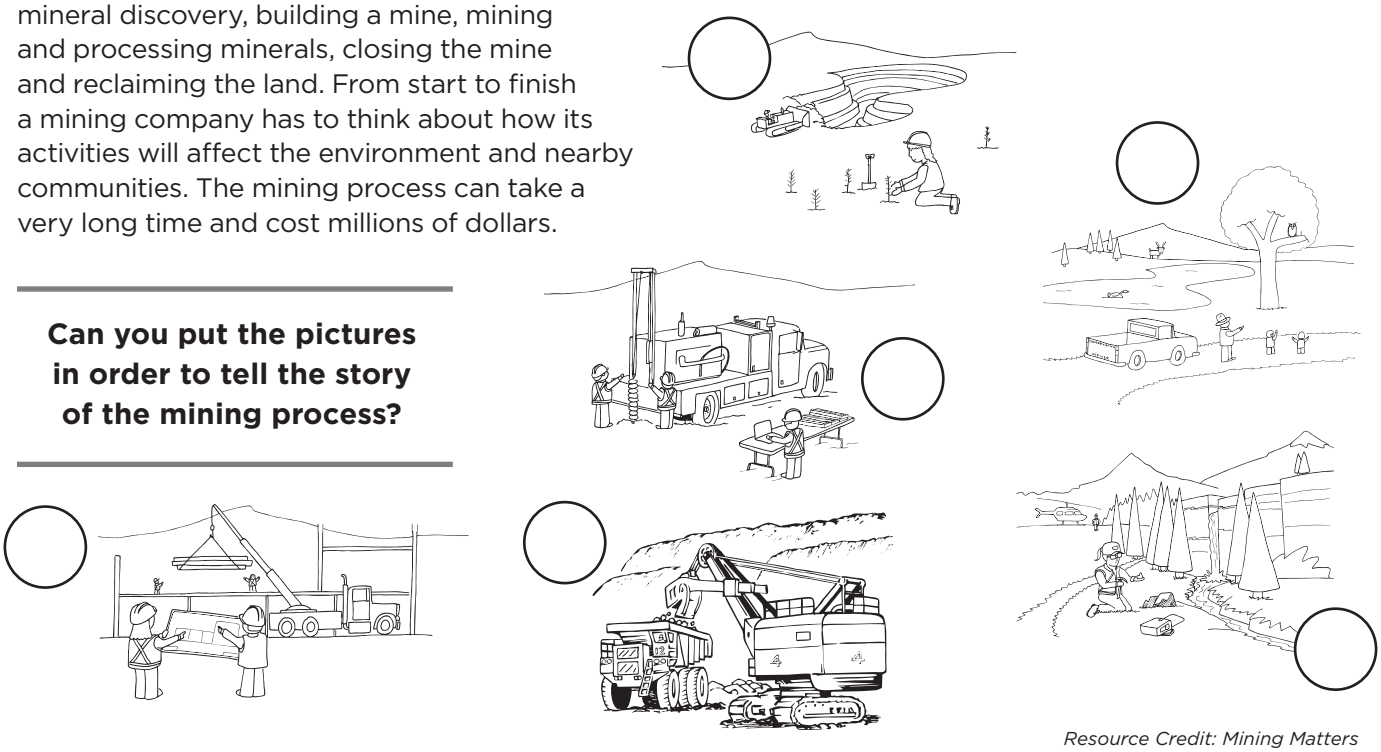
ACTIVITY: THE MINING PROCESS

GRADES 10-12

The mining process is complicated and involves looking for minerals, evaluating a mineral discovery, building a mine, mining and processing minerals, closing the mine and reclaiming the land. From start to finish a mining company has to think about how its activities will affect the environment and nearby communities. The mining process can take a very long time and cost millions of dollars.

Can you put the pictures in order to tell the story of the mining process?



Resource Credit: Mining Matters

A **LOOKING FOR MINERALS**
Geologists do field work to identify different rocks, study satellite images of Earth and use airplanes or helicopters to measure things, such as magnetism in the underlying rocks.

B **EVALUATING A MINERAL DISCOVERY**
The company drills holes in the ground to take out long, thin cylinders of rock called cores, which can be studied to find out how much valuable mineral they contain. The company determines how much it will cost to construct and operate the mine, to sell the minerals, to take care of the environment, and whether or not the company will make any money.

C **BUILDING A MINE**
Huge diggers scrape away the surface material and explosives are used to blast the solid rock to reach the valuable minerals located close to the surface, or tunnels are dug into the Earth to reach valuable minerals buried deep below the surface. Roads, mineral processing plants, employee housing and offices are also constructed.

D **MINING AND PROCESSING MINERALS**
Miners use drills and explosives to break up the rock. Large scoops and machines move the rock to the processing plant where it is crushed into a fine powder and valuable minerals are separated from the waste rock.

E **CLOSING THE MINE**
Buildings are removed, pits and tunnels are made safe, the environment is protected from mine waste, and the land is replanted with grass and trees.

F **RECLAIMING THE LAND**
The land is made safe, usable and a natural part of the surrounding environment.

For even more detail on the mineral resources cycle, go to miningnorthworks.com/mining-cycle/

ACTIVITY: CAREERS

GRADES 10-12

A career in mining is more than you think! There are over 150 different careers in the mining industry. Discover a world of opportunities.

Can you unscramble the careers described below?

Resource Credit: Mining Matters

	SCRAMBLE		CAREER
1.	LOOSEGGIT	_____	Evaluates the geological aspects of mine sites
2.	EINM ENIRNEEG	_____	Designs plans for mine sites and mining operations
3.	CRETILNIACE	_____	Repairs a variety of electrical equipment
4.	OADMIDN IDLRERL	_____	Uses a drill with a diamond tipped bit to bore deep holes
5.	TNNUACCTOA	_____	Manages the money spent by the company
6.	YETFSA TSRNEPICO	_____	Visits the mine to ensure safe working conditions
7.	REANLVMOINTNE ICESTSTNI	_____	Ensures that the mine operations follow environmental guidelines
8.	IYPSOCTEHIGS	_____	Interprets geophysical data to locate mineral reserves
9.	EPSPCRRTOO	_____	Searches for valuable mineral deposits
10.	LEBSTRA	_____	Blasts large rocks and other surfaces for mining
11.	AWYELR	_____	Obtains permits, rights and licenses
12.	EALLTGURISMT	_____	Supervises the extraction of metals from ores
13.	EIETQPUNM ROTEORPA	_____	Operates equipment used in daily mine operations
14.	EAHVY UYDT NIMCEHAC	_____	Repairs and maintains heavy duty equipment
15.	PUTRMECO ATSESIPLIC	_____	Maintains and operates robots and computer networks
16.	STIHCME	_____	Analyzes samples collected daily from the mine
17.	MNAREILS VRUESRYO	_____	Maps and develops plans for sites of mineral extraction

WORD BANK

ACCOUNTANT	ENVIRONMENTAL SCIENTIST	METALLURGIST
BLASTER	EQUIPMENT OPERATOR	MINE ENGINEER
CHEMIST	GEOLOGIST	MINERALS SURVEYOR
COMPUTER SPECIALIST	GEOPHYSICIST	PROSPECTOR
DIAMOND DRILLER	HEAVY DUTY MECHANIC	SAFETY INSPECTOR
ELECTRICIAN	LAWYER	

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ACTIVITY: WORD SEARCH

ALL GRADES

Canada is fortunate to have a lot of natural resources that we can use to build a sustainable economy and environmentally-friendly society. We call these critical minerals, and they are very valuable to us and our allies (like the United States). Critical minerals are used in low-carbon technologies such as wind turbines, solar panels, and electric cars. They are also used to make items like computers, cellphones, and GPS devices that we depend on in our everyday lives. The Government of Canada has a list of 31 critical minerals – lets learn their names!

ALUMINUM	FLUORSPAR	MAGNESIUM	POTASH	TITANIUM
ANTIMONY	GALLIUM	MANGANESE	RARE EARTH	TUNGSTEN
BISMUTH	GERMANIUM	MOLYBDENUM	ELEMENTS	URANIUM
CESIUM	GRAPHITE	NICKEL	SCANDIUM	VANADIUM
CHROMIUM	HELIUM	NIOBIUM	TANTALUM	ZINC
COBALT	INDIUM	PLATINUM GROUP	TELLURIUM	
COPPER	LITHIUM	MINERALS	TIN	

H	X	M	N	Y	E	N	W	I	D	S	M	M	M	F	M	H	L	N	X	G	I	D	D	R
U	V	J	U	W	K	Z	O	J	T	W	L	A	G	T	T	U	P	I	K	P	E	P	B	A
F	G	L	P	N	O	G	H	S	C	S	G	O	A	U	B	R	N	T	P	T	V	N	W	R
C	I	B	M	F	E	U	R	B	Q	N	I	Z	M	Z	V	C	P	I	R	Y	R	R	L	E
O	F	A	H	U	U	D	R	J	E	O	M	S	M	E	Q	C	H	X	M	W	S	V	E	E
B	R	C	C	Y	I	Y	B	S	C	E	I	U	I	R	A	P	S	R	O	U	L	F	K	A
A	Z	E	B	N	D	L	I	Y	I	B	I	X	I	L	X	B	W	V	O	M	L	M	C	R
L	W	Y	Q	O	Y	U	L	M	L	N	H	P	A	R	E	H	K	S	U	M	E	A	I	T
T	U	Y	I	M	M	Q	I	A	A	O	D	O	O	U	U	O	D	I	M	T	I	B	N	H
M	C	E	S	I	U	M	F	T	G	Q	M	I	R	T	Y	L	B	D	I	E	S	U	H	E
U	P	J	K	T	Z	J	I	X	J	N	V	G	U	A	A	O	L	H	C	C	J	V	M	L
I	B	U	U	N	M	T	C	K	H	E	L	I	U	M	I	S	P	E	A	A	Z	A	O	E
N	G	Q	N	A	E	S	E	N	A	G	N	A	M	N	X	A	H	N	T	I	G	N	I	M
A	T	U	N	G	S	T	E	N	E	C	W	V	L	Y	R	U	D	Q	N	F	Z	A	G	E
M	F	Q	T	H	W	A	Y	C	T	K	T	R	N	G	O	I	Y	C	R	P	T	D	B	N
R	E	U	A	Q	N	M	K	L	E	H	Y	U	C	U	U	F	G	P	X	M	V	I	O	T
E	W	G	Z	P	D	M	S	M	V	P	F	O	F	M	N	V	F	M	C	Y	M	U	H	S
G	G	W	V	K	V	F	K	H	O	X	P	N	F	G	G	U	P	A	X	P	L	M	A	D
Q	Q	U	V	Q	V	S	M	D	Y	P	Y	F	T	P	N	A	L	O	Q	B	I	A	P	J
L	V	U	R	J	P	A	A	N	E	S	X	A	W	B	Y	T	I	B	F	V	T	Z	W	J
I	C	D	H	A	R	Y	X	R	Y	M	U	L	A	T	N	A	T	B	L	J	H	S	K	B
P	L	A	T	I	N	U	M	G	R	O	U	P	M	I	N	E	R	A	L	S	I	J	S	K
B	T	V	E	W	Y	I	M	F	O	V	N	F	D	V	I	I	F	V	X	H	U	K	W	Z
U	G	P	O	R	U	W	U	Z	M	V	Y	V	T	Q	U	G	M	Z	M	Z	M	C	K	X
G	B	W	U	H	B	R	V	M	O	W	Z	U	J	V	E	C	X	W	W	J	L	Z	F	G

Find the words in the puzzle above!

Words can go in any direction, and can share letters.

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CRITICAL MINERAL PROFILE: COBALT

WHAT IS COBALT?

Cobalt is a mineral mostly found combined chemically with another element. When reduced and freed by smelting, cobalt is a hard, lustrous, silver-gray metal with many useful properties.

WHAT IS COBALT USED FOR?

Cobalt has wide application, especially for "green" or new technology uses:

- As the positive electrode in lithium-ion batteries for electric vehicles and portable electronics;
- In power and jet engine turbines;
- As a component of a hard-wearing alloy used in wind turbines;
- In electromechanical devices such as magnets, electric motors, generators and transformers; Good potential as a catalyst in hydrogen fuel cells;
- In cell phones, laptops and camera batteries;
- In electric vehicle batteries and power tools there is between 10-20 per cent cobalt by weight.

COBALT IN THE NWT

Past cobalt production in the NWT was from various operations located at the eastern edge of Great Bear Lake and the eastern arm of Great Slave Lake. It was commonly produced as a by-product of polymetallic veins. Fortune Minerals' NICO project is an advanced cobalt-gold-bismuth-copper deposit and has the necessary permits and licences for mine project and spur road development. Proven and probable reserves in the NICO deposit stand at 33 million tonnes, including 82.3 million pounds of cobalt, 1.1 million ounces of gold, 102.1 million pounds of bismuth, and 27.2 million pounds of copper. Fortune recently completed a private placement to raise funds for the project and received a grant from the Government of the Northwest Territories for a planned 2022 drilling project. Another promising cobalt source is Cornish Metals Inc.'s Nickel King deposit near the NWT-Saskatchewan border, approximately 145 km northeast of Stony Rapids, Saskatchewan. Primarily a nickel deposit, cobalt is expected to be a secondary product. Several satellite deposits and geophysical targets remain to be tested in the area.

WHY IS COBALT A CRITICAL MINERAL?

The market demand is increasing as the result of high demand for new and more complex electronic devices increases. Cobalt is recognized as critically important by Canada, United States and the U.S. and the European Union. China is the world's largest consumer of cobalt and the Democratic Republic of Congo is the world's leading producer with over one-half of world production.

CRITICAL MINERAL PROFILE: FLUORSPAR (FLOURITE)

WHAT IS FLUORSPAR?

Fluorspar, also called fluorite, is an important industrial mineral composed of two elements: calcium and fluorine.

WHAT IS FLUORSPAR USED FOR?

Fluorspar is used for metal refining to remove sulfur and other impurities. It is used to manufacture products such as:

- aluminum, gasoline, insulating foams, refrigerants, steel, and uranium fuel;
- non-stick cooking surfaces known such as Teflon are made using fluorine derived from fluorite.

FLUORSPAR IN THE NWT

Fluorspar is a common hydrothermal mineral and is very widespread. It has also been found at the Nechalacho project, a rich polymetallic rare earth elements resource, with potential for economic recovery of the heavy rare earth elements. This project jointly owned by Cheetah Resources Corp. which is undertaking a bulk sampling project in 2022. There are no other active projects containing fluorspar in the NWT.

WHY IS FLUORSPAR A CRITICAL MINERAL?

China was the world's largest miner of fluorspar in 2020, having produced 4.3 million tonnes. Mexico has the world's largest fluorspar reserves as of 2020, at 68 million tonnes.

As part of their joint Critical Mineral Strategy, Canada and United States have both declared fluorspar to be a critical material.

CRITICAL MINERAL PROFILE: INDIUM

WHAT IS INDIUM?

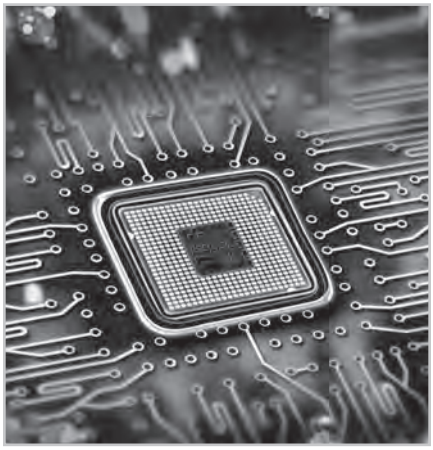
Indium is a silvery-white metal resembling tin. It has a low melting point and is stable in air.

WHAT IS INDIUM USED FOR?

- Indium, when alloyed with tin oxide, conducts electricity, bonds strongly to glass and is transparent so is important in the production of touch screens, flat panel televisions, monitors and solar panels;
- Indium nitride, phosphide and antimonide are used as semiconductors for transistors and microchips;
- Fire sprinkling systems for businesses and warehouse use an indium alloy because of its low melting point;
- Indium is used to give a mirror finish to windows in tall buildings, and as a protective film on welders' goggles;
- Indium is used to coat ball bearings in Formula I racing cars because of its low friction.

INDIUM IN CANADA

Indium is primarily produced as a byproduct of zinc mining. Although there are currently two potential zinc-lead projects in the Northwest Territories, neither Osisko Metals, owner of the Pine Point Mine project, nor NorZinc, owner of the Prairie Creek project, report indium as occurring at their projects. Indium is not produced in the NWT as this time.

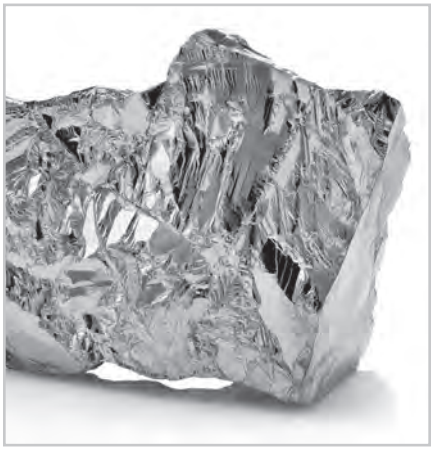


WHY IS INDIUM A CRITICAL MINERAL?

There is growing demand for indium in the high technology market, and Canada and United States have listed it as a critical mineral in their joint Critical Mineral Strategy. United States used approximately 170 tonnes of indium in 2018, all of it supplied from other countries. The major sources for these indium imports were China (27 percent), Canada (22 percent), Republic of Korea (11 percent) and Taiwan (10 percent).

Canada ranks fourth in global production, behind China, Republic of Korea, and Japan. Global production in 2020 was about 900 metric tonnes.

CRITICAL MINERAL PROFILE: NICKEL



WHAT IS NICKEL?

Nickel is a hard, silvery-white metal whose strength, bendability and resistance to heat and corrosion make it extremely useful for the development of a wide variety of materials.

WHAT IS NICKEL USED FOR?

Nickel is rarely used in its pure form. It is usually combined with other metals, especially iron, chromium and copper, to produce alloys like stainless steel. Nickel is also used in some metal coatings. Nickel alloys have many uses, such as:

- Household and industrial water faucets and shower heads;
- Kitchen wares such as utensils, pots and pans and cutlery;
- Cladding for kitchen appliances;
- Medical equipment;
- Power generation;
- Nickel-cadmium batteries (NiCad) and lithium-ion batteries, used in smartphones and electric and hybrid vehicles;
- Coins and jewelry;
- Car and truck bodies and jet engines.

NICKEL IN CANADA

In 2019, Canada ranked fifth in the world for nickel, produced from mines located in Newfoundland and Labrador, Quebec, Ontario and Manitoba. Canada's nickel and nickel-related products are exported to more than 100 countries, valued at $4.1 billion. Canada also produced 124,708 tonnes of refined nickel at three refineries located in Fort Saskatchewan, AB, Sudbury, ON and Long Harbour, NL.

As part of their joint Critical Mineral Strategy, Canada and United States have both declared nickel to be a critical mineral.

MY NOTES