МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РОССИЙСКОЙ ФЕДЕРАЦИИ
Государственное образовательное учреждение высшего профессионального образования
**«НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ
ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ»**

Р.Н. Абрамова, Л.М. Болсуновская, А.В. Баранова

ГЕОЛОГИЯ РУДНЫХ МЕСТОРОЖДЕНИЙ И РАЗВЕДКА ПОЛЕЗНЫХ ИСКОПАЕМЫХ

Часть 1

Горное дело

Учебно-методическое пособие
по дисциплине «Профессиональный английский язык»
для студентов старших курсов и магистрантов технических вузов
геологических и нефтегазовых специальностей

Издательство
Томского политехнического университета
2011

УДК 553:811.111 (075.8)
ББК Ш143.21-923
А16

Абрамова Р.Н.

А16 Геология рудных месторождений и разведка полезных ископаемых. Часть 1. Горное дело. Профессиональный английский язык: учебно-методический комплекс / Р.Н. Абрамова, Л.М. Болсуновская, А.В. Баранова; Томский политехнический университет. – Томск: Изд-во Томского политехнического университета, 2011. – 134 с.

Пособие является частью учебно-методического комплекса, разработанного для студентов старших курсов и магистрантов технических вузов геологических и нефтегазовых специальностей, прослушавших курс «Геология и методы разведки полезных ископаемых» на русском языке и изучающих данный курс в рамках профессионального иностранного языка.

Комплекс состоит из 3 частей, содержащих аутентичные материалы по вышеуказанной дисциплине, а также упражнения, направленные на совершенствование коммуникативных навыков студентов на английском языке.

Предназначено как для аудиторной, так и для самостоятельной работы студентов.

УДК 553:811.111 (075.8)
ББК Ш143.21-923

Рецензенты

Доктор филологических наук, профессор
заведующий кафедрой делового английского языка Института экономики, управления и природопользования СФУ (г. Красноярск)
Е.Б. Гришаева

Доктор геолого-минералогических наук, профессор
заведующий кафедрой динамической геологии ТГУ
В.П. Парначёв

Доктор геолого-минералогических наук, профессор, академик РАН
А.Э. Конторович

ORE GEOLOGY AND MINERAL EXPLORATION

CONTENTS

UNIT 1

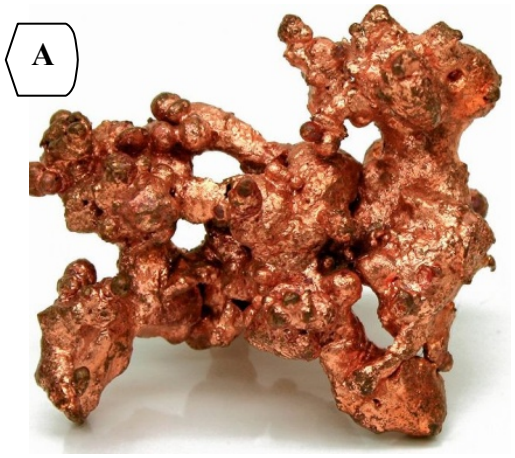
MINING INDUSTRY

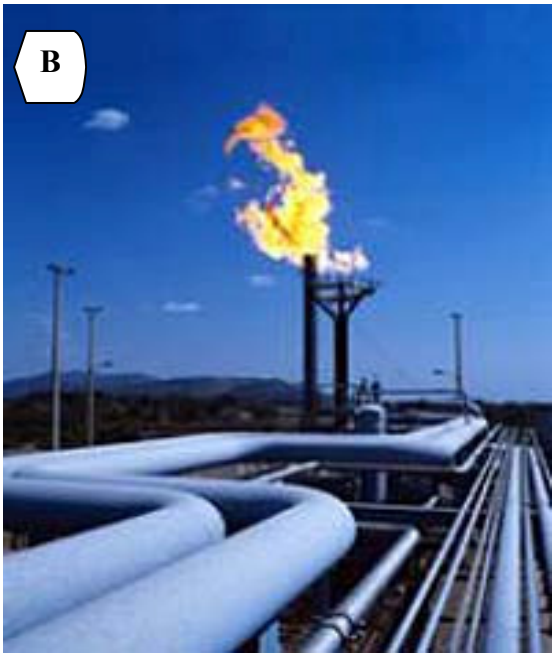
In this unit

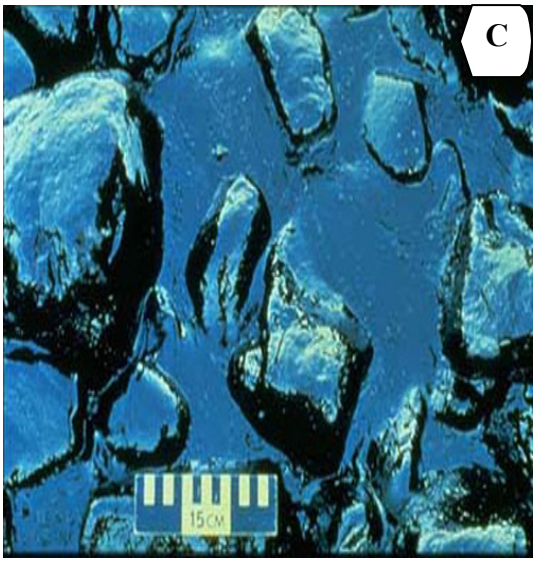
- speaking about the mining organization and its structure
- listening to people describing the importance of an interesting profession
- making inferences from written text
- how to stress technical words
- how to group and remember new terms

Switch on

1. Identify these mineral resources.







2. ***Match the consumer goods and commodities to pictures A – F and answer the questions for each product?***
    - ***What is it? (description)***
    - ***Where is it applied? (field of application)***

1. plumbing
2. fuel for heating
3. electricity
4. auto parts
5. drainage aggregate
6. jewellery
7. electrical wiring
8. decorative material
9. perfume
10. electronics

Listening

1. Listen to a radio interview with a representative of a technical school, discussing the importance of an interesting profession. You will hear the text twice. For questions A 1 – A 5 choose the correct answer (A, B, C, or D).

1. Most mineral deposits can be found
(A) on the surface
(B) at the surface
(C) deep under the surface
(D) at the subsurface

2. Which of the following features does NOT characterize an earth driller
(A) different working conditions
(B) long-working hours
(C) working knowledge of equipment
(D) physically trained

3. Earth driller job may be dangerous because it includes
(A) handling explosives
(B) working underground
(C) operating different boring machines
(D) maintaining equipment

4. Earth drillers should have one of the following skills:
(A) good physical training
(B) good eye – hand coordination
(C) excellent eye sight
(D) excellent knowledge

5. People think that this job is
(A) boring
(B) hard
(C) challenging
(D) uninteresting

2. Work in pairs. Listen to the representative of a technical school again and write down what he says. Help each other to make a complete and accurate version. Then compare with the Listening script on p.11-12 (Teacher Book)

LHD – Load-haul-dump

Vocabulary

1. Read the descriptions of different occupations in the mining industry. Match the descriptions with the correct professional and related job A - F.

1 Those who drill holes in the ore

2 Those who scoop up the material using a power shovel and deposit it in a truck for transportation to the surface

3 Those who locate deposits of sufficient size for extraction

4 Potentially dangerous work because it deals with explosives.

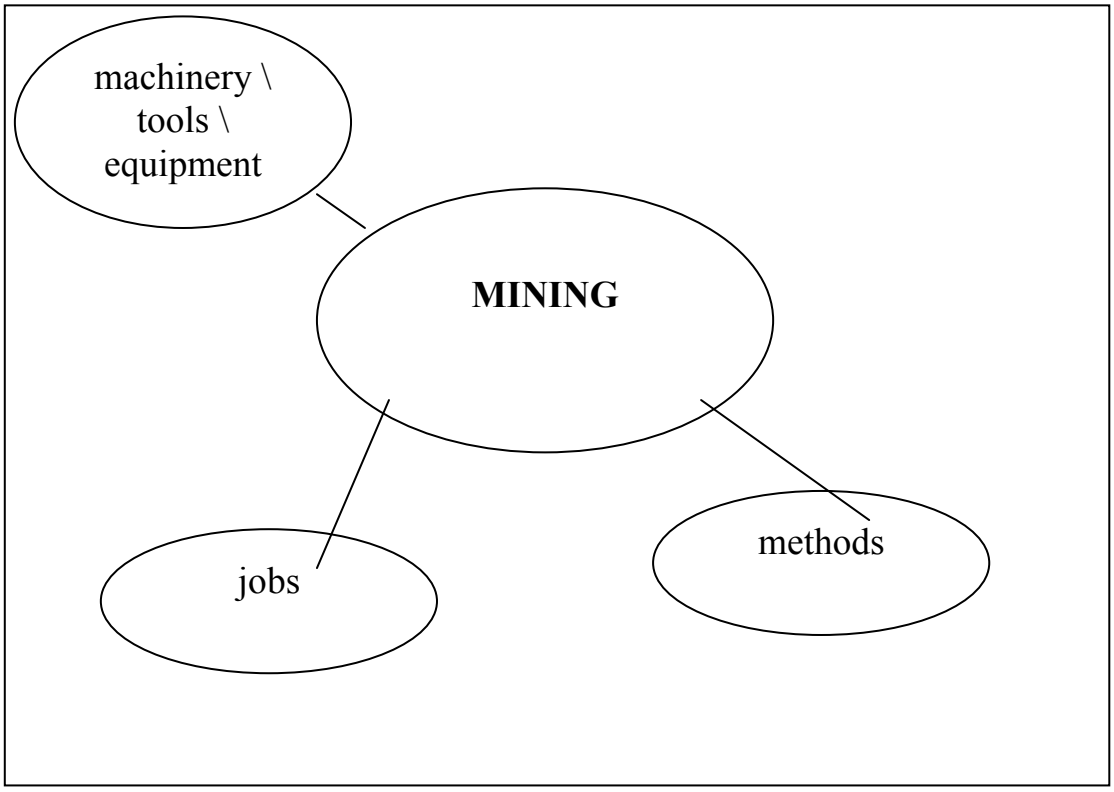
5 *Those who formulate the general plan for mining operations*

6 Those who supervise mine activities throughout the entire lifecycle of the project

A	geologist
B	drilling – machine operator
C	engineering technician
D	loading-machine operator
E	blaster
F	mining engineer

2. Recording down new words

a. Mind mapping- Refer to Writing Bank, pg. 97
b. One effective way of recording key words is to group them into word sets. Study the following example of how to group words related to the mining industry.



c. Work in pairs. Make word sets for each of the branches, using the word list below.

dragline mining	core samples	shuttle car
mechanical engineer	blaster	dragline operator
rock-dust machine	engineering technician	longwall mining
dredge operator	crane	safety inspector

load-haul-dump machine	surface mining	bulldozer
roof bolter	rock splitter	underground mining
truck	longwall machine	dredge
mining engineer	brattice builder	geologist
quarry	continuous mining	explosives

3. Take turns to read the words in (c) and find the Russian equivalents from the words below.

бестранспортная система разработки с перевалкой вскрыши драглайном	оператор погрузочной машины	скребковый экскаватор
оператор машины для постановки анкерной крепи	самоходная вагонетка	горный инженер
техник	бульдозер	(грузо-) подъемный кран
керн	инженер - механик	грузовик
подземные горные работы	разработка длинными забоями	инспектор по технике безопасности
взрывник	экскаватор	забойная машина
загрузка – обкатка – разгрузка	непрерывная выемка	разработка открытым способом

4. Read the description of different jobs in mining industry and match each one with the corresponding job.

JOB	DEFINITION
1. roof bolter	a. split rough dimension stone into smaller units, such as paving blocks, ashlars, or rubble
2. brattice builder	b. place explosives in holes or other spots and detonate the explosives to demolish structures or to loosen, remove, or displace earth, rock, or other materials. Include tier-detonator blasters, perforator operators, and seismograph shooters.

3. dragline operator	c. perform engineering duties in planning and designing tools, engines, machines, and other mechanically functioning equipment. Oversee installation, operation, maintenance, and repair of such equipment as centralized heat, gas, water, and steam systems
4. dredge operator	d. study composition, structure, and history of the earth's crust; examine rocks, minerals, and fossil remains to identify and determine the sequence of processes affecting the development of the earth; apply knowledge of chemistry, physics, biology, and mathematics to explain these phenomena and to help locate mineral and petroleum deposits and underground water resources; prepare geologic reports and maps; and interpret research data to recommend further action for study.
5. loading machine operator	e. determine the location and plan the extraction of coal, metallic ores, nonmetallic minerals, and building materials, such as stone and gravel. Work involves conducting preliminary surveys of deposits or undeveloped mines and planning their development; examining deposits or mines to determine whether they can be worked at a profit; making geological and topographical surveys; evolving methods of mining best suited to character, type, and size of deposits; and supervising mining operations.
6. blaster	f. build doors or brattices (ventilation walls or partitions) in underground passageways to control the proper circulation of air through the passageways and to the working places.
7. mechanical engineer	g. operate power-driven crane equipment with dragline bucket to excavate or move sand, gravel, mud, or other materials.

8. geologist	h. operate power-driven dredges to mine sand, gravel, or other materials from lakes, rivers, or streams; and to excavate and maintain navigable channels in waterways
9. mining engineer	i. operate underground loading machines to load coal, ore, or rock into shuttle or mine cars or onto conveyors. Loading equipment may include power shovels, hoisting engines equipped with cable-drawn scraper or scoop, or machines equipped with gathering arms and conveyor.
10. rock splitter	j. operate machinery to install roof support bolts in underground mine

It's my job

1. Listen to Henry Scott, a Mechanic Engineer, and put the questions in the correct order.

a. What qualifications are required in this job? _____

b. Are there any risks? _____

c. What sort of training do you need? _____

d. What's the job? _____

e. What's the most challenging part of this job? _____

f. What does a person need to do in this job? _____

g. What equipment is used? _____

h. What does this person do? _____

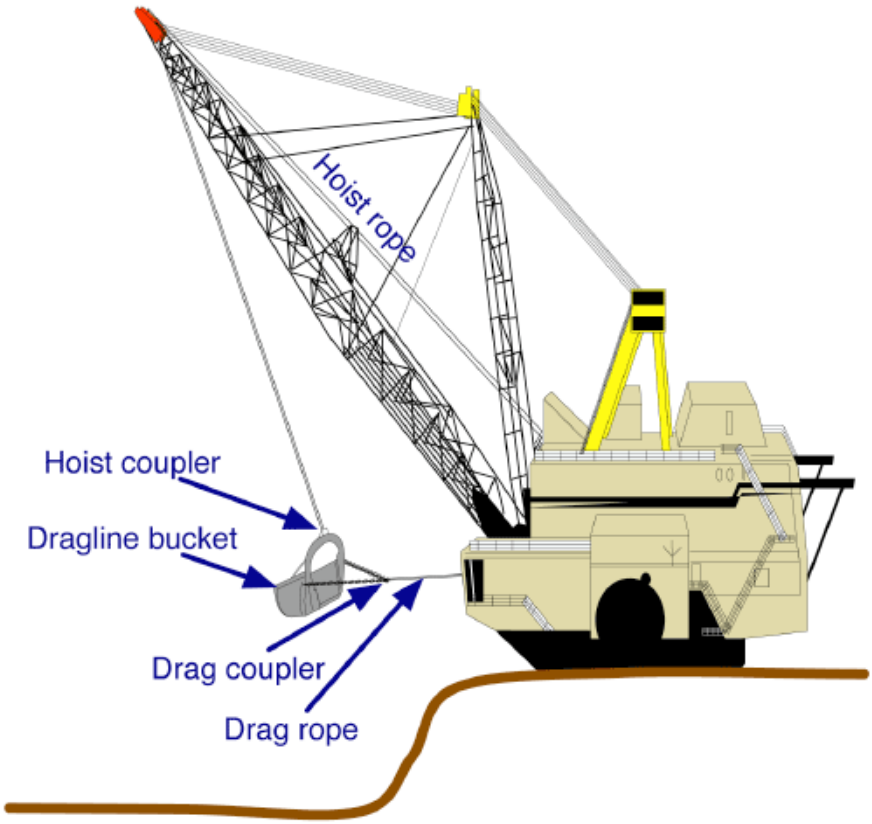
2. Listen again and answer the questions in 1.

3. Discuss with a partner.

1. Would you like to do this job?
2. Why is this job still considered to be dangerous nowadays?
3. What health problems are connected with this job? Why?

Pairwork

1. Work in pairs. Look at the pictures of mining methods. What types of mining methods are these? Discuss the advantages and disadvantages of each method?



1. What is this method?
2. Where is it used?
3. What is the function of each item?
4. What are the advantages and disadvantages of this machine?
5. What improvements could you make to this machine?

Reading

1. Match the industry segments 1 – 5 with their functions a – e.

1. coal mining segment	a. produces petroleum and natural gas for commodity application
2. nonmetallic mineral mining and quarrying	b. contract companies specialize in one aspect of resource extraction
3. support activities	c. extraction of metal ores for a variety of industrial purposes
4. oil and gas extraction	d. a wide range of mineral extraction for different construction and domestic application
5. metal ore mining	e. produces coal for electrical power generation and production of steel

2. Now read the text and check your answers in 1.

The mining industry contains five main industry segments, which are defined by the resources they produce: oil and gas extraction, coal mining, metal ore mining, nonmetallic mineral mining and quarrying, and support activities for mining.

1. *Oil and gas extraction segment* produces the petroleum and natural gas that heat homes, fuel cars, and power factories. Petroleum products are also the raw materials for plastics, chemicals, medicines, fertilizers, and synthetic fibers. Petroleum, commonly called crude oil or just oil, is a liquid formed under ground from the decay of plants and animals over millions of years through extreme heat and pressure. Occasionally, this decaying material becomes trapped under a layer of impermeable rock that prevents it from dispersing and creates a pocket of oil. Similar processes also produce natural gas, which can be found mixed with oil or in separate deposits. Finding and extracting the oil and gas in these pockets is the primary function of this industry segment.

2. *Coal mining industry segment* produces coal, a fossil fuel that is used primarily for electric power generation and in the production of steel. Like oil, coal is formed over millions of years from plant and animal matter, but unlike oil, coal is a solid and miners must go into the earth to recover it. Many coal seams are located close to the surface which makes the extraction of this resource easier.

3. *Metal ore mining industry segment* covers the extraction of metal ores, primarily gold, silver, iron, copper, lead, and zinc. These naturally occurring minerals have a variety of industrial purposes: gold and silver are primarily used in jewelry and high-end electronics; iron is used to produce steel; copper is the main

4. *Nonmetallic mineral mining and quarrying industry segment* covers a wide range of mineral extraction. The majority of the industry produces crushed stone, sand, and gravel for use in construction of roads and buildings. Other important minerals produced are clays, primarily for ceramics, water filtration, and cement

component of electrical wiring; lead is used in batteries; and zinc is used to coat iron and steel to reduce corrosion and as an alloy in the making of bronze and brass. Most metals do not exist in concentrated form but rather in small traces in rock called "ore". Some ores are currently mined that contain only a fraction of a percent of metal. As a result, a massive amount of rock must be extracted from the ground in order to obtain a useable amount of metal. As a result of this, metal mines can be much larger than coal mines and operate in more extreme environments.

making; gypsum, the primary material used in wallboard; salt, used in foodstuffs and as an ice remover; phosphate, for use in fertilizers; and sulfur, the main component of sulfuric acid, a major industrial input. Most of these minerals are found in abundance close to the surface.

5. *Support activities for mining*. The activities of this industry are often the same as those of the other industry segments, but the work is done by contract companies that specialize in one aspect of resource extraction.

(The above information was adapted from www.wikipedia.org)

Learning Tip
Making inferences – sometimes the information we want when we read is not stated clearly in the text. We have to infer it. That means we have to work it out by linking different pieces of information in the text or by combining text information with our knowledge of the text topic.

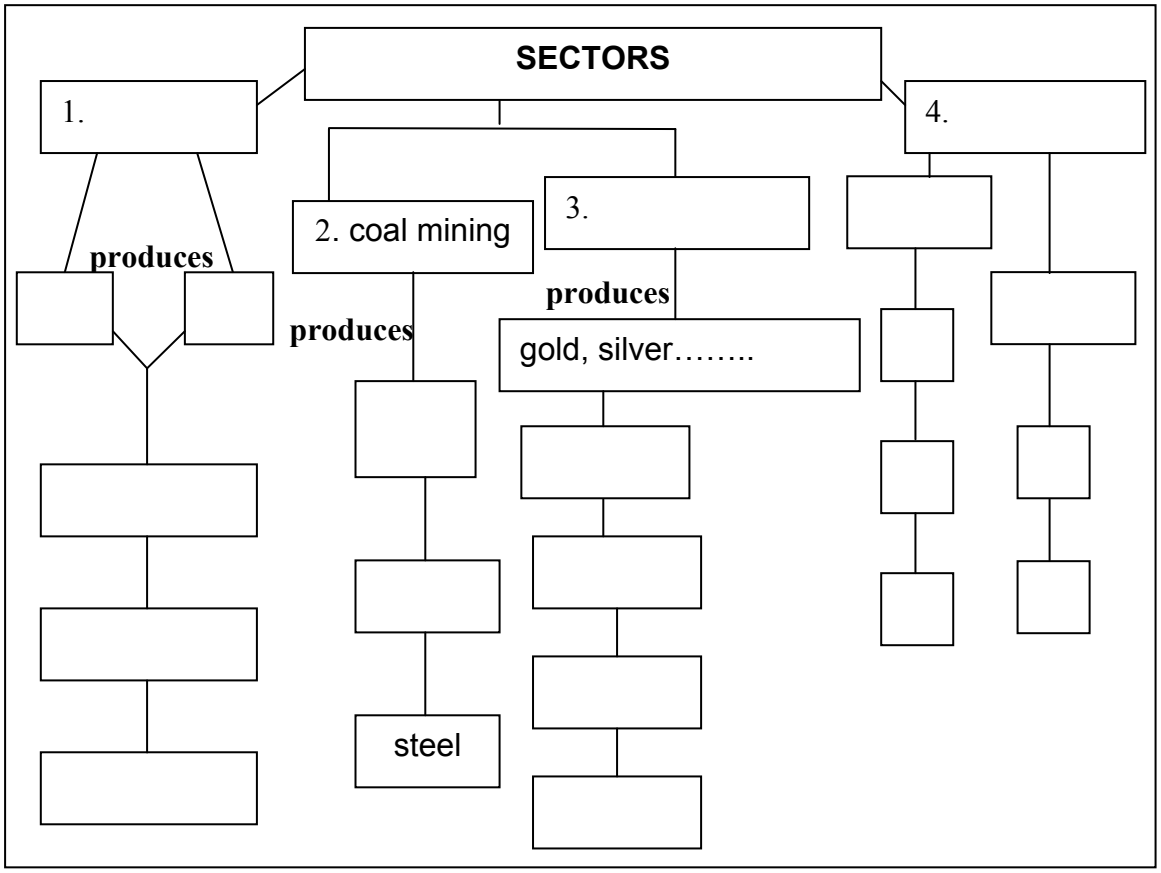
EXAMPLE:

Question	How is natural gas formed?
• Information from the text: *1. is mixed with crude oil* 2. *similar process as crude oil*	
• From our knowledge of the text topic: 3. natural gas is a fossil	Gas is composed of the remnants of decayed plant and animal matter that has been subjected to immense pressure under the earth's crust. This formation is referred to as thermogenic methane.
Possible answer	Another way in which natural gas can be produced is by microorganisms breaking down organic matter and producing methane in a process known as biogenic methane. Usually this type of natural gas is either lost in the atmosphere or it is found close to the Earth's surface.

3. Use the information from the text and your own knowledge to answer the following questions. ***Pay special attention to word order in English sentences. Refer to Writing Bank, pg. 97*** .

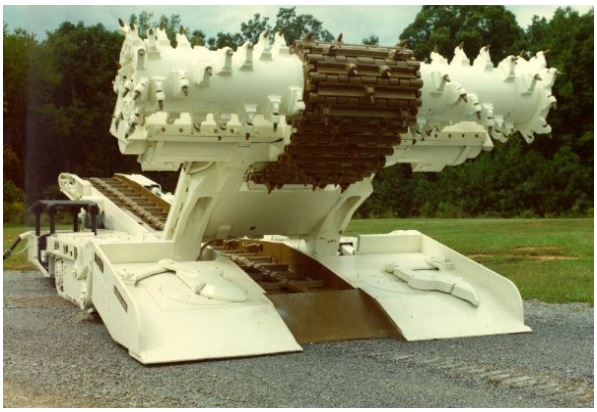
1. What are the main everyday commodities produced from petroleum?
2. Which is lighter: crude oil or natural gas?
3. How is coal formed?
4. What mining methods are used for coal?
5. Why do not most metals exist in a concentrated form?
6. What is the percentage fraction of metals in ores?
7. What is quarrying industry?
8. What are the support activities for mining?

4. Read the text again, this time in more detail, and complete the flowchart.



INTERESTING FACTS!!

Continuous mining machines and Roadheaders are giant automated modern day mining machines that slice through rock at high speed and look like something from hell. They are often used as design inspiration in movies and video games. Here are some of our favorite examples of these magnificent objects



This machine differs from most in that it has no cab and the cutter head itself has a spiral and waste removal system that is not unlike a vacuum cleaner, in principal.

Two 3 pronged fan-like blades with giant studded teeth tear through rock as they spin round. A central roller on top follows through like a ferocious car wash.

Webquest

The structure of the mining industry changed greatly in the 1990s and early 2000s. The producing section of the mining industry was dominated by three companies mining a range of commodities (BHP Billiton, Rio Tinto and Anglo American) and by Alcoa (aluminum producer). Other major companies concentrate on gold mining (Newmont Mining, Barrick Gold), platinum (Anglo American Platinum), nickel production (Norilsk Inco.). Other smaller mining companies produce at regional or national levels. Junior companies are a major feature of the mineral exploration industry. They are based largely in Canada (more than 1000 active companies), in Australia, and to a lesser extent in the USA and Europe.

Find a company you think is interesting and follow the link:

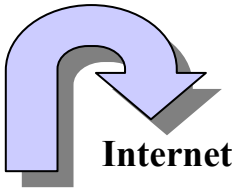
www.google.com

www.yandex

www.wikipedia.org

www.ixquick.com

You are going to use the information you find to make a poster presentation. You can do this individually or in small groups of three, providing everyone contributes equally. Refer to the *Poster Presentation in* **Guide To Effective Technical Writing and Professional Communication p.45**



Internet Activity

Electronic Dictionary – Compile your own English - Russian Dictionary in «Mineral Exploration». The following sources and websites can be used:

www. multitran.ru
ABBYY Lingvo 12
http://dictionary. refernce.com (you can find definitions)
www.the freedictionary.com\mining
www.britannica.com
Mining WA.com.au (www.theminesite.com)
www.merriam-webster.com
www.askoxford.com
www.bartleby.com
www.onelook.com
www.encyclopedia.com

Key words

blaster
brattice builder
bulldozer
coal seam
commodities
contract company
copper
core sample
crane
dragline mining
dragline operator
dredge
dredge operator
electric power generation
engineering technician
extraction
geologist
gold
iron
lead
load-haul-dump machine
loading machine operator
longwall machine
longwall mining
mechanical engineer
metal ore mining
mineral resources
mining engineer
nonmetallic mineral mining
ore
quarry
rock splitter
rock-dust machine
roof bolter
safety inspector
shuttle car
silver
surface mining
underground mining

UNIT 2

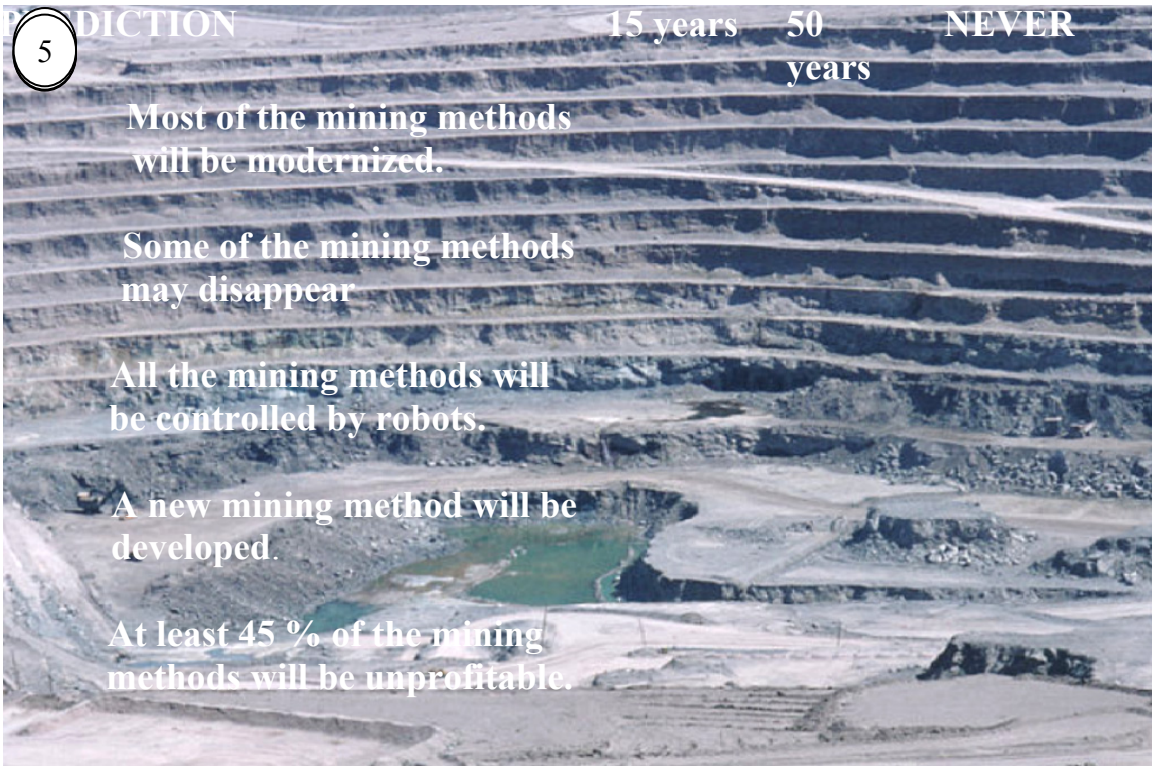
MINING

In this unit

- predicting text content by sampling key sentences
- describing how ore is mined
- skimming – reading for general understanding
- listening and note-making
- assessing explanations and sharing ideas
- writing a short sequence

Switch on

Work in pairs. Discuss these predictions about future mining methods. Decide if this will happen within 15 or 50 years, or never. Explain your own reasons for each prediction.

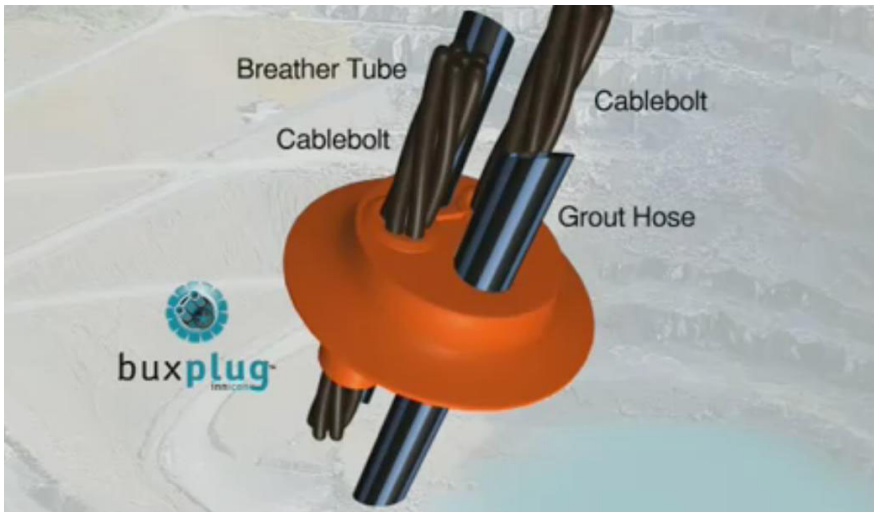


Listening

1. Mr. Steward, Manager in the Marketing Department of Innocom. It was established in 1994. With 15 years of experience it has been built upon solid achievements, specializing in different advanced and integrated programs, maintenance services and consulting. Listen and say:

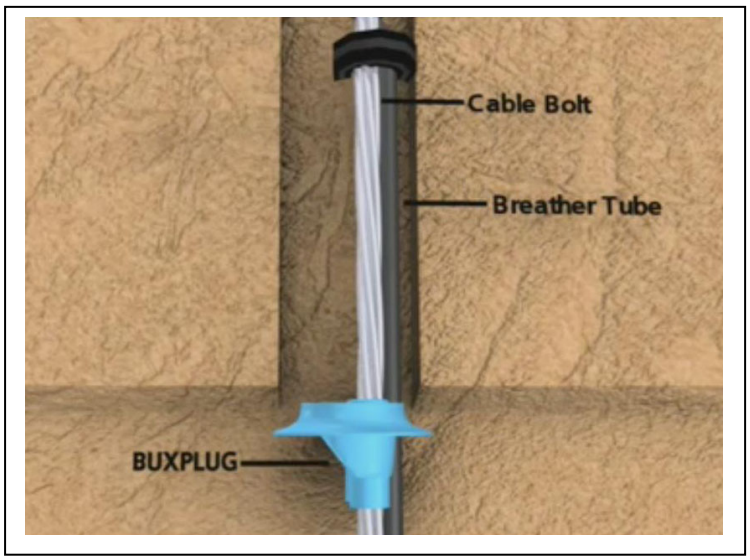
- ***What is this equipment for?***
- ***Where can it be used?***
- ***Why is it an innovation?***
- ***Why is its name interesting (your opinion)?***

The following picture may help you.

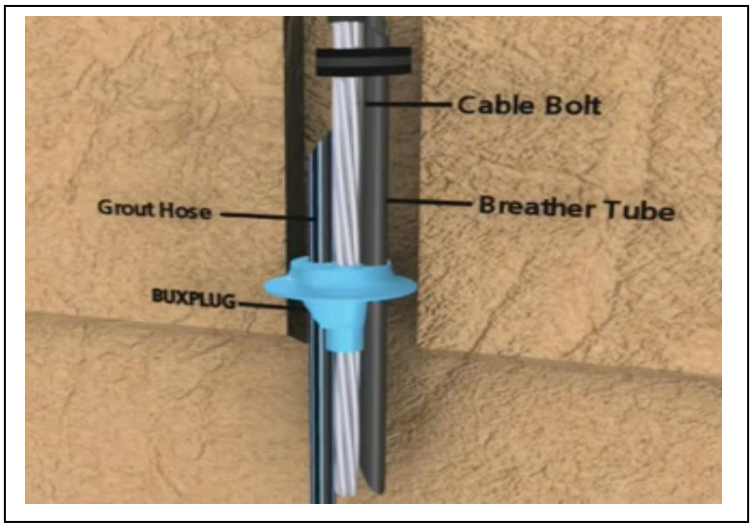


2. Listen to the second part. Study these diagrams, demonstrating the stages of Buxplug.

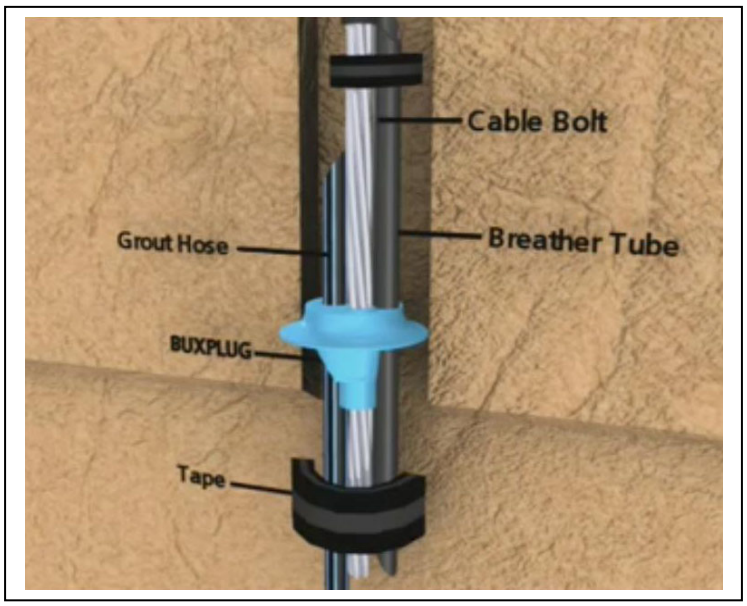
a. Identify the parts and write them down in the correct order.


Cable Bolt
Breather Tube
BUXPLUG

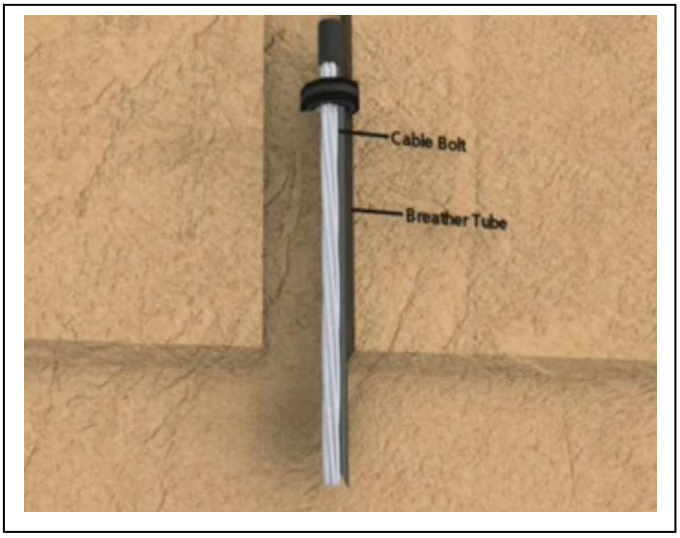
(B)


Cable Bolt
Grout Hose
Breather Tube
BUXPLUG

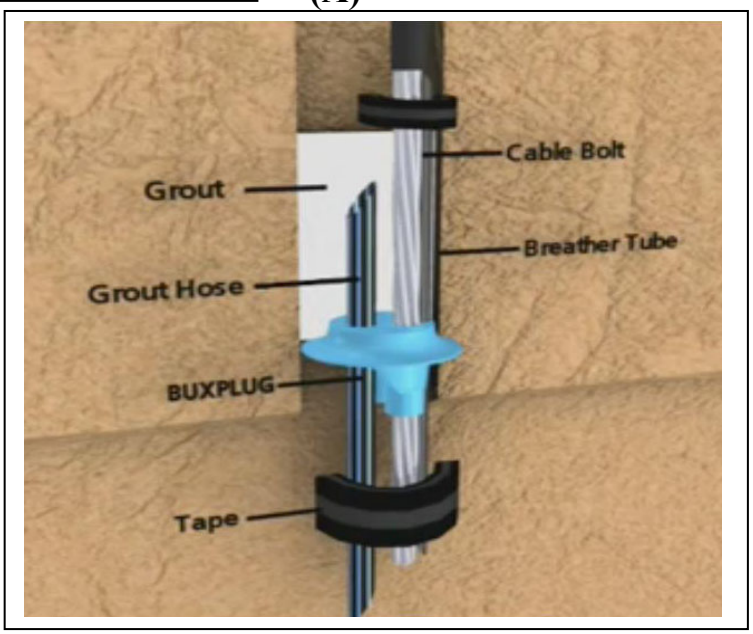
(D)


Cable Bolt
Grout Hose
Breather Tube
BUXPLUG
Tape

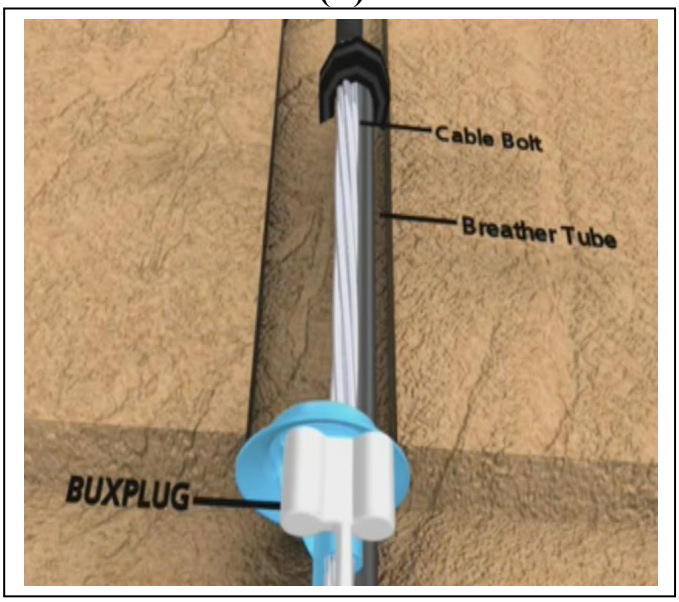
(E)


Cable Bolt
Breather Tube

(A)


Grout
Cable Bolt
Breather Tube
Grout Hose
BUXPLUG
Tape

(F)


Cable Bolt
Breather Tube
BUXPLUG

(C)

b. Study the Buxplug. Put the stages of its operation in the correct sequence. The first and last stages are done for you.

1. **the cable bolt is installed;**
2. tape the breather tube, grout tube and cable together to avoid slipping.
3. slide the Buxplug onto the breather tube;
4. insert the grout hose through the Buxplug (at least 500 millimeters up past the plug);
5. drive cable tape through the plug sleeve;
6. push the Buxplug firmly into the whole collar with the Buxplug tool;
7. **you're ready to group**.

3. Work in pairs. Study the diagrams of the stages. Match the sentences to the each diagram. Discuss your information with your partner.

B. – A. -

E. – F. -

D. - C. –

4. Read more information about Buxplug. Go to Reading Bank, Buxton Innicon pg. 85

Do the interesting crossword and find out how much you know. Go to Reading Bank, Buxplug Installation Crossword, pg. 88

Writing

Describe the operation stages of Buxplug. ***Refer to Writing Bank, pg. 99***

Vocabulary

LCM – Loose cubic meters
BCM- Bank cubic meters

1. Study the diagram on page 25. Make a word list of the mining terminology.
Two examples are completed for you.

waste dump	
adit portal	

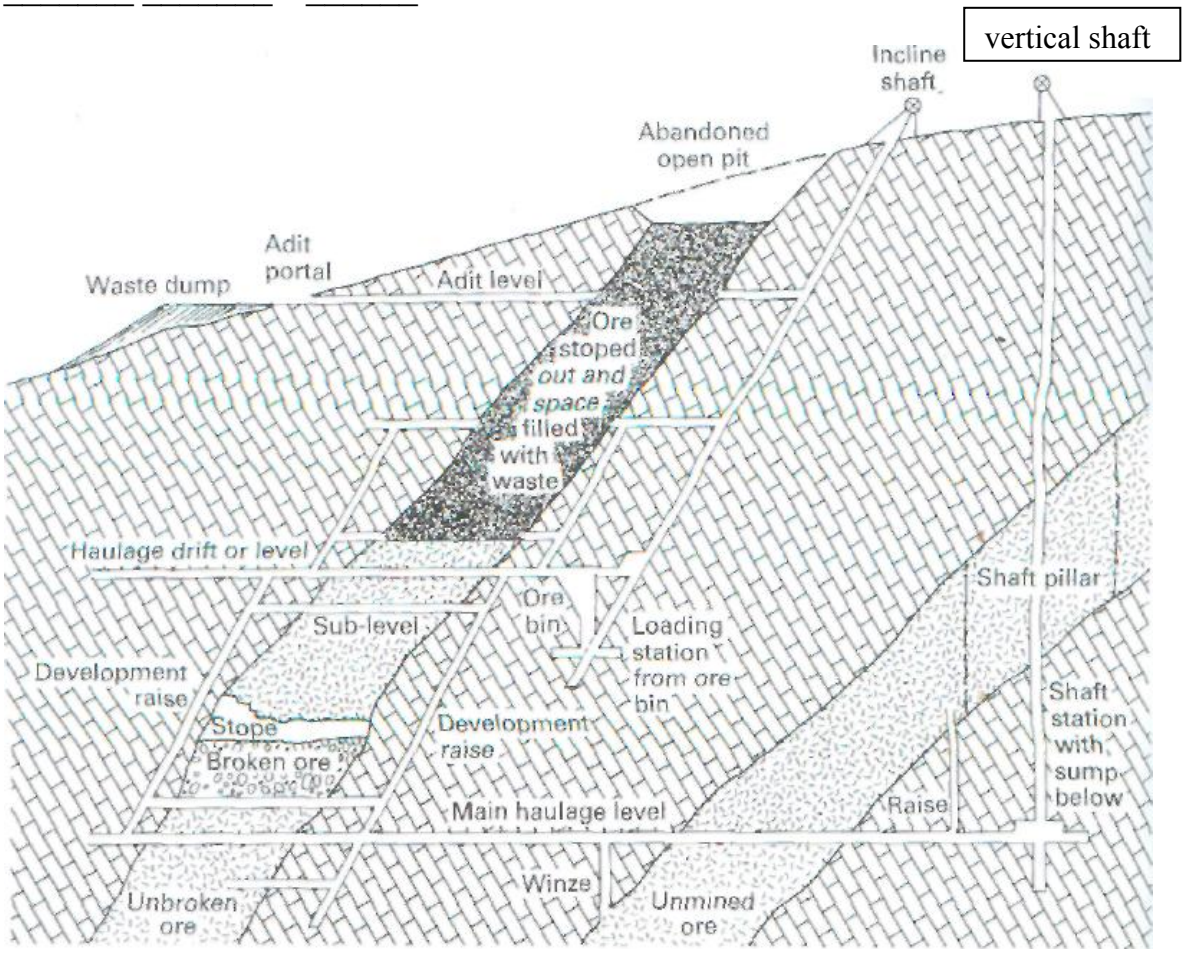
2. Match the mining terminology with the Russian equivalents.

a. промежуточный уровень	j. откаточная выработка
b. швейч	k.предохранительный целик шахтного ствола
c. выемочная камера	l. горизонт штольни
d. открытая разработка \ карьер	m. околоствольный двор
e. гезенк \ подземная выработка	n. бункер \ резервуар-накопитель
f. нарезной восстающий	o. раздробленная руда
g. зумпф \ отстойник	p. шахта \ шток
h. неразрабатываемая руда	q. породный отвал \ карьера
i. устье штольни	r. нераздробленная руда
	s. штольня

3. Complete the description of how ore is mined, using the words in 1.

Ore was first mined at the outcrop from an _____ _____; then an adit was driven into the hillside to intersect and mine the ore at a lower level. An _____ _____was sunk later to mine at even deeper levels and, eventually, a _____ _____ was sunk to serve operations to two orebodies more efficiently. Ore is mined by driving two _____ _____at different levels and connecting them by _____ which are then connected by_____. Ore is

mined upwards from the lower _____ to form a _____. Supporting pillars can be left in the stope to form a working platform and to support its walls, or withdrawn and _____from the mill pumped in. Ore between haulage and sublevel is left as supporting _____ _____ until the level is abandoned. A _____ _____ is_____.



(After Barnes, 1988, Ores and Minerals, Open University Press, with permission)

4. Collocations in mining industry

A collocation is an association of a word with other words.

a. Make the collocations related to ore mining by matching noun in A with nouns in B. Then find the Russian word for each collocation in C.

A	B	C
1. shaft	a. station	околоствольный двор
2.haulage	b. bin	швейч
3.ore	c. raise	нарезной восстающий
4.waste	d. pillar	породный отвал
5.adit	e. level	горизонт штольни
6.development	f. station	бункер
7.shaft	g. level	откаточный горизонт
8.loading	h. dump	предохранительный целик шахтного ствола

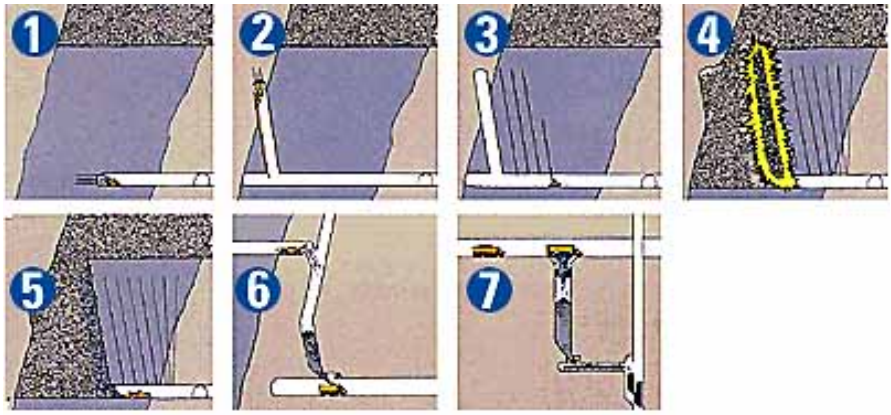
b. Now use the collocations in 1 to complete the following sentences.

1. The area of the _____ _____is considerably greater than the surface area requiring protection.
2. A _____ _____ may be cut at an average rate of 3500 cubic feet per day.
3. Ore passes lead from the main mining level to a small _____ _____.
4. The _____ _____ is able to receive a dumped load of run-of-mine ore.
5. The depth at the actual _____ _____ sites range from 200 to 1000feet.
6. Seepage and inflow water was identified at 10 locations in the 3M _____ _____.
7. The vertical opening driven upward that forms a level to connect with the level above is _____ _____.
8. All mined ore is moved to the _____ _____.

Pairwork

Work in pairs A and B. Here you see the diagram of ore mining. Use the vocabulary from Exercises 2, 3 and 4; and information from the following site www.mining-technology.com. Describe diagrams A and B.

A



B

*(www.**mining**-technology.com)*

It's my job

1. Before you listen to the description of Mine Cutting and Channeling Machine Operator, answer these questions with a partner.

1. What do you think is the operator's responsibility?
2. What kind of work do you think it is?
3. Is it a high-paid job?
4. Do you need any special education \ qualifications for this job?

2. Now listen and check your answers.

3. Listen again to find the answers to the following questions.

1. What was this job like in the past?

2. Where do mine cutting and channeling machine operators work?

3. What are their responsibilities?

4. What equipment is used?

5. What are the disadvantages of this job?

6. What training \ education is necessary?

7. Why do we need this profession?

Reading

Learning Tip – when we read a text for the first time, we often use a technique known as *skimming* – looking over a text rapidly to get a general impression. It allows us to select parts of the text that are worth re-reading. Then we read these particular phrases, sentences or sections more carefully to understand the details.

1. Look at the title of the article and decide what the article is about.

2. Now read the first underlined sentence in each paragraph: this should give an overview of the text. Decide which of the points in the table will be included in the text.

	Yes	No	Perhaps
what the word mining means			
what are recovered materials			
what mining industry includes			
what are estimated deposits			
	Yes	No	Perhaps
what are mining methods			
what are wasting assets			
what are ore mining			
what nonmetal mining includes			

3. Now read the whole text quickly and check your answers.

4. Work in pairs. Without looking at the text again, see how much you can remember.

1. What is the first activity in mining?

2. How many types of mining operations are there?

3. Why do mining companies periodically find new deposits?

MINING INDUSTRY

Mining activities take place all over the world, and are often a major source of a country's natural wealth. Mining is the extraction of valuable minerals or other geological materials from the earth, usually from an ore body, vein or (coal) seam. Materials recovered by mining include base metals, precious metals, iron, uranium, coal, diamonds, limestone, oil shale, rock salt and potash. Any material that cannot be grown through agricultural processes, or created artificially in a laboratory or factory, is usually mined. Mining in a wider sense comprises extraction of any non-renewable resource (e.g., petroleum, natural gas, or even water).

The activities of the mining industry begin with exploration. Mining industry commonly includes such functions as exploration, mineral separation, hydrometallurgy, electrolytic reduction, and smelting and refining. After suitable deposits have been found and their worth proved, development, or preparation for mining is necessary.

Mining companies must periodically find new deposits. A unique feature of mining is the circumstance that mineral deposits undergoing extraction are "wasting assets," meaning that they are not renewable as are other natural resources. Depletion means that the supplies of any particular mineral must be drawn from ever-lower-grade sources.

There are many types of mining operations. They range from precious metals, such as gold to other metals, and to minerals such as asbestos, sand, granite, and iron ore. Nonmetal mining can take many forms, including coal mining, which supplies much of the world's energy, and the mining of other materials such as clay, diamonds, semiprecious stones, and related substances.

(The above information was adapted from http://www.Wikipedia)

Writing

You complete the summary by writing no more than three words and \ or a number from the passage in each gap. The summary may cover the ideas in the whole passage or may be based on a section of the passage only.

Read the following texts: **Reading Bank, pg. 80-81**

Then **refer to Writing Bank, pg. 98**

Speaking

Assessing explanations

A good way to prepare for presenting information to others is to practice in small groups first.

1. Work in groups.

Group 1 ***Go to Reading Bank, pg. 80 (Underground mining)***

Group 2 ***Go to Reading Bank, pg. 81 (Surface mining)***

Group 3 ***Go the Reading Bank, pg.81 (Dredging)***

***Within each group there are three students* A**, **B** ***and* C.**

2. Student A ***plays the role of Speaker first, telling the others about their text using only notes to help.***
Student B ***plays the role of Reporter, taking notes from*** A's ***talk and reporting it briefly.***
Student C ***plays the role of Assessor, listening carefully to both talks and judging how accurately*** B ***has reported. If there is disagreement, you can refer to the texts.***

3. When you discussed all the details, report your findings to the rest of the class as a poster presentation.

Webquest

WHERE to find job vacancies: The following resources will help you in your job and ad research. Look through the below mentioned websites and find the vacancies concerning your specialty and give a full description of this vacancy. Use the plan below.
These sites may help you:

heheadhunter.com.ua\employer
hekazan.hh.ru\vacancy (HEADHUNTER
http://www.cornerstone.ru\es\esvacancies
http://www.sfinga.ru\mypages\message
http://www.MonsterRussia.ru
http://msk.job.nuclear.ru
http://rabota.westsib.ru
http://www.careerclub.ru\personnel

PLAN

1. Job title
2. Position type
3. Location
4. Company
5. Industry
6. Region
7. Responsibilities
8. Requirements
9. Qualifications
10. Education
11. Languages
12. Required experience (competencies)
13. Salary
14. Required personal capabilities
15. Additions (gender; age; mail address; E-mail)

Refer to the *Job Hunting in* **Guide To Effective Technical Writing and Professional Communication p.52**

INTERESTING FACTS!!

OTHER TYPES OF MINING

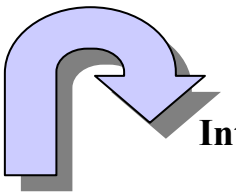
Placer

Placer mining involves any type of mining where raw minerals are deposited in sand or gravel or on the surface and are picked up without having to drive, use dynamite or any other significant means. The word placer means "sand bank" in Spanish. Specific types of placer mining are panning, dredging, sluicing, using a Rocker, or just picking up what lies on the ground

Hydraulic mining involves high pressure water. The water is sprayed at an area of rock and/or gravel and the water breaks the rock up, dislodging ore and placer deposits. The water / ore mixture is then milled. This is a very destructive way to mine and has been outlawed in most areas.

Hardrock mining is digging into solid rock to fine minerals usually in their ore form (the metal plus oxygen). To do this, miners used picks and shovels, rock drills, dynamite and more. Miners dug either shafts that went straight down to follow ore bodies and veins, or tunnels which went somewhat horizontal into rock faces. Shafts usually had some sort of head frame (pictured left) standing above them to support the hoists. Shafts and tunnels were often supported with large timbers to prevent cave-ins.

(The above information was adapted from www.wikipedia.org)



Internet Activity

Concentration Game is a fun way to challenge your memory. You uncover a picture and try to locate its twin. «Modern Mining»

The site is: www.coaleducation.org \ fun stuff – game

Key words

adit level
adit portal
breather tube
broken ore
cable bolt
depletion
development raise
extraction
grout hose
haulage drift (level)
incline shaft
loading station
mineral separation
non-metal mining
non-renewable resources
ore bin
placer
raise
reduction
refining
shaft pillar
smelting
slope
sublevel
tape
unbroken ore
unmined ore
vertical shaft
waste dump
wasting asset
winze

UNIT 3

MINERAL ECONOMICS

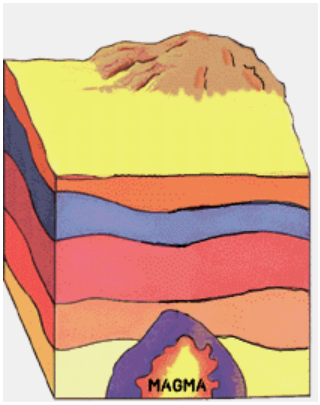
In this unit

- describing the rock formation process
- key terms in mineral economics
- comparing and analyzing different definitions
- how compound nouns work
- reading for detail
- locating information in a diagram and text
- developing the skill of listening for detail
- using strategies for remembering terms
- how to write different types of definitions

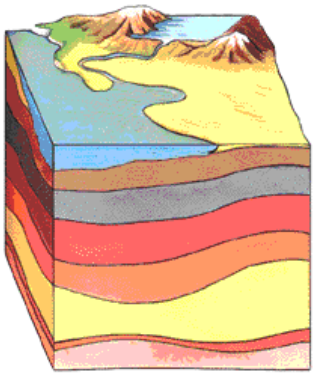
Switch on

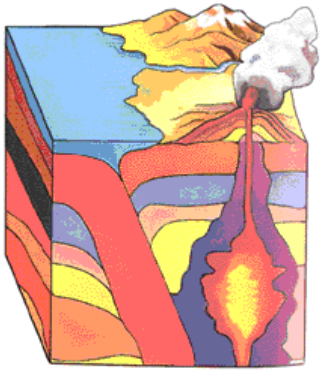
Before exploration one must have an understanding of the geologic forces that form rocks. Choose from the list and complete the table showing the formation of each rock type.

molten state	intrusive	lithification
changed from	degree of foliation	physical composition alteration
weathering	melting	grain size
cooling rate	erosion	fire formed
heat and pressure	extrusive	sediments\ fragments
rock fragments	transportation	



Igneous rock formation


Sedimentary rock formation


Metamorphic rock formation

Rock	Meaning	Mode of formation	Formation process	Classification
Igneous				
Sedimentary				
Metamorphic				

Refer to **Reading Bank** pp 82-83 for more information on «Rocks and rock structure».

Listening

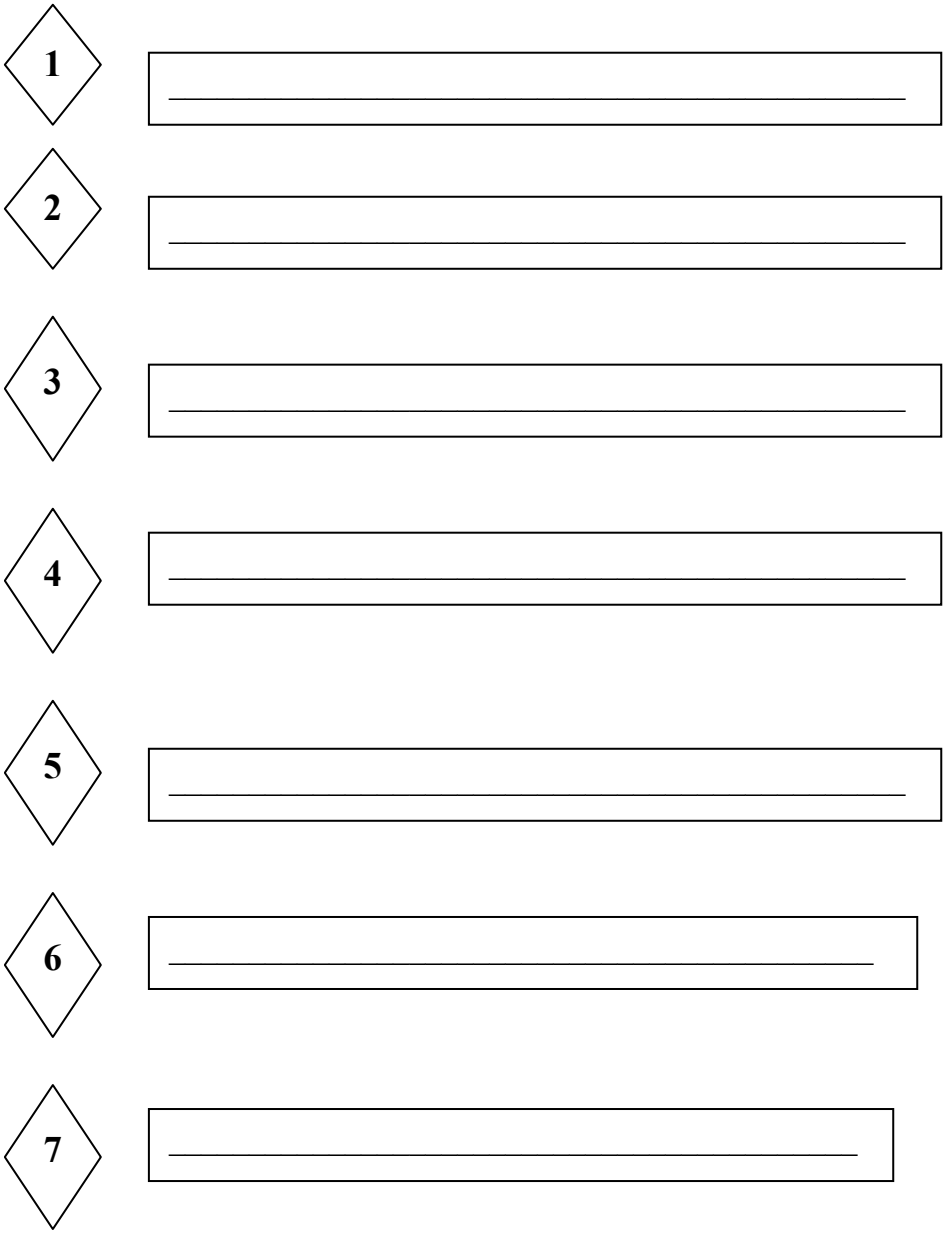
1. Listen to an engineer from the Kingsgate Consolidated Limited, describing the mining and processing of platinum ore. Before you listen, answer the questions about platinum ore.

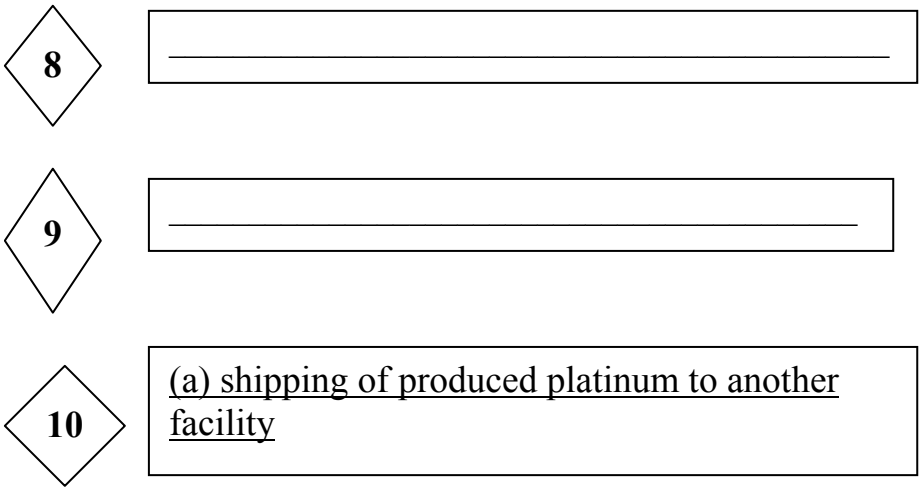
1. What is platinum?
2. Where is platinum located?
3. What makes platinum so valuable?

Now discuss whether your answers are correct.

2. Listen again. Complete the missing stages in the production of platinum by choosing from the list. One is already done for you.

a.	**Shipping of produced platinum to another facility**
b.	Drying and packing of the froth into cakes
c.	Mixing remaining material with water and air
d.	Showering molten mixture into fine particles
e.	Digging the precious metal
f.	Moving the ore to the surface
g.	Platinum collecting on the top
h.	Grinding ore into powder
i.	Burning off extra elements
j.	Finding a seam





SOW – scope of work
t p.a – tonnes per annum
t p.d - tonnes per diem

Vocabulary

The formation of valuable mineral deposits result from a combination of factors, conditions, and events which go hand in hand to determine the areas in which metals are gathered into concentrations. Here are some elementary aspects of mineral economics.

1. Match the following words with their definitions.

1. ore minerals	a. unwanted material, minerals or rock, with which ore minerals are usually intergrown.
2. industrial minerals	b. economically mineable part of a Measured or Indicated Mineral Resource.
3. gangue	c. minerals (galena, sphalerite) that form the economic portion of the mineral deposit.
4. protore	d. mineral material in which an initial but uneconomic concentration of metals has occurred that may by further natural processes be upgraded to the level of ore.
5. ore	e. extraction of the ore reserve has been established or analytically demonstrated to be viable and justifiable under reasonable

6. mineral deposit	f. portion of a mineralized envelope within which ore reserves have been defined.
7. ore reserve	g. any rock, mineral or other naturally occurring substance of economic value, exclusive of metallic ores, mineral fuels and gemstones.
8. economic	h. a metalliferous mineral, or an aggregate of metalliferous minerals, which can be profitable, investment assumptions.
9. orebody	i. target material

2. Compound nouns are often used in mining industry. They consist of two nouns working together. Form the following compound nouns with the first noun mineral \ ore.

mineral	reserve
	mineral
	resource
	concentrate
	fuels
	products
ore	aggregate
	body
	deposit
	exploration

Now explain the compound nouns. Study the example.

orebody – a body containing ore

Problem – solving

1. ***Here are three definitions. Work in groups of three or four. Define the type of definition, its structure and composition. (Refer to Writing Bank, pg.102***

- Ore is rock that may be, is hoped to be, will be, is or has been mined, and from which something of value may be (or has been) extracted. (*Lane (1988) \ Taylor (1989*).

- Ore is a solid naturally-occurring mineral aggregate of economic interest from which one or more valuable constituents may be recovered by treatment *(Institution of Mining and Metallurgy – IMM)*
- Ore – a metalliferous mineral, or an aggregate of metalliferous minerals, more or less mixed with gangue, which from the standpoint of the miner can be won at a profit, or from the standpoint of the metallurgist can be treated at a profit. The test of yielding a metal or metals at a profit seems to be the only feasible one to employ *(J.F. Kemp, 1909).*

2. Compose a definition to the following terms using the information from Writing Bank, pg.102

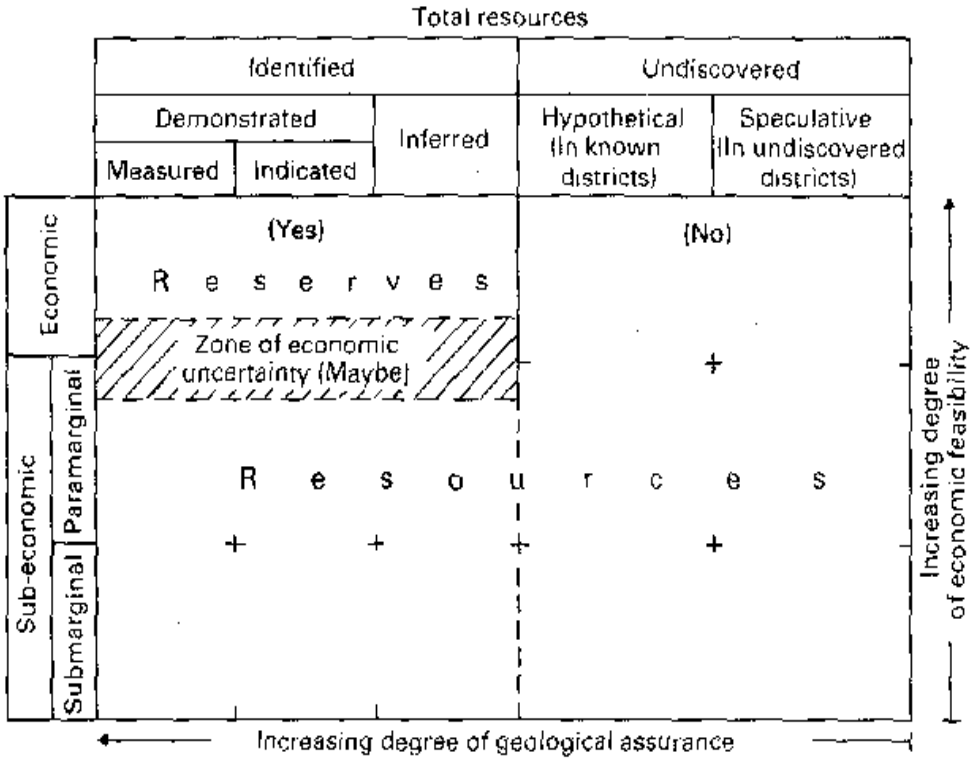
mineral, aggregate, deposit, concentrate, exploration.

Describing diagrams

1. Look at the diagram on page 42 and answer the questions.

1. What is the topic of the diagram?
2. What is the division of total resources?
3. What are similar terms to *measured, indicated* and *inferred*?
4. What is the relationship between reserves and resources?
5. Explain the following terms: *geological assurance, economic feasibility*

2. Read the text and check your answers.



McKelvey Box (McKelvey 1973) showing scheme of categories of reserves and resources with a modification by Taylor (1989) and indicating areas of immediate economic interest

Ore reserve classification

Ore reserves are divided into three classes: *proved, probable and possible* (synonyms – measured, indicated and inferred). *Proved ore* has been sampled so thoroughly *(основательно, тщательно)* that it is we can be certain of its outline *(контур),* tonnage *(тоннаж)* and average grade *(сорт)* within certain limits. *Probable ore* has been sampled from drilling and development workings not so thoroughly, but there may be enough information to be reasonably sure of its tonnage and grade. *Possible ore* during exploratory workings may indicate enough information to infer that ore extends for some way into only partially explored ground and

Mineral resources

These represent the total amount of a particular commodity *(товар)* and usually they are estimated for a nation as a whole and not for a company. They consist of ore reserves; known but uneconomic deposits; and hypothetical deposits not yet discovered. Theoretically, world resources of most metals are enormous.

Taking copper as an example, there are large amounts of rock running 0.1 – 0.3% and enormous volumes containing about 0.01%. The total quantity of copper in such deposits probably exceeds that in proven reserves by a factor of from 10^3 to 10^4. The enormous amount of such material does not at present imply a

that it may amount to a certain volume and grade.

virtually endless resource of metals. As grades approach low values, a concentration (the mineralogical limit) is reached, below which an element no longer forms a distinct physically recoverable mineral phase

(The above information was adapted from Anthony M. Evans \ 1993\ Ore Geology and Industrial Minerals, Blackwell Publishing)

3. Match the definition to the term. Find the corresponding Russian word.

1. a concentration of naturally occurring solid, liquid, or gaseous forms of the Earth's crust in such form and amount that economic extraction of a certain concentration is currently or potentially feasible.	a. inferred reserves	ресурсы
2. resources whose location, grade, quality and quantity estimated from specific geologic evidence.	b. marginal resources	выявленные (открытые) ресурсы
3. a term for the sum of measured plus indicated.	c. subeconomic resources	подтвержденные ресурсы
4. quantity is computed from dimensions revealed in outcrops or drill holes; grade and\or quality are computed from the results of detailed sample inspection, sampling and measurements are spaced so closely and the geologic parameters defined that size, shape, depth and mineral content of the resource are well established.	d. reserves	подсчитанные запасы (по данным разведочных скважин)
5. quantity and grade and\or quality are computed from information used for measured resources.	e. undiscovered resources	предполагаемые запасы

6. estimates are based on an assumed continuity beyond measured resources, for which there is geologic evidence.	f. resources	предварительно оценённые запасы
7. that part of the reserve base which could be economically extracted at the time of determination (include only recoverable materials).	g.hypothetical resources	экономические запасы
8. part of the reserve base which at the time of borders on being economically producible.	h. identified resources	ресурсы на границе рентабельности
9. that profitable extraction or production under which assumptions has been established, analytically or assumed with reliability.	i. cumulative production	экономические ресурсы
10. part of identified resources that does not correspond to criteria of reserves and marginal reserves.	j. demonstrated	неэкономические ресурсы
11. resources, the existence of which are only possible deposits.	k. indicated reserves	вероятные [прогнозные] запасы
12. undiscovered resources that are similar to known ones and that may be reasonably expected to exist in the same producing distribution of analogous geologic conditions.	l. measured	возможные запасы
13. undiscovered resources that may occur either of deposits in favorable geologic settings where mined discoveries have not been done or deposits as yet unrecognized for their economic potential.	m. other occurrences	предположительные запасы
14. materials that are too low grade or for other reasons are not potentially economic.	n. speculative resources	распространение
15. a knowledge of what has been produced is the understanding of current resources.	o. economic	суммарная [накопленная] добыча

(Definitions are adapted from www.mineral.ru \Library)

Speaking

1. Work in pairs A and B. Each of you has information about mineral-resources classification. Find out the information you need from the table below.

Major elements of Mineral –Resource Classification

Cumulative Production	IDENTIFIED RESOURCES			UNDISCOVERED RESOURCES	
	Demonstrated		Inferred	Probability Range	
	Measured	Indicated		Hypothetical	Speculative
ECONOMIC	Reserves		Inferred reserves		+
MARGINALLY ECONOMIC	Marginal Reserves		Inferred marginal reserves		+
SUBECONOMIC	Demonstrated Sub-economic Resources		Inferred Sub-economic reserves		+
Other Occurrences	Includes non-conventional and low-grade materials				

(adapted from [www.mineral.ru\](http://www.mineral.ru) Library \ reserve classification)

2. Compare this classification to the Russian one. Draw the scheme of categories of reserves and resources and explain it. Don't forget to state the differences; advantages and disadvantages.

Writing

Draw a diagram of the Russian classification of reserves and resources. Now describe this diagram. Don't forget to use expressions for describing diagrams (Refer to Writing Bank, pg. 106).

Grouping Words in Categories

One way to remember terms is to group words into sets, which describe properties, special names, etc.

It is traditional in the mining industry to divide metals into groups with special names. Name the sets of the following metals, using the terms below.

base metals related non-metals ferroalloy metals precious metals fissionable metals

(1)	(2)	(3)	(4)	(5)
gold	copper	iron	antimony	uranium
silver	lead	nickel	arsenic	thorium
platinum group (PGM)	zinc	manganese	REE	
	tin	chromium	titanium	
	aluminum	molybdenum	bismuth	
		tungsten	magnesium	
		vanadium	zirconium	
		cobalt	mercury	

It's my job

You are going to listen to a radio program about the profession of a geologist. As you listen, complete the table.

Definition	Specialization	Work requirements	Education
	1.		

Earth, its composition, processes and history.	2.	2.	2.
	3.		
	4.	3.	

Reading

Learning Tips- texts may often contain words that you have not met before. Try not to use your dictionary every time you come across a new word. The word might not be important in terms of information. However, you may be able to work out its meaning from related words or from the context. Try to use the dictionary as the last resort – or to check that the meaning is correct.

1. ***Read the text- Part 1. Pay attention to the bold underlined terms and details in each paragraph. Try to understand the new terms from the context.***

Ore Deposits

Part1

(1)……The ultimate source of ore deposits is deep in the igneous rocks in the earth. The original concentration takes place within

Part 2

A large group of important mineral deposits is formed by action of surface agents upon earlier magmatic or hydrothermal deposits. Reworking

bodies of **magma** through a process called **differentiation**. The concentration of some simple high temperature oxide minerals occurs within the liquid magma itself. The vast majority of minerals are deposited in the **surrounding rocks** from the cooling liquid by replacement of **wall rock** and by the filling of the cavities. In addition, important deposits may be formed by the **reworking** of older deposits of magma origin, by weathering and erosion acting at or near the earth's surface.

(2)……Whatever the source of energies involved in its formation, the magma is very important in the field of ore deposits since a great **bulk** of these deposits is found as a direct result from magma activity. The nature and location of deposition is influenced by factors outside the magma, such as structure, **nature** of rocks **invaded**, depth below surface, and **abundance** of **ground water.** The main source of mineral, however, is the magma itself and therefore, it must be of considerable size in order to have sufficient mineral present.

(3)……The term "**direct magma deposits**" refers to deposits of mineral, which have formed within the body proper of magma mass. As magma ceases to rise and **encroach upon** the rocks in which has been invading, it begins to cool. The rate of older material and **reposition** or reconcentration by mechanical, chemical or organic means form them. Sedimentary ore deposits may be divided into the following:

- Mechanical deposits form by concentrating valuable materials with relatively high specific gravities and comparative **resistance** to chemical and physical **breakdown.** These are placer deposits. Gold, platinum, tin, monazite, and gemstones occur in mechanical deposits.
- **Residual deposits** form in place by selective **leaching** and **removal** of worthless material while the valuable mineral is left behind, thus building a concentration that is worth mining. Examples are iron, manganese, nickel, and aluminum deposits.
- Chemical deposits form by the **precipitation** of material from solution into bodies of surface water such as lakes or seas. Generally, these deposits are non-metallic, for example, dolomite, gypsum and salt deposits.
- Supergene **enrichments** form by solution of minerals of **percolating** ground waters above the water table and re-precipitation at or near the water table. Copper deposits of New Mexico and Arizona are notable examples.

depends upon such factors as total amount of heat present and the amount of **overlying, insulating rocks** present. Depending on their temperatures of formation in the magma solution, minerals begin to crystallize out and rise or sink depending on their specific gravities. By this method of differential crystallization, high temperature minerals, such as magnetite and chromite are formed. They separate into localized concentrations and upon **solidification** of the magma, become ore deposits. As cooling continues minerals continue to crystallize out of the magma solution, the remaining liquid becomes increasingly **rich in** low temperature minerals, such as quartz, and volatile minerals, such as water. The great bulk of metallic ore minerals are concentrated in this late-stage **residual solution**.

Metamorphic deposits result from **rearrangement** of minerals already existing in a rock, from heat and pressure. No outside minerals are added. Graphite, asbestos, talc, garnet, jade are examples of minerals which form economic deposits of this type.

*(**The above information was adapted from Leo Mark Anthony and Michael Mark Anthony, Introductory Prospecting and Mining, pp. 69-93. Mining and Petroleum Training Service, University of Alaska, Soldotna, AK, 1997.)*

2. Match the headings to the paragraphs 1-3.

Paragraph 1 ……..

Paragraph 2 ……..

Paragraph 3……

a. Magma – the major source.
b. Different formations of ore minerals.
c. Formation of ore deposits.

3. Put steps in the correct order to show the formation of ore deposits in paragraph 1.

a. These mineral are the result of weathering and erosion at the earth's surface.

b. Many minerals are from a cooling liquid

c. Several high-temperature oxide minerals form within liquid magma.

d. The source of ore concentration is within magma bodies.

e. Some minerals are formed by the alteration of older magma-origin deposits.

f. Most minerals are found in surrounding rocks.

4. Answer the questions to paragraph 2.

1. What is important in the formation of ore deposits?

2. What percentage of deposits is the result of magma activity?

3. What factors influence the nature and location of deposition?

4. Why must there be a sufficient amount of magma to form a mineral deposit?

5. Complete the sentences using the information from paragraph 3.

1. Direct magma deposits are when _____.

2. Magma cools when _____.

3. Cooling rate occurs when _____.

4. Minerals begin to crystallize when _____.

5. High temperature minerals become ore deposits when _____.

6. Quartz forms when _____.

7. Great bulk of metallic ore minerals concentrate when _____.

6. Complete the summary about how ore mineral deposits form, using the terms after the text.

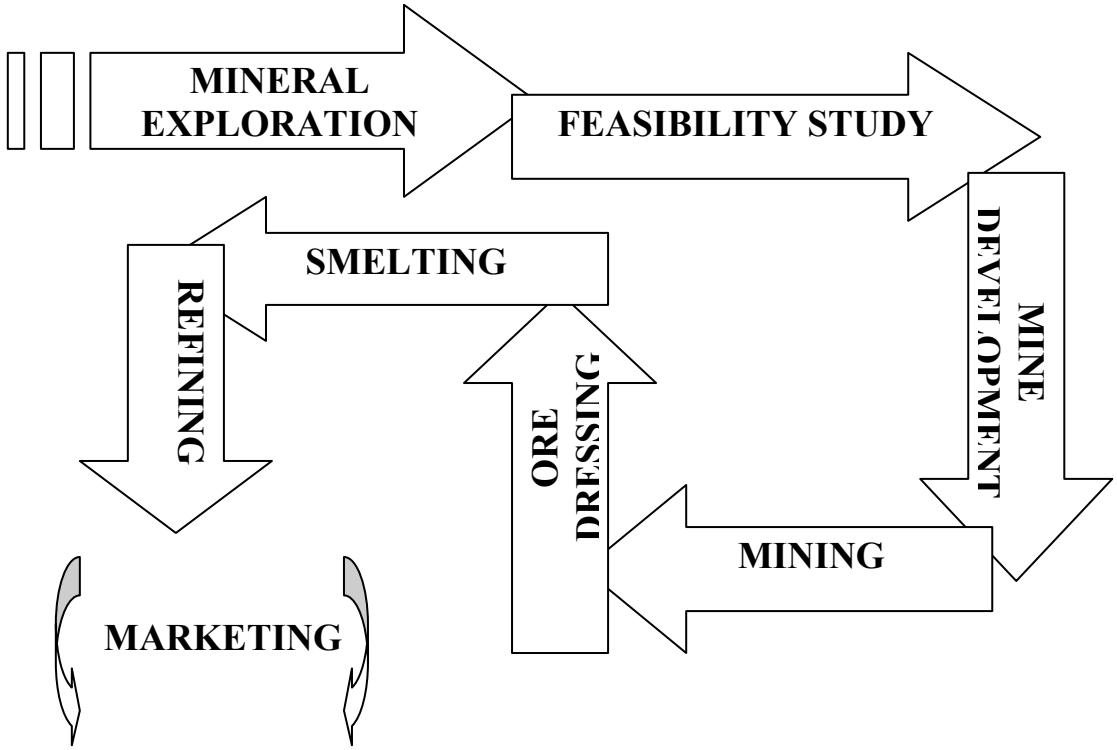
One useful way to classify (1)_____ is to distinguish deposits that were formed at the rocks from those that were formed afterwards. (2)_____ mineral deposits are those which formed bodies or by way of (3)_____ _____. (4) _____mineral deposits form in rocks that for example, solid rock may fracture and veins may be deposited in the (5)_____. Ores can be formed by the processes that produce rocks. There are mineral deposits that are created by the (6) _____ of magma from (7)_____ and (8) _____ of mineral in sedimentary rocks. But mineral deposits also form by another process, called (9)_____. Many mineral deposits are (10)_____ _____ from hydrolysis, i.e. they have come out of solution as solids. A mineral deposit is made up of ore minerals, which carry the metal and (11) _____ minerals. For example, gold veins contain large amounts of (12) _____ and carbonate gangue, with some (13) _____ and a little gold. Only the form and amount is worth (14) _____

epigenetic	syngenetic
crystallization	erosion
hydrothermal	fractures
mineral deposits	sedimentary processes
gangue	re-deposition
pyrite	chemical precipitates
extracting	quartz

Read more about «Structural Control of Ore Deposits» ***Go to Reading Bank*** (Structural Control of Ore Deposits) ***pg. 84.*** Write a paragraph. (***Refer to Writing Bank, pg.108)***

Project

This diagram shows the steps in the life cycle of a mine.



1. What are these features shown on the diagram? Check your answers with a good mining (technical) dictionary or use Google. (online encyclopedia with a lot of technical information: http://en.wikipedia.org\)

2. Use the correct form of the verbs (to complete the gaps in the sentences about the steps in the establishment and operations of a mine.)

ship	separate
establish	prove
recover	mill
discover	extract
purify	

1. An ore body _____ during mineral exploration.
2. Feasibility study _____the commercial viability of an ore body.
3. The entire infrastructure of a mine _____ in the mine development.
4. Ore _____ from the ground during mining.

5. Ore dressing includes the following steps: the ore _____, ore minerals _____ from gangue, separated ore minerals _____ into concentrates, and then the industrial products _____.
6. Metals _____ from mineral concentrates during smelting.
7. Metal _____ during refining.
8. After refining the product _____ to the custom seller or manufacturer.

3. Research one topic from the diagram. You can use the information you find in Project or online sources.

www.wikipedia.org
www.howstuffworks.com
www.mmsd.mms.nrcan.gc.ca \guide
wapedia.mobil\en\Mineral_exploration

You can find pictures and other graphics on Google Images, but remember these may be copyright. You must not publish them on a webpage or blog or in print form without permission of the copyright holder.

4. Write a summary about your findings.

Webquest

The most important step in the exploration and exploitation of mineral deposits is the exploration phase. This step is subdivided into five phases: (1) study *(анализ),* (2) reconnaissance *(первоначальная \ предварительная разведка)*, (3) target testing *(опробование),* (4) pre-feasibility *(предпосылка экономического анализа)* and (5) feasibility *(экономический анализ)*.

1. Research more about one of these phases and make notes. The websites will give you plenty of information. Follow the links to find out as much as you can.

www.ainc.ggc.ca
www.miningbasics.com
www.miningonlineexpo.com
www.teck.com

2. Report your information to the rest of the class.

INTERESTING FACTS!!

How much gold is produced annually?
It is estimated that all the precious metal ever mined amounts to about 145 thousand tons.

Who owns most gold?
If we take national gold reserves of the sovereign states, then most gold is concentrated in the USA vaults (around 8 thousand tons), followed by Germany and the IMF (International Monetary Fund). If we include jewelry ownership, then India occupies the first place as the largest repository of gold in terms of total quantity of gold within the national boundaries. In terms of personal ownership, it is known who owns the most gold, but it is believed that it is one of the royal families in the East.

The world's largest gold nugget.

- the world's largest gold nugget was found in Australia in 1872 at the Hill End mine. The nugget had the form of tile with length of 144cm., width – 66cm and a thickness of 10cm. The nugget was named "Holtermann's Nugget". So far, the nugget is not preserved, because, in olden times, it was sent for remelting.
- the second-largest gold nugget was also found in Australia, in 1869. It weighed 70.9kg. and was named "Welcome Stranger", but after a while it was also remelted.
- today there still exists the nugget discovered in 1842, in the southern Urals. It is called the "Big Triangle" and weighs 36kg. In 1842 it was valued at 28 146 rubles. Naturally, it costs considerably more nowadays.

(adapted from www.nordfort.ee\gold)

Internet Activity

Creating a vocabulary log.

Using Internet as a research tool, you can create a log entry for a new term (or word). This entry log includes:

- definition;
- other forms of the term (word);
- collocations;
- 2-3 examples of the term (word) in context;
- at least one picture (drawing, diagram) that illustrates the term (if possible);
- 2 sentences demonstrating your own use of the term (word).

These sites may help:
http://images.google.com (you can find images)
http://dictionary. refernce.com (you can find definitions)
www.the freedictionary.com\mining
www.britannica.com
Mining WA.com.au (www.theminesite.com)
www.merriam-webster.com
www.askoxford.com
www.bartleby.com
www.onelook.com
www.encyclopedia.com

EXAMPLE

extract (v) 1. to obtain from a substance by chemical action, as by pressure, distillation or evaporation
2. to pull \ draw out, often with great force or effort

extraction (n) 1. the act of extracting or the condition of being extracted
2. smth. obtained by extracting
3. origin, lineage

Other forms:
extractive; extractor
Collocations:
extract into
extract with

Idiomatic uses:

Synonyms – removal, separation, concentrate

Antonyms – addition, introduction, insertion

The words in the context:
Solvent extraction processes can be divided into two broad categories according to the origins of the differential solubility.

Maple extraction is a concentrated component (substance) for food flavoring.

My uses:
Ore extraction is a long-term cycle.

Task

Choose one term from the list below that you would like to understand better. Create your vocabulary log using the example above.

1. ore
2. gangue
3. orebody
4. resources
5. aggregate
6. deposit
7. exploration
8. mineral
9. concentration
10. reserves

Key words

aggregate
base metals
breakdown
bulk
commodity
concentration
differentiation
enrichment
feasibility
ferroalloy metals
fissionable metals
gangue
grade
industrial minerals
infrastructure
insulating rock
invaded
leaching
life cycle
marketing
mineral deposit
mineral resources
nature
ore
ore dressing
ore minerals
ore reserves
orebody
outline
percolating
possible ore (inferred)
precious metals
precipitating
pre-feasibility
probable ore (indicated)
protore
proved ore (measured)
rearrangement
reconnaissance
refining

related non-metals
removal
reposition
residual deposit
residual solution
resistance
reworking
rich in
smelting
solidification
surrounding rock
target testing
tonnage
viability
wall rock

UNIT 4

MHS (MINE SAFETY and HEALTH)

In this unit

- key terms in health and safety
- discussing «acronyms»
- predicting text content by sampling key sentences
- combining information from a text and table

Switch on

Do the quiz

1. ***Risk is defined as***
a) anything that has the potential to cause harm;
b) the likelihood that illness, injury, or even death might result;
c) talking to the boss.

2. ***Hazard is defined as***
a) anything that has the potential to cause harm;
b) the likelihood that illness, injury, or even death might result;
c) taking valuable time to consider how to do a job safely and correctly.

3. ***Most accidents happen when***
a) a slight change in procedures occurs;
b) something out of the ordinary takes place during the work process;
c) the boss gets involved,.

4. ***RISKS*** acronym (слово, сформированное из первых букв словосочетания, которое оно заменяет***) means***
a) rise, inquire, stop, know, sustain;
b) repeat, identify, slow, knowledge, safety;
c) remember, identify, share, know, safety.

5. ***When starting a new task you should***
a) use your own head and figure the best way to do the task without bothering others;
b) ask someone who is knowledgeable in the task before proceeding;
c) look around for hazards;
d) discuss your concerns with experienced persons.

Listening

A person from the USA Department of Labor is describing the importance and work of MSHA.

1. Listen to the Part 1. Are these statements true (T) or false (F).

1. Mining has always been a dangerous job.
2. MSHA means Mine Safety and Health Administration.
3. MSHA is part of the USA Mine Department.
4. The main task of MSHA is to develop safety and health issues.
5. MSHA works in every type of mining.

2. Listen to Part 2 and complete the sentences.

1. The modern Federal Mine Safety and Health Act was designed_____.
2. According to the Act, underground mines are inspected four _____.
3. In both surface and underground mines, inspectors take health samples, such as _____.
4. If there are unsafe and unhealthy conditions, the area is _____.
5. The technical support staff works to solve _____.
6. Besides safe design and equipment maintenance, inspectors examine _____.
7. MSHA involves the mining organizations to take part in _____.
8. Effective safety team includes not only government agencies, but also _____.

3. Listen to Part 3. Answer the following questions. Explain your answers.

Is it possible to ……..

1. improve mining training plans?
2. start work without basic safety and health training?
3. get classes in an institution?
4. find different mine safety programs?

4. Listen to Part 4. Tick the information that answers the question:

What do we know about MSHA?

	1. an important organization in mining.
	2. safety and technology are inseparable.
	3. cooperation of only a small group of people.
	4. inspection of only equipment
	5. prevention of different causes

OHS- Occupational Health & Safety
ERT - Emergency Response Team
MSHA- Mining Safety & Health Administration

Vocabulary

In the mining industry there are a few acronyms. Acronym is

a word formed from the letters of the word itself. For example,

NEWS which means north, east, west, south.

1. Choose the correct answer.

1. The **RISKS** acronym means: a) rise, inquire, stop, know, sustain b) repeat, identify, slow, knowledge, safety c) remember, identify, share, know, safety

2. The **SLAM** acronym stands for: a) stop, look, absorb, mandate, b) start, learn, arrange, manage, c) stop, look, analyze, manage, d) strike, lock, arrest, mandate (давать полномочия).

3. S in the **SLAM** acronym means: a) stop, take time to study the situation and think through the task before proceeding, b) start learning, c) strike a blow against accidents, d) stop stupid mistakes.

4. L in the **SLAM** acronym means: a) long-term effects of a hazard, b) logical approach to risk prevention, c) look for and identify the hazards in each job step, d) likely loss from hazard.

5. A in the **SLAM** acronym means: a) accidents are preventable, b) analyze the risk using a simple mathematical routine, c) analyze to determine if you have the knowledge, training and tools to do the task safely, d) accountability (ответственность), e) acknowledge that you need help.

6. M in the **SLAM** acronym means: a) mandate accountability, b) my life and health are important, c) manage by removing or controlling the hazards and using proper equipment, d) get married and you can stop cooking, e) messes often precede accidents.

2. Look at a completed accident report form. Find the Russian word from the vocabulary list below for the underlined words in the report.

поизводственная практика	поднимание
работающий не по найму	спотыкаться
частное лицо	вредное вещество
опыт работы	транспортировка
падать	погрузочно-разгрузочные работы
подвергать действию	скользить
синяк, кровоподтек; ушиб	самосвал

Name of injured person	*Henry Smith*
Address	*Flat 267, Block 65, New City, Birmingham*
Phone number	*O121 121212*
Age	*18*
Female \ Male	*Male*
Job title	*student*
Who was the injured person?	

Employee On training scheme On work experience Employed by someone else Self-employed Member of the public	√
Kind of accident Contact with moving machinery Hit by moving object Hit by moving vehicle Hit something fixed Injured while handling, lifting or carrying Slipped, tripped, fell Exposed to harmful substances Exposed to fire Exposed to electricity	√
Description of what happened	*Henry was hit by a moving dumper truck which was carrying earth on the construction site. The truck driver did not see Henry, who had entered the site. Jolan Balog, Site Foreman, saw the accident and called an ambulance. Jolan and two other workers stayed with Henry until ambulance arrived. At hospital, Henry was X-rayed and found to have a broken leg and bruised arms.*

(The above information was adapted from Eric H. Glendinning, Technology 2, pp. 62-63. Oxford University Press, 2008)

3. An Accident Investigation Inspector has produced a Health and Safety report following Henry's accident.

3.1 Fill in this blank using the information from the accident report.

About you, the person filling in the report.

Name _____

Address _____

Occupation _____

About the person who had the accident.

Name _____

Address _____

Occupation _____

Signature_____ Report Number _____ Date _____

About the accident

When did it happen? Date: _____ Time: _____

Where did it happen? _____

How did it happen and why? _____

_____

_____

Give details of any injury suffered and treatment given _____

_____

_____

Give any recommendations to avoid similar accidents occurring _____

_____

_____

_____

_____

_____

1.2 Match the paragraphs A-D with the correct part of the accident report 1.1 – 2.2.

1.0 Findings

1.1

1.2

2.0 Recommendations

2.1

2.2

A. Vehicle access points to the site should be manned during construction work to prevent persons accessing the site when gates are open.

B. Vehicle access points to the site were constantly open and unmanned.

C. Site should be securely fenced off to prevent unauthorized access by members of the public. Any breaks should be fixed immediately.

D. Site had not been securely fenced off. Temporary fencing had fallen over in two places and had not been put back up.

(The above exercise was adapted from Eric H. Glendinning, Technology 2, pp. 62-63. Oxford University Press, 2008)

It's my job

Listen to a representative from MSHA, who is talking about the importance of industrial safety and health engineers.

1. Listen and tick off the subjects that are discussed.

1. Worksites
2. Job responsibilities
3. Necessary skills for an industrial safety and health engineer
4. Education

2. Listen again and fill in the gaps

Many jobs carry an element of (1) _____. Industrial Safety and Health Engineers are (2) _____making sure workplaces (3) _____ of laws designed to protect people. They (4) _____ worksite or products of safety and health. They must be able to anticipate and evaluate (5) _____, as well as, hazardous control methods. They work with other public health and safety officials to (6) _____. They also can be (7)_____ who search for violations and (8 _____. And they explore new ways of doing things that (9) _____. Training workers in safety and (10) _____procedures is another aspect of this job. Many of these positions require a 4-year college degree in engineering.

Reading

1. Study the opening sentences for each paragraph in this text. Predict the topics of each paragraph.

A. Different types of injuries

B. Environmental impact

C. Organizations monitoring mining activities.

D. Lung diseases.

1. Depending on the nature of the material being mined, there may also be a risk of damage to various organs. Particularly exposed are the lungs, with many lung diseases associated with mining. These include the pneumoconiosis (пневмокониоз, запыление лёгких), or dust diseases of the lung, which are caused by coal, silica, asbestos, kaolin, talc, and many other dusts. There is also a risk of lung cancer caused by some of these materials, and the fumes from diesel vehicles that may be used in underground mining settings also cause a threat. In many underground mining operations there is a risk of exposure to radioactive materials, especially in the form of radon gas (радон), which can lead to high rates of lung cancer. Most mining-related lung disease is entirely preventable with the use of good ventilation, respirators when necessary, and other precautions (профилактика).

2. There are many organizations involved with overseeing (следить) mining activities. Some of these include NIOSH (National Institute of Occupational Safety and Health) which certifies respirators for use, and MSHA (Mining Safety and Health Administration), which directly oversees safety practice at working mines, including oversight (контроль) of dust sampling.

3. Traumatic (травматический) injuries (увечье; травма) of many types are associated with mining activities. In underground mines there is the ever-present danger of explosion, foul air (воздух с высоким содержанием диоксида углерода), water hazards, and other difficulties related to the use of mechanized equipment in confined (замкнутой пространство) spaces. Many injuries also take place in the transportation and processing of ore and other mined products.

4. Mining activities also have a high potential for affecting the general environment through air pollution, the fouling of bodies of water through runoff (сток), or the contamination (загрязнение) of soil with waste products (отходы). Excavation of materials from the Earth's crust includes those of organic origin, such as coal and petroleum. Modern mining is costly and complicated. First, a mineral vein that can likely produce enough of the desired substance to justify the cost of extraction must be located. Then the size of the vein or deposit is determined, and mining engineers decide the best way to mine it. Most of the world's yearly mineral production is extracted by surface mining, which includes open-pit mining, strip mining, and quarrying. For ore bodies that lie a considerable distance below the surface, underground mining must be considered. In both techniques, excavating and extracting mineral substances involve costly combinations of

drilling, blasting, hoisting, and hauling, as well as, measures for health and safety and reduction of environmental impact (воздействие на окружающую среду).

(The above information was adapted from http://www.Wikipedia)

2. Complete the sentences using the information below

1. Many lung diseases depend on _____.
2. Most lung diseases are caused by _____.
3. Some materials and fumes from diesel vehicles cause_____.
4. Most mining – related diseases can be prevented by _____.
5. The following organizations oversee mining activities_____.
6. Underground mines include _____.
7. Mining activities affect the environment through _____.
8. All mining activities involve _____.

a. traumatic injuries.
b. a threat, such as lung cancer.
c. measures for health and safety and reduction of environmental impact.
d. nature of mined material.
e. NIOSH and MSHA
f. different types of dust.
g. air pollution, fouling of bodies, contamination of soil.
h. good ventilation, respirators and other precautions.

Problem – solving

You are going to hold a meeting to discuss and investigate the following case. Arthur Toscano, mine safety and health inspector from MSHA is reporting the fire accident that happened in Surface Metal Mine, Taconite.

REPORT OF INVESTIGATION - Surface Metal Mine (Taconite)
Fatal Fire Accident
October 13, 2000
UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
Metal and Nonmetal Mine Safety and Health

1. Before you begin, read the overview and discuss the reasons of the accident. What should be done? What precautions must be stated?

OVERVIEW

On October 13, 2000, Clarence Brant, tractor operator, age 59, was seriously injured when flames suddenly engulfed the cab of the bulldozer he was operating. Brant sustained multiple burns in the accident and died of related complications on November 2, 2000.

The accident occurred because oil leaked onto the engine and was ignited by heat from hot engine components.

Brant had a total of 20 years of mining experience, nine at this mine. He had received training in accordance with 30 CFR, Part 48.

2. Read the report of the investigation. Go to Reading Bank (Report of Investigation) ***pg. 90.***

3. ***Make notes according to the following plan:***

- general information
- description of the accident
- investigation of the accident

Speaking
Discuss this accident. Here is a list of the persons participating in the investigation and those who were interviewed.

Hibbing Taconite Company:

Bill Williams ..... area manager - mining
John Kannas ..... safety manager

United Steel Workers of America, Local Union 2705

Allen Caligiuri ..... safety chairman

Buchanan Ingersoll

R. Henry Moore ..... attorney at law

Mine Safety and Health Administration

Donald Foster ..... supervisory mine safety and health inspector
Arthur Toscano ..... mine safety and health inspector
William Pomroy ..... industrial hygienist
David Couillard ..... mine safety and health specialist

Persons interviewed during the investigation:

Hibbing Taconite Company:

Benny Caple ..... operating coordinator
Patrick Angelo ..... pit services coordinator
Jimmy Lahtela ..... auto mechanic
Richard Rojeski ..... maintenance mechanic, union president
James Bradach ..... tractor operator
Steve Beliaj ..... tractor operator

(www.msha.gov\fatals)

1. Choose a role and discuss the problem from his point of view.
2. Make notes.
3. Make a conclusion- state the results of your discussion, what precautions should be taken to prevent further accidents of this type.

Writing

Write a summary of the investigation which must be handed in the MSHA.

(Refer to Writing Bank, pg. 109).

INTERESTING FACTS!!
Labels are an important component of any safety program. The following are some of the safety related applications that involve labeling. In some cases labels are required. In other cases labeling may not be required by law or code, but it is an accepted industry standard.

Safety Labels: Danger Labels & Signs – are not required by code. Such a label states that an arc flash hazard exists.

Safety Labels Information Labels & Signs (Operating Instructions, Procedures, Maintenance Information) – identify an immediate hazard. These signs inform people about the hazard that should be taken and provide a description of any precautions that should be taken.

Safety Labels: Warning Labels & Signs – provides operating instructions, information about procedures or maintenance information is not commonly thought of as safety labels.

These labels are to identify a hazard level that is more serious than CAUTION, but not as serious as DANGER.

Webquest

1. Listen to the following two presentations «Gold Mining Techniques» »Gold Mining Methods \ Equipment». Make all necessary notes according to the plan:

- ***early gold mining methods***
- ***gold mining companies***
- ***modern gold mining methods***

2. Compare answers with other students in your class. Find additional information. Make a poster presentation and discuss your findings. These sites may help:

www.en.wikipedia.org \ Gold mining
www.en.wikipedia.org \ Placer mining
www.sierrafoothillmagazine.com
www.stivespark-p.schools.nsw
www.ehow.com
www.greatmining.com
www.the gold-spot.com

Internet Activity

You have heard a lot about the Gold Rush. On this site you can find some Gold Rush quizzes. Do one of them.
www.funtrivia.com - (4) Basic Rush: Basic knowledge.

Key words

caution
confined
contamination
danger
environmental impact
foul air
hazard
investigation
label
overseeing
precaution(s)
risk
safety
warning

MINING GAME

(adapted from Eric H. Glendinning, Technology 2 (2008) Oxford University Press)

This game revises what you have learned in this book. Work in groups of six. Divide into three pairs. You need one dice for each group and a counter *(фишка)* for each pair.

Rules

1. Decide who is going to start. Place your counters on the start square. The first pair throws the dice and moves their counter to the correct square. Read the instructions aloud. You are allowed one minute to discuss your answer. (The other pairs should also think about the answer.) Give your answer in no more than one minute. If you cannot answer, another pair can offer an answer.
2. If another pair thinks that the answer is incorrect they can challenge and offer another answer. If they get the correct answer, they can move their counter along one square. It is now their turn to throw the dice. If the answer is correct and there is no challenge, the pair rolls again.
3. The first pair to reach **Finish** is the winner.
4. Red squares give instructions. Yellow squares test your knowledge and career skills. Green squares test your speaking skills. Brown squares test your language knowledge (terminology).
5. If there are a), b) or c) questions, the first pair to land on the square can choose which they want to answer. The next time a pair land on that square, they must answer a different question. If the square has only one question, the next pair to land on the square must give an answer that is different to the first pair.
6. If the instructions tell you to ***Talk about …,*** you must talk for 30 seconds.

GOOD LUCK!

1 START Name 3 different jobs in mining industry.	2 Give 3 collocations used in mining .	3 Talk about future mining methods.	4 What are the main types of mining methods?
5 Make 2 sentences about MSHA	6 Give a definition to the word «ore».	7 Go back to the start.	8 Name the 5 main industry segments.
9 Explain the word «exploration».	10 a. What is BuxInnicon? b. What does this company specialize in?	11 What is the first activity in mining?	12 Name the three main rock types.
13 Where can Buxplug be used?	14 Make 2 sentences with the word from your vocabulary log.	15 State the main health problems connected with mining.	16 Ore reserves are divided into_____.
17 Give a definition to the word «mining».	18 Gold, silver and PGM are _____.	19 What is the main source of ore deposits?	20 Geologists specialize in _____.

21 Is it true: skilled machine operators have a high salary.	22 Move forward 1 square.	23 Talk about the Russian classification of reserves and resources.	24 The metal concentration in an ore body is expressed in _____.
25 Describe the formation of mineral deposits.	26 Make two compound nouns with the word «mineral».	27 What is the difference between gold placer and gold nugget?	28 Can a mineral be a gangue and valuable mineral at the same time?
29 SLAM acronym means…….	30 What is main objective of MSHA?	31 Describe the steps in the life cycle of a mine.	32 Describe the main responsibilities of industrial safety and health engineer.
33 Take a break – miss a turn.	34 Give the synonyms to «proved», «probable» and «possible» reserves.	35 Mining industry includes ---- segments.	36 What does *RISK* mean?
37 State the types of mining operations.	38 Talk about ...um: a. what b. where c. why so valuable	39 Name related non-metals.	40 Describe the stages in the production of platinum. FINISH

QUIZ

The quiz is divided into three parts. Part A includes simple, general questions; part B – questions from Unit 1- 5; and part C – comprehensive questions

Work in groups of three. One student is the quizmaster and asks the questions. The other two students work individually and write down their answers. Change roles for parts B and C.

Remember for Part A you can get only 1 point for each correct answer; Part B- 2 points, while for Part C – 4 points. That is **100 points!**

Now, find out what you remember!

PART A

1. What is electrical wiring made of?
2. What are native elements?
3. Which is the most abundant metallic element in Earth's crust?
4. How do scientists classify minerals?
5. What minerals is much in demand for modern technology?
6. What metal can be a liquid at room temperature?
7. What rock can float in water?
8. What is glass made of?
9. What are the three basic types of rock?
10. What is REE?
11. What does a geologist study?
12. What is platinum?
13.  What is it?
14. Who is a blaster?
15. What mining methods are used for coal?
16. Name the compound words with «mineral»
17. Where can you find magma?
18. What is RISK?
19. What is Ag?
20. Where can you find this machine- in a film or in the mining industry?

PART B

1. What is ore?
2. What is quarrying industry?
3. Describe the operation procedure of Buxplug.
4. What is a horizontal mine shaft called?
5. Where can most mineral deposits be found?
6. What are advantages and disadvantages of a dragline?
7. What is the basic factor in the division of mining industry segments?
8. Where do mine cutting and channeling machine operators work?
9. What are the advantages of Buxplug?
10. What are some elementary aspects of mineral economics?
11. What is the relationship between reserves and resources?
12. What are mineral resources?
13. How are sedimentary deposits divided?
14. What factors influence the nature and location of deposition?
15. What is the most important step in the exploration and exploitation of mineral deposits?
16. What is the major classification of ore minerals?
17. What is another term for hypogene \ supergene?
18. What type of ore affects the mining operations?
19. Why are maps so important in geology?
20. What is an acronym?

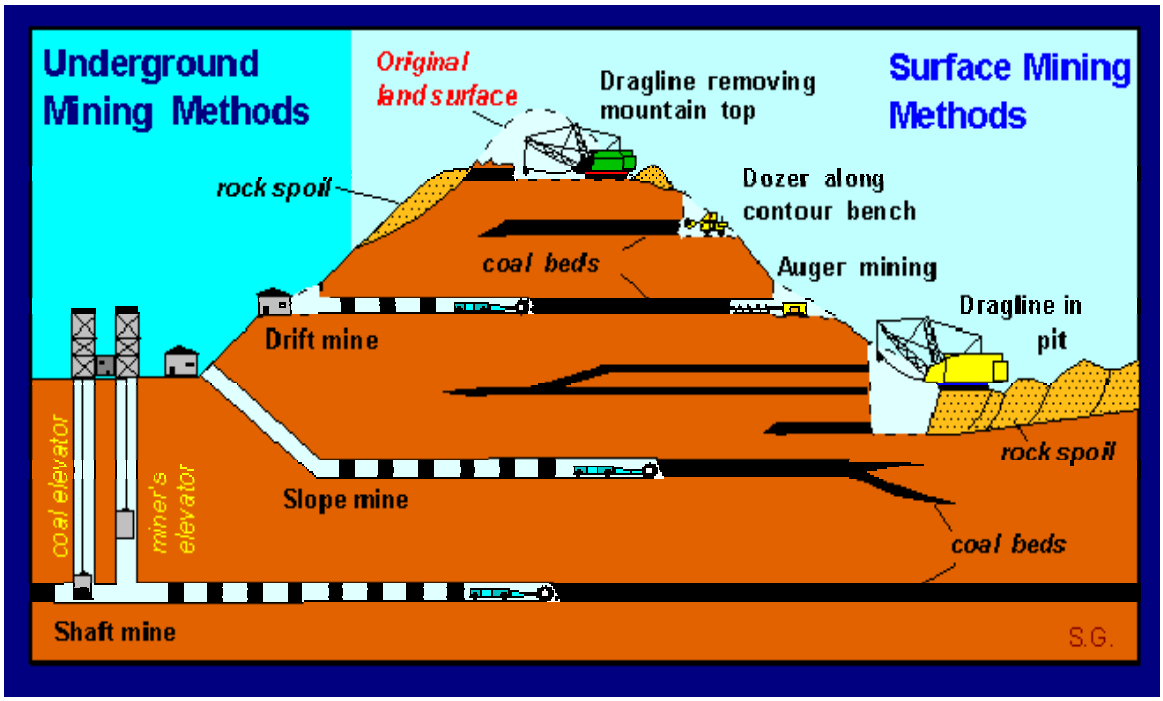
PART C

1. Do minerals in rocks ever pose a health hazard?
2. What is the difference between Russian reserve system and SEC (United States Securities & Exchange Commission) standards and PRMS (Petroleum Resources Management System) standards?
3. What country is the world's leading producer of copper?
4. How is iron extracted from its ore?
5. How can gold mining have a negative impact on the environment?
6. How many troy ounces is 50 grams in silver?
7. Is zinc a renewable or nonrenewable resource?
8. What are the benefits of mining?
9. Why must mining companies periodically find new deposits?
10. What does the word «placer» mean?

READING BANK

Methods of Mining

When a mineral deposit is found, it is studied to determine if it can be mined profitably. If so, the deposit can be worked or extracted by a variety of mining methods.



Underground Mining

Underground mining includes drift, slope, and shaft mining, and actual mining methods include longwall and room and pillar mining. Drift mines enter horizontally into the side of a hill and mine the coal within the hill. Slope mines usually begin in a valley bottom, and a tunnel slopes down to the coal to be mined. Shaft mines are the deepest mines.

In room and pillar mining (the most common type of underground coal mining) coal seams are mined as a network of "rooms". "Pillars" composed of coal are left behind to support the roof of the mine. Each "room" alternates with a "pillar" of greater width for support. Using this mining method normally results in a reduction in recovery of as much as 60 percent because of coal being left in the ground as pillars.

Longwall mining is another type of underground mining. Mechanized shearers are used to cut and remove the coal at the face of the mine. This method of mining has proven to be more efficient than room and pillar mining, with a recovery rate of nearly 75 percent, but the equipment is more expensive than conventional equipment, and cannot be used in all geological circumstances.

Surface Mining

Surface-mining methods include area, contour, mountaintop removal, and auger mining. Area mines are surface mines that remove shallow coal over a broad area where the land is fairly flat.

Contour mines are surface mines that mine coal in steep, hilly, or mountainous terrain. Mountaintop removal mines are special area mines used where several thick coal seams occur near the top of a mountain. Large quantities of overburden are removed from the top of the mountains, and this material is used to fill in valleys next to the mine. Augur mines are operated on surface-mine benches.

Dredging is a high-volume mining technique for low-value products near a plentiful source of water. Scoops/buckets are used to extract material from shallow water. Dredging is an excavation activity or operation usually carried out at least partly underwater, in shallow seas or fresh water areas with the purpose of gathering up bottom sediments and disposing of them at a different location. Grab dredgers are a relatively simple method of dredging

which involves the collection of sediments in a crane mounted bucket, the jaws of which are opened and closed (rope operated or hydraulically) like a clamshell trapping sediments. The mining process is usually combined with the processing (typically drying and concentration) on a floating barge, which is anchored in the middle of the lagoon.

(The above information was adapted from http://www.Wikipedia)

1. Scan the text quickly to find out which method is used to mine the following minerals \ metals.

a. minerals \ rocks found near the surface (sand, cinder, gravel)
b. coal
c. gold, copper, zinc, nickel, lead
d. underwater mineral deposits

Geological Exploration - Rocks and Rock Structure

To find a particular ore, one must begin by looking in regions where the ore is formed and/or concentrated. Therefore, before exploration one must have an understanding of the geologic forces that form rocks and ore deposits.

A rock is a mineral, or aggregate of minerals, that forms an essential part of the earth's crust. In other words, enough of a particular mixture of minerals exists, so that the rock can be named and recognized in many localities throughout the world. Rocks differ from minerals in that rocks are merely physical mixtures of minerals, while the minerals themselves are chemical compounds of fairly uniform composition. Rock structures can be indicative of ore deposits, as well as, the potential size of an ore deposit.

Any rock can be classified as one of three types: **igneous**, **sedimentary**, or **metamorphic**. This method of classification is based on the mode of formation of the rock. Igneous rock is formed from a molten state. The sedimentary rocks are formed from sediments or erosion fragments deposited in lake and ocean beds. Metamorphic rocks form when great heat and pressure, caused by deep burial, alter the physical condition of sedimentary, igneous, or another metamorphic rock.

Igneous (fire formed) rocks are formed in deep-seated areas of the earth's crust. They may be fine grained, large grained or a combination of large and

small grains. The grain size indicates the cooling rate of the rock. Fine grained (dense) igneous rocks form when rapid cooling occurs. Conversely, coarse-grained rocks cooled slowly and crystals grew large. Fundamentally, igneous rocks are classified as either intrusive or extrusive. Intrusive rocks originate from magmas (molten rock materials combined with gases) at depth in the earth. Intrusive rocks occur as massive structure or as in "injection" structure. This latter structure forms when the hot, liquid or plastic rock is injected into fractures in the surrounding solid rock. Intrusive action leads to the formation of **batholiths**, **laccoliths**, **stocks**, **dikes**, and **sills**. Weathering and erosion later expose these structures on the earth's surface. Extrusive rocks are formed by volcanic activity at the surface of the earth. These rocks cool rapidly. Examples of some common igneous rocks are: rhyolite, andesite, basalt, granite, diorite, gabbro.

The formation of sedimentary rocks begins with the breaking down of other rocks into fragments. The forces of weathering and erosion, such as running water or freezing and thawing, accomplish this mechanical and chemical breakdown. Fragments are transported to and deposited in lake and ocean bottoms. Later, spaces between the fragments are filled with a cementing material or are eliminated by pressure. After some time passes, a massive rock layer results. Sedimentary rocks are classified based on the size of the particle of the sediment, or fragment. Shale (dense, fine particles), sandstone (particles distinguishable to the naked eye) and conglomerate (pebbles and gravel cemented together) are examples of sedimentary rocks.

Metamorphic rocks are formed from previously existing igneous, sedimentary or possibly other metamorphic rocks. Great heat and pressure, yet not enough to completely melt the rock, alter the rocks original physical composition. Sometimes the process of metamorphism aligns the grains in parallel layers or bands. This layering is called foliation. When broken, a metamorphic rock usually breaks along the plane of foliation. Metamorphic rocks are classified based on their grain size and degree of foliation. Some examples of metamorphic rocks are: slate, schist, gneiss.

(The above information was adapted from Leo Mark Anthony and Michael Mark Anthony, Introductory Prospecting and Mining, pp. 69-93. Mining and Petroleum Training Service, University of Alaska, Soldotna, AK, 1997.)

Read the text again to find the answers to these questions.

1. What is a rock?
2. How are rocks named?
3. What are minerals?
4. How many types of rocks are there?
5. The rock classification is based on what feature?
6. How does the cooling rate influence the grain size in igneous rocks?
7. Where do intrusive rocks form?
8. How are extrusive rocks formed?
9. What common igneous rocks can you name?
10. What is mechanical and chemical breakdown?
11. What affects the classification of sedimentary rocks?
12. What is foliation?
13. How are metamorphic rocks classified?
14. Is heat and pressure enough to form metamorphic rocks?

Structural Control of Ore Deposits

The formation of valuable mineral deposits result from a combination of factors, conditions, and events which go hand in hand to determine the areas in which metals are gathered into concentrations greatly. **Differentiation** of large masses of rock material in a molten state is a major means of metal accumulation. Highly mobile and volatile solutions contain high concentrations of metal and carry them to some point where chemical and physical conditions are favorable for deposition. Hydrothermal and secondary deposits are found in areas where rocks have been "prepared" in advance by some kind of structural deformation. Areas of mountain building activity combine structural deformation and igneous activity. They are favorable places for ore deposits.

There are two divisions of rock structures, which control ore formation, primary structures, and secondary structures:

Primary structures are features such as bedding in sediments, igneous contacts, pillows in lavas, and other minor features that developed during the formation of the rock mass. Such structures might have had important local influence on the size, shape, or grade of a deposit. Bedding surfaces, igneous contact, or intergranular spaces might act as zones along which solutions move to points of deposition;

Secondary structures develop after the formation of the rock. They are such features as faults (fractures in rock masses with major slippage), joints (cracks in which there has been no movement of the rock on side of the opening relative to the other side), and folds, and are of greater importance in control of ore deposition than are the primary structures.

(The above information was adapted from Leo Mark Anthony and Michael Mark Anthony, Introductory Prospecting and Mining, pp. 69-93. Mining and Petroleum Training Service, University of Alaska, Soldotna, AK, 1997.)

Answer the following questions which will help you to write your summary.

1. What is the main idea of this text?
2. How many parts can you divide the text into?
3. Can each part be an independent text? Why?

Buxplug

BuxInnicon is a privately owned Australian company that has been servicing the Metalliferous and Coal Mining industry since 2002. Buxton Innicon is all about Innovation, Ideas and Concepts. Buxton Innicon specializes in product and process, concept, design and development for the mining industry.

Background

The Buxplug is the first range of products designed by Buxton Innicon to assist the underground workforce in making daily tasks a little easier and safer. The Buxplug is used in conjunction with cable bolts and makes the task of cable grouting "hassle-free». The initial idea of the Buxplug began after observing the difficulty underground miners had when plugging cable bolt holes in preparation for grouting (*цементация горных пород*).

What is a Buxplug?

The Buxplug is a single device that replaces existing methods for plugging cable bolt holes in preparation for grouting. The Buxplug enables a one pass, simple installation technique that is faster to use than other plugging methods. The Buxplug reduces gaps that grout can escape from compared to the other plugging techniques due to its design. The Buxplug is lighter, more durable and easier to handle than any other technique. The Buxplug is easier and cheaper to store and transport compared to other plugging methods \ devices. The Buxplug when used in conjunction with expanding foam minimizes foam usage and provides a perfect seal.

Why use a Buxplug?

1. The Buxplug is a single device that can be used as an alternative to traditional plugging methods.
2. The Buxplug enables a one pass, simple installation technique that is faster to use than other plugging methods.
3. The Buxplug further reduces gaps that grout can escape from compared to the other plugging techniques due to its design.
4. The Buxplug is lighter, more durable and easier to handle than any other technique.
5. The Buxplug is easier and cheaper to store and transport compared to other plugging methods / devices.
6. The Buxplug reduces grout spillage which

- improves housekeeping on a work platform
- reduces potential for grout burns on workers
- reduces maintenance on the work platform
- reduces cost of grout lost

Easy Installation

Step 1 – Slide Buxplug (sleeves pointing down) onto the breather tube. Then guide cable tails through plug sleeves.

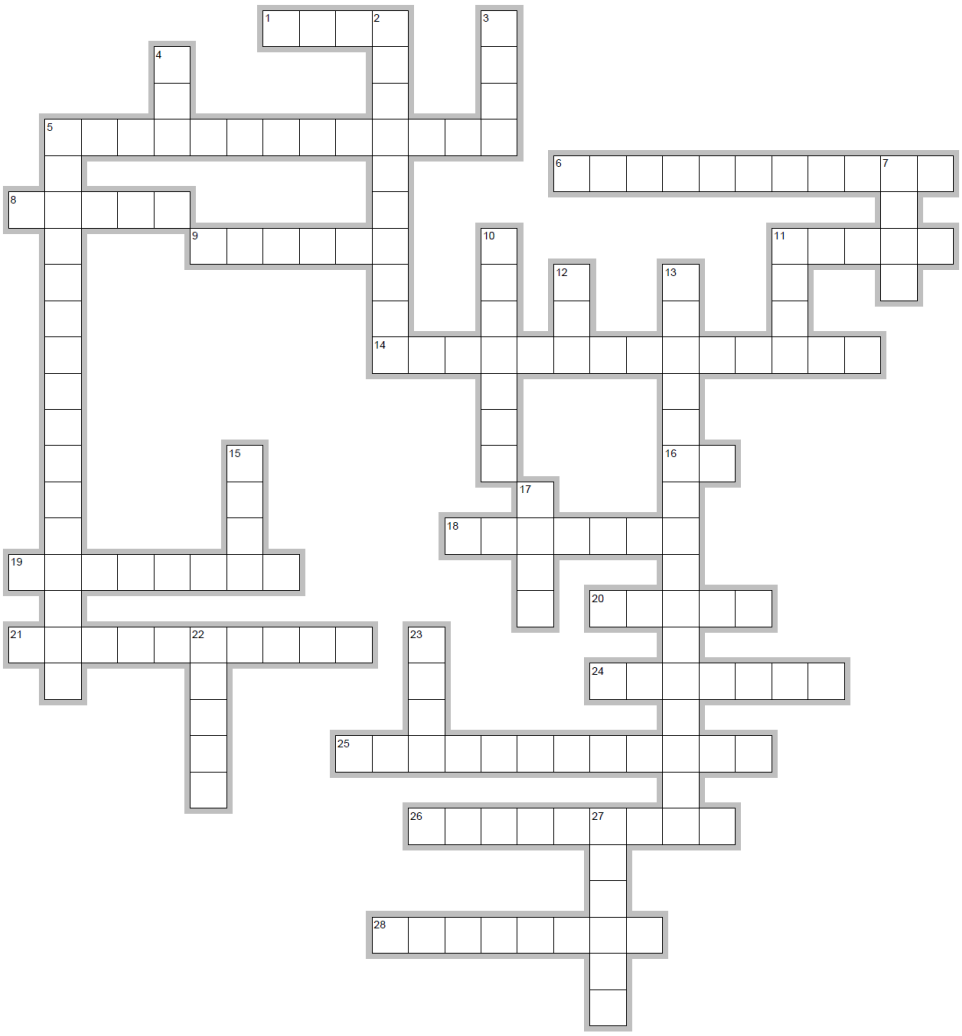
Step 2 – Push the Buxplug firmly into the hole collar with the Buxplug tool.

Step 3 – Insert the grout hose through the Buxplug (at least 500mm up past the plug). Tape the breather tube and grout tube and cable tails together to avoid slipping.

(information was adapted from www. buxplug.innicon.com)

Buxplug Installation Crossword

Read the text above and do the following crossword.



Across

1. Cutting the poly hose at an angle makes it easier to____ through the buxplug.

5. What is the minimum distance the grout hose must be pushed past the buxplug?

6. If the cablebolts are mechanically pre-installed what tool must be used to push the buxplug up the hole?(2W)

8. Buxton Innicon recommends a _____ hose diameter between 20mm and 25mm.

9. If too much pressure builds up inside the hole during grouting some grout may leak past the buxplug which should then _____ itself.

11. The grout hose, breather tube and cable tails must be _____ tightly together after the buxplug has been installed up the hole.

14. What should each mine site perform before using the buxplug?(2W)

16. If the cablebolt hole diameter is 76mm, can you use the CAB64 buxplug?

18. What may happen when too much pressure builds up inside the hole during grouting?

19. The _____ tube should be taped about 300mm from the top of the cablbolt.

20. The cable tails go through the largest holes in the buxplug.(T or F)

21. The CAB76 buxplug (orange) must only be used for cablebolt hole diameters _____ ___mm. (2W)

Down

2. What should be inspected to see if the buxplug is seated correctly after it is installed?

3. The buxplug should be ____ to hard to push up the hole.

4. What must be worn when using cement for a hand mixed, thick grout paste with the buxplug?(3L)

5. What angle should you cut the breather and grout tubes to make it easier to push them through the buxplug holes?(3W)

7. If there is only one cable tail, which sleeve hole in the buxplug must it go through?

10. What is the best tool to cut poly hose with?

11. The cable tails must go through the holes in the cablebolt sleeves on the buxplug.(T or F)

12. Can multiple buxplugs be pushed up the hole if ground conditions at the hole collar are poor?

13. There are 3 main steps to install the buxplug shown in the "____ _____" brochure. (2W)

15. What colour is the CAB64 buxplug for underground metalli-ferous mines?

17. What type of ground conditions would you consider using a hand mixed, thick grout paste with the buxplug?

22. How many basic steps are there to install a buxplug?

24. If the buxplug is not inspected inside the hole collar once it has been inserted and is not seated correctly, what may happen during grouting?

25. What brochure can you refer to as a quick guide?(3W)

26. Only persons who have been trained and assessed as _____ should install buxplugs and grout cablebolt holes that have buxplugs installed.

28. What problem is reduced by taping the grout hose, breather tube and cable tails tightly together after installing the buxplug?

23. What direction must the sleeves of the buxplug be pointing before it is installed?

27. Buxton Innicon recommends a breather tube diameter between 16mm and _____mm.

(Created by Sean Buxton - Buxton Innicon Pty Ltd with EclipseCrossword — www.eclipsecrossword.com)

REPORT OF INVESTIGATION

GENERAL INFORMATION

Hibbing Taconite Company, a surface, multi-bench, taconite operation, owned and operated by Bethlehem Steel Corporation (70.3%), Cliffs Mining Company (15%), and Stelco Inc. (14.7%), was located four miles north of Hibbing, St. Louis County, Minnesota, on the Messabi Iron Range. The principle operating officials were: Larry Dykers, general manager; John Koivisto, safety engineer; and John Correll, safety director. The mine normally operated three, 8-hour shifts per day, and seven days a week. Total employment was 800 persons.

About 22 million tons of overburden and low quality ore, and 31 million tons of crude taconite ore were mined annually from several open pits using multiple bench mining methods. The overburden and ore were drilled, blasted, and loaded into 240 ton haulage trucks. The overburden was taken to the waste stockpile and the ore transported to the mill where it was crushed,

ground, and passed over magnetic separators. The concentrate was then pelletized and fired in furnaces prior to rail shipment to steel mills.

Yearly production totaled about eight million tons.

The last regular inspection of this operation was completed on September 28, 2000. Another inspection was completed following the investigation.

DESCRIPTION OF THE ACCIDENT

On the day of the accident, Clarence Brant (victim) reported for work at about 10:50 p.m., his normal starting time. Patrick Angelo, pit services coordinator, assigned Brant to operate the No. 321 bulldozer on the 1039 stockpile.

At 12:00 a.m., Brant was instructed to move bulldozer No. 321 from the 1039 stockpile to the surge pile. Paul Husmann, tractor operator, normally pushed material on the surge pile and took over operation of the No. 321 bulldozer once Brant arrived.

Brant was then assigned to take No. 83 front-end loader to the shop for servicing. While Brant was servicing the front-end loader, Jimmy Lahtela, mechanic, informed Angelo that he had serviced No. 319 bulldozer but he could not locate an oil leak that had been reported on the machine.

Angelo and Brant traveled to the No. 319 dozer to check it for leaks. A trail of fluid was discovered on the ramp of the stockpile but the machine would not leak while sitting still. Brant moved the machine about 200 yards, with Angelo following, before the machine began to leak. A loose fitting was discovered on the metal transmission line. Lahtela returned to the machine, repaired it, and checked the fluid levels. At about 2:20 a.m., Brant moved the machine from the 1037 stockpile to the 1039 stockpile. The move of 1.25 miles lasted about 45 minutes. Angelo checked the path of the machine for evidence of further leakage and found none. He instructed Brant to periodically check for leaks and to report any problems.

At about 3:30 a.m., Brant observed a mist surrounding the cab of the machine and then the bulldozer suddenly burst into flames. Brant tried to activate the fire suppression system and attempted to exit the cab through the right side door, the normal egress route, but the flames were too intense. He closed the door and then exited the left side of the cab. He jumped from the cab deck,

through the flames, to the ground, a distance of about 9 feet. Brant rolled on the ground to extinguish his clothing and then moved away from the dozer.

John Lessar, truck driver, called the dispatcher and reported a fire on the 1039 stockpile. The guard at the main gate called 911 and notified the on-site fire fighting units. James Bradach, tractor operator, arrived at No. 319 bulldozer first and called to report that Brant was burned. Angelo arrived at the scene and transported Brant to the mine service building where emergency medical technicians and first responders administered treatment. Brant was transported to a local hospital then transferred to a burn center in Duluth, Minnesota. He was discharged on November 1, 2000 and died on November 2, 2000, as a result of pulmonary emboli directly due to burns sustained in the fire.

INVESTIGATION OF THE ACCIDENT

MSHA was notified at 8:55 a.m. on the day of the accident by a telephone call from John Koivisto, safety engineer, Hibbing Taconite Company, to Arthur Toscano, mine safety and health inspector. An investigation was started the same day.

MSHA's accident investigation team conducted a physical inspection of the accident site, interviewed a number of persons, and reviewed training records and work procedures being performed at the time of the accident. The investigation was conducted with the assistance of mine management and mine employees. The miners were represented by Local Union 2705, United Steelworkers of America.

DISCUSSION

The accident occurred at the 1039 stockpile where waste rock (low grade ore and overburden) was stored. Trucks dumped the waste rock at the stockpile and a bulldozer was used to level the material.

The equipment involved in the accident was a Caterpillar, Model D-11N, Tractor Bulldozer, Serial Number 7YG00761, entered into service on May 27, 1994. The company identification number was 319. The dozer was equipped with a Cat 3508 V-8 diesel engine, with a gross horse power rating of 817. Twin turbo- charging units were located on the cab end of the engine. The external temperature of the turbochargers approached 1400 degrees Fahrenheit after 20 minutes of normal operation.

Two types of fluids manufactured by Exxon Company, U.S.A., were used in the hydraulic system of the dozer. One was Univus N 32, Petroleum lubricating oil, with a minimum flash point of 381 degrees Fahrenheit and an auto-ignition temperature of greater than 500 degrees Fahrenheit. The other was Torgue Fluid 30, Petroleum lubricating oil, with a minimum flash point of 320 degrees Fahrenheit and an auto-ignition temperature of 450 degrees Fahrenheit.

On the day shift of October 12, 2000 (two shifts prior to the shift when the accident occurred), the No. 319 bulldozer was reported to have a transmission leak. The source of the leak could not be determined at that time so the dozer was removed from service. In the early morning hours of October 13, 2000, a loose fitting was discovered on a transmission fluid line, on the front left lower side, under the radiator. A field maintenance mechanic tightened the fitting and, after checking to insure the leak had been fixed, the No. 319 dozer was returned to service.

The fire protection system installed on No. 319 bulldozer was an LT-A101 multipurpose dry chemical fire suppression system manufactured by Ansul Incorporated. The system was controlled by a Check-Fire II detection and automatic actuation system and two manual actuators. The Check-Fire II and a manual actuator were located inside the cab just to the right side of the operator's position. When the manual actuator was examined after the fire, the ring pin had not been removed from the strike button and the tamper seal on the ring pin was intact. Another manual actuator was located outside the cab on the right side of the machine directly adjacent to a 30-pound portable fire extinguisher. It had not been activated. The installed LT-A101system included two, 30-pound (nominal) dry chemical agent tanks which, when full, together contain about 50 pounds of multipurpose dry chemical agent. The system was provided with six agent discharge nozzles. This system is rated for A, B, and C class fires. The nozzles are each designed to discharge one-half pound of agent per second. Fifty pounds of agent discharged through six nozzles would thus result in a total discharge time of about 16.7 seconds.

The Check-Fire II system detected the fire automatically and actuated the system to release the entire contents of dry chemical agent in both onboard tanks, but failed to extinguish the fire. This system employed a two-stage alarm sequence before auto actuation occurred. The pre-alarm delay is the time period between the initial fire detection and latching of the alarm condition. The agent release delay is the time period between the completion

of the pre-alarm time delay and the operation of the agent release circuitry. The settings for pre-alarm and agent release delays were found to be 12 and 10 seconds respectively. Therefore, the total time necessary from detection to actuation was 22 seconds, which was the default setting on the system.

The D-11 N tractor had four fire suppression discharge nozzles located in the engine compartment. One fan-discharge nozzle was centered above and forward of the turbochargers pointing down and backward. Two more were centered above and to the rear of the turbochargers on the engine firewall pointing down and forward. These included one fan discharge nozzle and one cone discharge nozzle. The other nozzle was a fan discharge in an area containing numerous hydraulic system components in the right rear portion of the engine compartment under a hinged access panel. Two additional nozzles were provided for the transmission area located under the operator's cab.

A local distributor installed the fire suppression system and Hibbing Taconite Company maintained the system. The mine's fire brigade was activated and traveled to the fire. A 150-pound dry chemical fire extinguisher was used to initially fight the fire. This extinguisher was totally expended and reportedly knocked down the flames considerably. Fire fighting foam was then sprayed on the dozer. Approximately five gallons of foam concentrate mixed with about 250 gallons of water were used to extinguish the flames. Water was then applied to cool the hot metal surfaces and engine compartment.

The following were identified immediately after firefighting activities were conducted: The key was found in the on position, the back-up alarm was on, the transmission was in reverse, the fire suppression system control was in the alarm mode, the engine was off, and the blade was down. Based on this information, it is believed that the dozer was backing up with the blade up, when the fire began.

On November 1, 2000, representatives from Packer Engineering removed four hydraulic hoses from the machine. The hoses provided hydraulic fluid for both the right and left lift cylinders and were located in a compartment on the blade side (in front) of the radiator and radiator-cooling fan. The fitting on the transmission line that was tightened prior to the accident was examined and appeared to be intact. All of the items removed from the No. 319 dozer by the operator, Packer Engineering representatives, and the MSHA investigation team was sent to Packer Engineering, Inc. and was

examined at their Naperville, Illinois laboratory on November 17, 2000, and on April 26, 2001.

The hoses that controlled the left lift cylinder had 8-10 inches of the outer jacket material burned away at the top end of the hoses, exposing the outer spiral wrapping of both hoses. The mid section of the hoses had evidence of heat (some blistering of the outer jacket) and the lower section of the hoses had some charring and blistering at the bottom end. Photographs taken on the day the dozer was towed from the accident site showed hydraulic fluid streaming from the outer left lift cylinder hose. The dirt and debris were removed to the extent possible from the spiral braiding approximately 2-6 inches from the hose connector. While moving the hose and removing the debris, seepage was identified approximately 5 inches from the hose connector. The leak in this hose was originally identified and photographed when the No. 319 dozer was moved from the accident scene to the maintenance facility and occurred while the blade was being lowered after moving the equipment. The original brown color of the hoses was readily apparent when the support brackets were removed during the examination and this is consistent with new Caterpillar-supplied hoses.

Both hoses were viewed with a Bor-a-scope. This examination revealed that the inner tube of each hose failed in a similar manner. Both hoses had been exposed to a considerable amount of heat from the outer sections of the hose, all the way into the inner tube. As each layer of spiral wire was removed, the rubber material separating each layer fell off as ash. The failures on both hoses were similar and appeared to have failed inward (from heat) and not outward (due to physical damage, puncture, or over pressure). The inner tube was brittle due to the heat. No evidence was discovered that would indicate that the hoses failed due to over pressure. The failures and condition of the hose material were consistent with failure due to fire exposure.

It could not be determined at what point the hose became damaged during the fire. It may have, however, continued to provide fuel after the fire broke out, considering the weight of the blade and the constant flow of hydraulic fluid through the leak.

Two scenarios for the start of the fire were considered. They included a leak from the left hydraulic lift cylinder hose inside the compartment to the front of the cooling fan and/or the failed O-ring at the top of the right lift cylinder. Examination and disassembly of the hoses revealed that the nature

of the failure of the hoses was due to extreme heat caused by the fire.

An examination was conducted of both rubber O-rings removed from the right and left lift cylinder valves of the dozer. The O-rings were compared to two new exemplars, circular cross section, O-rings provided by the Caterpillar representative for the examination. The O-ring removed from the right lift cylinder was "lathe cut" and had a square cross-section. It was considerably larger and shaped differently than the exemplar O-ring. It had been extruded or "squeezed out" around its entire circumference. There was a failure in this O-ring consistent with "nibbling" along a one-half inch section of the O-ring. The undamaged O-ring on the left lift cylinder was molded with a circular cross-section. Caterpillar was contacted regarding the usage of a lathe cut O-ring for this application and they confirmed that the only acceptable O-ring replacement part for this application was a circular cross-section O-ring.

An air flow test was performed on another Caterpillar D-11N dozer with the engine at normal operating RPMs. The radiator fan pulled air through the radiator and out the front. The air was then forced against the blade of the dozer and pulled back toward the engine compartment. A portion of the air was forced up over the top of the engine cover toward the cab. The test revealed that the air traveled the same path as the burn path of the dozer involved in the accident. The weather on the day of the accident was cool and clear, with very little wind.

CONCLUSION

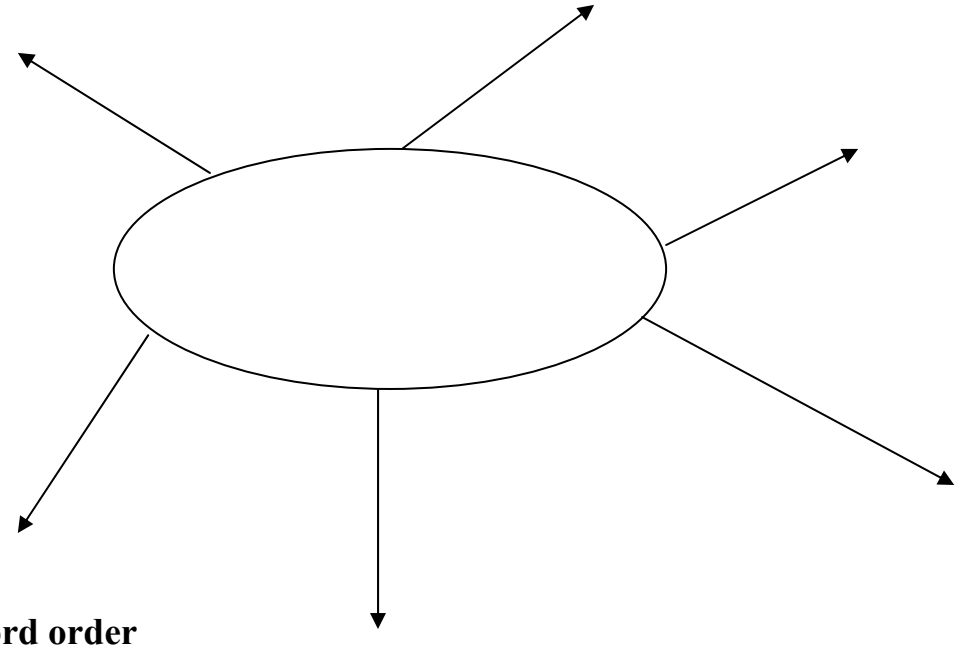
The accident occurred because oil leaked onto the engine of the dozer, contacted hot engine components, and ignited. Due to the extensive damage from the fire, the source of the oil leak could not be determined. The hoses that controlled the left lift cylinder and the improper O-ring for the right lift cylinder were found damaged; however, it could not be determined if either caused the fire. The failure of the dozer's fire suppression system to activate quicker may have contributed to the severity of the injuries.

(information was adapted from www.msha.gov\fatals)

WRITING BANK

Mind mapping

Ask students to close their eyes and think of <u>mining</u>. They should jot down all the things associated with <u>mining</u> that come into their minds. Set a definite time limit (1-2 minutes). Let them jot down things in their first language if they do not know the English words.



Word order

English is generally considered to be a language with a relatively fixed word order. In practice, this means that the positions of the subject **S,** the main verb **V** and the object **O** are fixed in relation to each other.

S (subject) –V (verb) – O (object).

Put the words in the correct word order.

1. is, dusty, dim, the, and , environment, working, noisy.
2. industry, skilled, in, machine, the, operators, highest, some, the, in, are, of, salary.
3. longwall, form, of, mining, coal, is, a, mining, underground.
4. coal, draglines, dirt, remove, to , other, expose, and, minerals, underneath.
5. there, coal, are, basic, two, mine, ways, to.

Summary Completion

You complete the summary by writing no more than three words and \ or a number from the passage in each gap. The summary may cover the ideas in the whole passage or may be based on a section of the passage only.

Complete the summaries below.
Choose ONE OR TWO WORDS from the passage for each answer. Use the words from the box below.

Questions 1-4

Dredging is a high-volume mining technique for _____products. Dredging is operation usually carried out in _____ areas. The purpose of dredging is to gather up _____ _____. A simple method is _____ _____.

Questions 5-9

Underground mining includes different methods, such as _____ _____, pillar mining and others. Pillar mining is a common _____ _____ type. Longwall mining is the most _____mining method. It _____ _____ is about 75%. However, this method cannot be used in all _____circumstances.

Questions 10-15

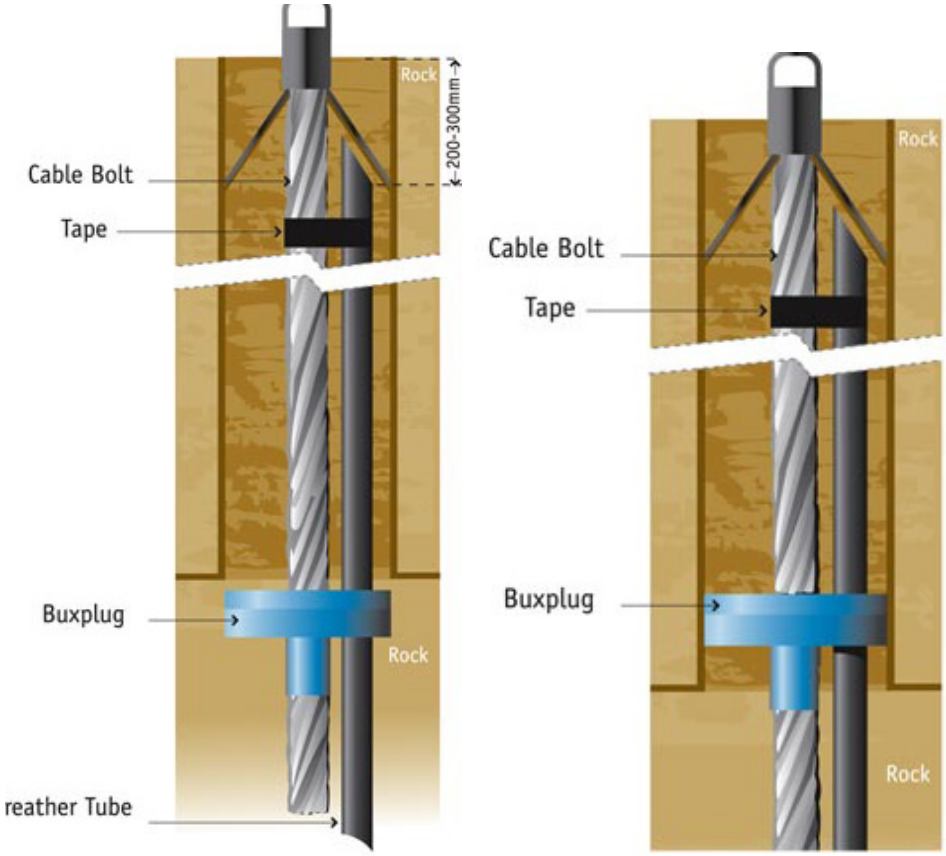
_____ mining is carried out in various area regions. Surface mines are used to remove _____ from flat land. In_____ areas coal is removed in contour mines. If there are coal seams at the _____of mountains, then mountaintop _____ mines are applied. The surface mining types depends on the type of _____.

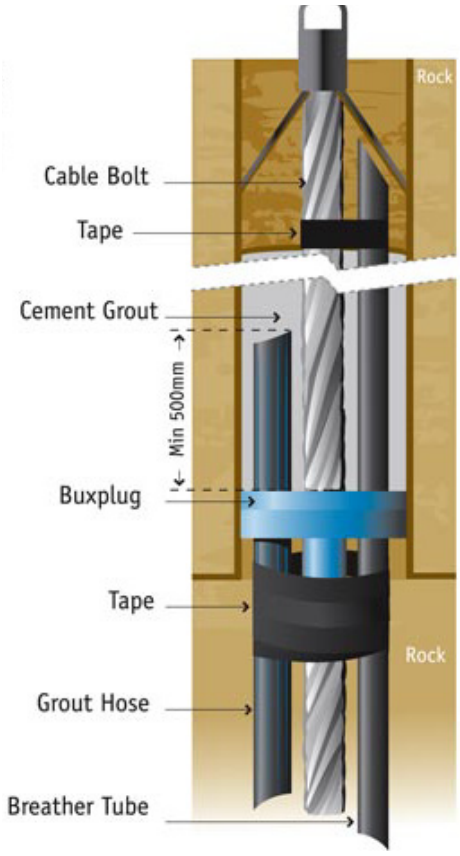
geological longwall mining recovery rate top low-value
water surface landscape coal mining efficient grab dredgers
mountainous bottom sediments

Description: process and procedure

What is this? **Go to Reading Bank, pg. 85.** ***Identify the parts and write them down. Give a characteristic of this device.***
Look at the diagram and describe the process, using the words in the box.
Don't forget: use only the PASSIVE VOICE!!

device	
plugging method	through
installation	firmly
lighter	
durable	
easier to handle	
	that is (i.e.)
slide	first
guide	further
push	now
insert	too
tape	overall





(adapted from www. buxplug.innicon.com)

Definitions

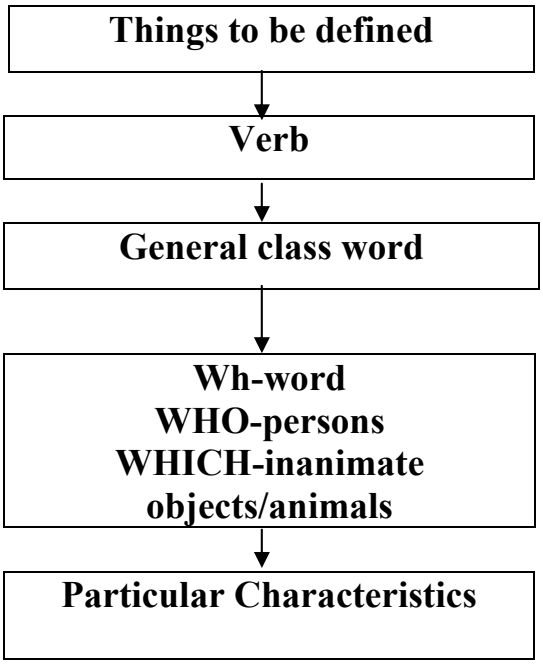
A BRIEF DESCRIPTION OR EXPLANATION OF THE PRECISE MEANING OF A TERM

When we describe things, especially in academic writing, it must be **perfectly clear** ***what is meant.***
There are three types of definitions:

1. simple
2. academic
3. extended

1. SIMPLE (REAL) DEFINITION that explains precisely the essential, intrinsic (свойственный) characteristics of an object.

STRUCTURE of a SIMPLE DEFINITION

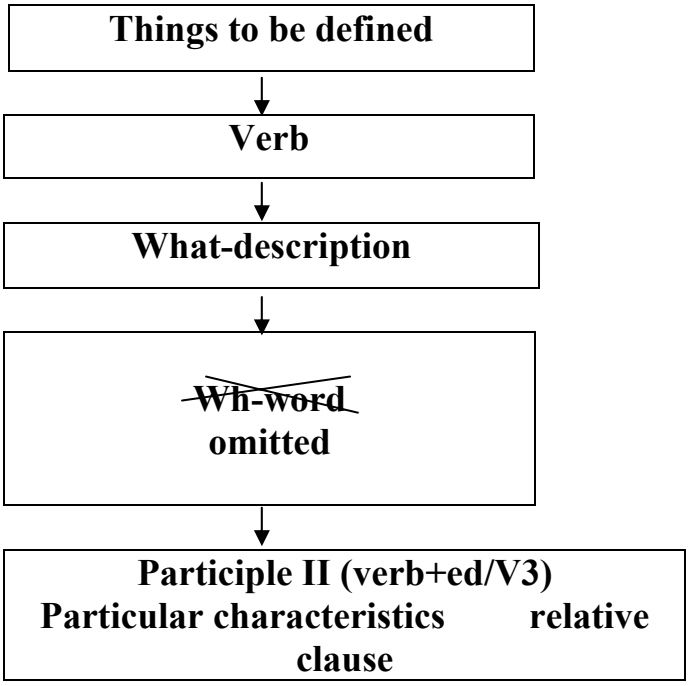


EXAMPLE: Exploration geologist is a person who discovers oil and gas accumulations.

2. ACADEMIC (NOMINAL) DEFINITION that helps to determine the meaning of the term.

The wh-word is omitted. A definition written in this way uses a reduced relative clause. Academic subjects may be more cautiously defined.

STRUCTURE of an ACADEMIC DRFINITION

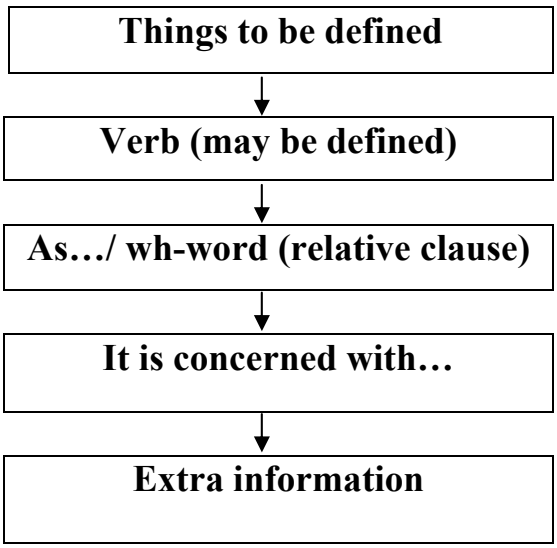


EXAMPLE: A mineral is a structurally homogeneous solid of definite chemical composition, formed by the inorganic process of nature.

3. EXTENDED DEFINITION defines an academic subject more specifically (when more information is given). A definition may be extended in order to be more precise/ to give more information about the subject.

EXAMPLE: Econometrics may be defined as the branch of economics which applies mathematical and statistical techniques to economic problems. It is concerned with testing the validity of economic theories and providing the means of making quantitative predictions.

STRUCTURE of an EXTENDED DRFINITION



STRUCTURE AND VOCABULARY AID

A. Frequently used verb forms for definitions

Present Simple (Active / Passive)

	is…….
	means…
X	is defined as…
	is used….
	describes…

B. Relative clauses

Relative clauses are often used to qualify or give extra information

C. Useful verbs:

is concerned with
deals with
relates to
involves

D. Defining an object

A	is is equal to equals is equivalent to corresponds to is said to be may be said to be	(noun with attribute) (noun without attribute) B = (noun + genitive) (noun + preposition + object)

E. Defining an object by assigning it to a category and specifying it.

A	is is may be	called termed thought of as referred to as defined as	B + specification: (relative clause) (prepositional phrase) (to + infinitive) participle clause (ing/ed) participle clause +*to* infinitive / *for*+gerund

F. Sentence patterns:

A	defined by.. determined by…	is called is said to be is expressed as is expressed in the form of is termed	Z

(adapted from Writing in English. A Practical Handbook for Scientific and Technical Writers-pilot project)

Write a definition to the following terms -

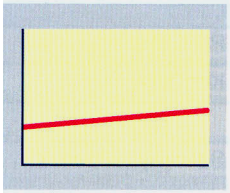
1. Simple definition- raise, extraction
2. Academic definition: engineering technician
3. Extended definition: geologist

Describing graphs and diagrams

Graphs

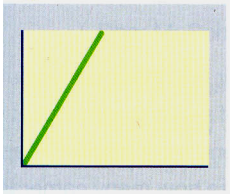
1. Complete the tables with the words below:

Fig.1



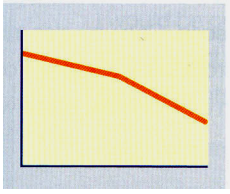
The temperature	rose	slightly.
	_____	_____
	_____	_____

Fig. 2



There was a	dramatic	rise	in solar energy production.
	_____	_____	
	_____	_____	

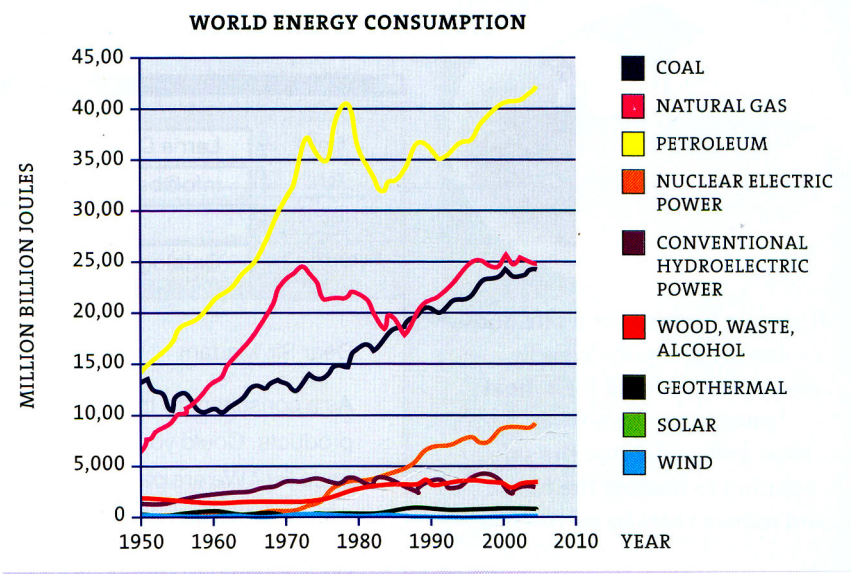
Fig. 3



Rice production	fell	significantly.
	_____	_____
	_____	_____

considerably	increased
decreased	moderately
dropped	sharp
gradually	slowly
growth	steep
increase	went up

2. Look at the graph in Fig. 4
    1. What is the topic of the graph?
    2. What does the horizontal (X) axis represent?
    3. What are the figures on the vertical (Y) axis?
    4. What were the most important sources of energy? Why are 1978 and 1983 significant? What do you notice about alternative sources of energy? Which source of energy grew significantly after 1970?



3. Read the description of the graph in Fig. 4.
   1. What is the purpose of the first sentence?
   2. What is the purpose of the second sentence?
   3. Which words have a meaning similar to *approximately*?

The graph in Fig. 4 shows how much energy from different sources was used between 1950 and 2005. We can see that over this period the amount of energy used increased sharply and the largest amount of energy came from petroleum. In 1950 just over 13.000 million billion Joules was used but this figure rose sharply to reach a peak of roughly 40.000 million billion Joules in 1978. There was a dramatic fall to just over 30.000 million billion in the following five years before rising rapidly to reach 42.000 million billion Joules by 2005. The second and third largest sources of energy were natural gas and coal, which each accounted for about 25.000 million billion Joules in 2005. The graph shows that insignificant amounts of energy came from renewable sources during this time, but there was a growth in the amount of nuclear electric power after 1970, reaching approximately 8.000 million billion Joules in 2005. The fall in energy consumption in the years around 19809 was probably due to the world oil crisis.

(adapted from Eric H. Glendinning, Technology 2 (2008) Oxford University Press.)

Paraphrasing

Squeeze the following sentences to leave only key words.

1. The formation of valuable mineral deposits result from a combination of factors, conditions, and events which go hand in hand to determine the areas in which metals are gathered into concentrations greatly.
2. Highly mobile and volatile solutions contain high concentrations of metal and carry them to some point where chemical and physical conditions are favorable for deposition.
3. Primary structures are features such as bedding in sediments, igneous contacts, pillows in lavas, and other minor features that developed during the formation of the rock mass.
4. Rocks differ from minerals in that rocks are merely physical mixtures of minerals, while the minerals themselves are chemical compounds of fairly uniform composition.
5. Hydrothermal and secondary deposits are found in areas where rocks have been "prepared" in advance by some kind of structural deformation.

Writing a Paragraph

A paragraph is a group of sentences that tell about one main idea. The first line of a paragraph is always indented. Not every group of sentences is a paragraph. In order for it to be a paragraph, ***there must be one main idea.*** Often a paragraph contains a sentence that tells what the main idea of the paragraph is. This is called the ***topic sentence.*** The other sentences give ***supporting details*** about the main idea.

Summarizing

REMEMBER the following rules when writing your summary.

- Read the whole of the original text quickly to gain an impression of its content and its relevance to your work.
- Highlight the main points as you read.
- Make notes on these points.
- Put away the original and rewrite your notes in your own words in complete sentences.
- Begin your summary with a statement of the main idea at the start.

- Using your notes, write out your supporting points in well-connected sentences.
- Re-read your work to check that you have included all the information that you need.

Write a summary about Henry's accident. Go to Reading Bank -Report of Investigation, pg. 90 based on the Accident Investigation Inspector report. Look through the presented report to find all necessary information.

GLOSSARY

A

accelerator (n)– a foot pedal of a car that controls the speed.

adit (n)- a nearly horizontal passage from the surface into a mine.

adit level (n) – mine workings on a level with an adit.

adit portal (n) –a nearly horizontal passage from the surface by which a mine is entered and dewatered.

asset (n)- an advantage or resource

B

base metals (n) – any of certain common metals, such as copper, lead, zinc and tins as distinct from the precious metals, gold, silver and platinum.

blaster (n) – a person who is responsible for placing and detonating of explosives to demolish structures or to loosen, remove, or displace earth, rock, or other materials.

bolter (n)– a person who operates machinery to install
roof support bolts in underground mine.

brattice builder (n) – a person who builds doors or ventilation walls or partitions in underground passageways to control the proper circulation of air through the passageways and to the working place.

breakdown (n) – a sudden failure in operation or effectiveness.

broken ore (n) – rock or mineral formations fragmented by blasting with explosives.

bulk (n)– a distinct mass or portion of matter, especially a large one.

bulldozer (n) – a powerful machine used for pushing heavy objects, earth etc. out of the way when a level surface is needed.

C

cable bolt (n)– suited to stabilize rock surfaces, particularly to withstand loads.

caution (n)- alertness and prudence in a hazardous situation; care.

commodity (n) – an article of trade or commerce, especially a mineral.

component (n)- a constituent element, as of a system.

concentrate (n)- the desired mineral that is left after impurties have been removed from mined ore.

concentration (n) – the measure of the amount of a substance contained in a liquid.

confined (n)- limited or restricted.

contamination (n)- smth. that is impure or unsuitable by contact or mixture with unclean, bad materials, substances, etc.

continuous mining (n) - the method of rock extracting that means equipment that constantly extracts coal (or other rocks) while it loads it.

contract company (n) – a professional management consultancy for companies seeking qualified individuals, methods and technology to assist with strategic initiatives.

core sample (n)- a cylindrical section of a naturally medium consistent enough to hold a layered structure.

crane (n) – a machine for lifting and moving heavy objects by means of a very strong rope or wire fastened to a long movable arm.

cumulative production (n)- a knowledge of what has been produced is the understanding of current resources.

D

danger (n)- exposure or liability to injury, pain, harm or loss.

depletion (n)– the act of decreasing smth.

deposit (n) – an accumulation or layer of solid material, either consolidated or unconsolidated, left or laid down by a natural process.

development mining (n) - work undertaken to open up coal reserves as distinguished from the work of actual coal extraction.

raise (development) (n)– a shaft which joins two levels by definition mined upwards.

differentiation (n) – chemical zonation caused by differences in the densities of minerals.

dragline (n) – a large excavation machine used in surface mining to remove overburden (layers of rock and soil) covering a coal seam.

dragline mining (n) – one of surface mining methods which uses draglines.

dragline operator (n) – a person who operates power-driven crane equipment with dragline bucket to excavate or move sand, gravel, mud, or other materials.

dredge (dredging) (v) – to bring to the surface of water using a dredger.

dredge operator (n) – a person who operates power-driven dredges to mine sand, gravel, or other materials from lakes, rivers, or streams; and to excavate and maintain navigable channels in waterways.

dump (n)- the mechanism for unloading, e.g. a car dump (sometimes called tipple); or, the pile created by such unloading, e.g. a waste dump (also called heap, pile, tip, spoil pike, etc.)

E

economic (n)- extraction of the ore reserve has been established or analytically demonstrated to be viable and justifiable under reasonable investment assumptions.

electric power generation (n)-large-scale production of electric power for industrial, residential and rural use.

engineering technician (E-technician) (n)– a person who has relatively practical understanding of the general theoretical principles of the specific branch of engineering in which they work.

environmental impact (n)- possible effect-positive or negative- on the environment (surroundings), including natural, social and economic aspects.

exploration (n)- the act or process of exploring.

explosive (n) – any rapidly combustive or expanding substance. The energy released during this rapid combustion or expansion can be used to break rock.

extraction (n) - the process of mining and removal of ore from a mine.

F

feasibility (n) – the determination as to whether the assigned tasks could be accomplished by using available resources.

feature (n)- a prominent \ distinctive part (aspect) of a landscape.

ferroalloy metals (n) – any of various alloys of iron and one or more other elements, such as manganese or silicon used as a raw material in the production of steel.

fissionable metals (n) - capable of undergoing nuclear fission as a result of any process.

foul (air) (n)- containing or characterized by offensive matter or material.

G

gangue (n) - unwanted material, minerals or rock, with which ore minerals are usually intergrown; valueless and undesirable material, such as quartz in small quantities, in an ore.

gold (n)- a soft, yellow, corrosion-resistant element, the most malleable and ductile metal, occurring in veins and alluvial deposits

geologist (n) – one who studies the constitution, structure, and history of the earth's crust, conducting research into the formation and dissolution of rock layers, analyzing fossil and mineral content of layers, and endeavoring to fix historical sequence of development by relating characteristics to known geological influences (historical geology).

grade (n) - a position in a scale of size, quality or intensity.

grain distribution (n)- classification of the relative size of the particles composing a substance or pattern.

H

haulage (n)- horizontal transport of ore, coal, supplies, and waste. The vertical transport of the same is called hoisting.

haulage drift (level) (n)– the arteries of a mine as they transport the valuable minerals out of the mining zone.

hazard (n)- anything that has the potential to cause harm.

host rock (n)- rock which serves as a host for other rocks or mineral deposits.

hypogene (n)- formed or situated below the earth's surface.

hypothetical resources (n)- undiscovered resources that are similar to known ones and that may be reasonably expected to exist in the same producing distribution of analogous geologic conditions.

I

incline (n)- any entry to a mine that is not vertical (shaft) or horizontal (adit). Often incline is reserved for those entries that are too steep for a belt conveyor (+17 degrees -18 degrees), in which case a hoist and guide rails are employed.

incline(d) shaft (n) - secondary inclined opening, driven upward to connect levels, sometimes on the dip of a deposit.

identified resources (n)- resources whose location, grade, quality and quantity estimated from specific geologic evidence.

indicated resources (n)- quantity and grade and (or) quality are computed from information used for measured resources.

industrial minerals (n) - any rock, mineral or other naturally occurring substance of economic value, exclusive of metallic ores, mineral fuels and gemstones.

inferred resources (n)- estimates are based on an assumed continuity beyond measured resources, for which there is geologic evidence.

infrastructure (n) – the system or structures which are necessary for the operation of a country or an organization.

intergrowth (n)- the growing together of crystals from two or more minerals.

invade (v) – intrude upon, encroach on.

investigation (n)- a searching inquiry for ascertaining facts; detailed or careful examination.

iron (n)- silvery-white, lustrous, malleable ductile magnetic, metallic element occurring abundantly in combined forms.

L

label (n)- short word or phrase describing or indicating a procedure, movement or action.

leaching (n) – separation a substance from material by passing water through the material.

lead (n)- soft, malleable, ductile, bluish-white, dense metallic element, extracted chiefly from galena.

life cycle (n) – a progression thoroughly a series of differing stages of the development.

load-haul dump machine (n) – a machine allowing safely to extract ore from dangerous zones.

loading station (pocket) (n)- transfer point at a shaft where bulk material is loaded by bin, hopper, and chute into a skip.

longwall machine (n)– equipment (machine) with a plow or rotation drum which goes back and forth across a face of coal.
longwall mining (n) employs rotation drum, which is pulled mechanically back and forth across a face of coal. The loosened coal falls onto a conveyor for removal from the mine.

M

marginal reserves (n)- part of the reserve base which at the time of borders on being economically producible.

marketing (n) –the branch of business concerned with advertising.

mechanical engineer (n) – a person who performs engineering duties in planning and designing machineries and mechanical equipment, oversees installation, operation, maintenance, and repairs of such equipment as centralized heat, gas, water, and steam systems.

mercury (n)- a silvery-white poisonous metallic element, liquid at room temperature.

measured reserves (n)- quantity is computed from dimensions revealed in outcrops or drill holes; grade and (or) quality are computed from the results of detailed sample inspection, sampling and measurements are spaced so closely and the geologic parameters defined that size, shape, depth and mineral content of the resource are well established.

mill (mineral dressing plant) (n)- building equipped with machinery for processing raw materials into finished or industrial products.

mineral (n) – a naturally occurring homogeneous inorganic solid substance having a definite chemical composition and characteristic crystalline structure, color and hardness.

mineral deposit (n) – minerals that have been laid (set) in rock by a natural process.

mineral occurrences (n)- prospect of geological interest but not necessarily of economic interest.

mineral resources (n) – valuable mineral deposits of an area that are presently recoverable and may be so in the future, includes known ore bodies and potential ore.

mineral separation (processing) (n) – treating crude ores and mineral products in order to separate the valuable minerals from the waste rock (gangue). It's the first process that most ores undergo after mining in order to provide a more concentrated material for the procedures of extractive metallurgy.

mineralization (n)- introduction of minerals into a rock resulting in a mineral deposit.

mineralogical form (n)- the properties of a mineral that govern the ease with which existing technology can extract and refine certain metals.

mining engineer (n)– a person who determines the location and plans ways of extraction of any natural resources.

N

nature (n) –essential characteristics and qualities of a thing.

non-metal mining (n) – extraction of non-ferrous metals.

non-renewable resources (n) – a natural resource which cannot be produced, re-grown, regenerated or reused on a scale which can sustain its consumption rate.

O

open pit (n)- a method of extracting rock (minerals) from the earth by their removal from an open pit.

ore (n) – a metalliferous mineral, or an aggregate of metalliferous minerals, which can be profitable.

ore bin (n) – a container for ore awaiting treatment or shipment.

ore body (n) – portion of a mineralized envelope within which ore reserves have been defined.

ore character (n)- is the type of ore that affects the mining operations.

ore dressing (n) – treatment of ores to concentrate their valuable minerals into products (concentrate) of smaller bulk and simultaneously to collect the gangue (worthless mineral) into tailing (discardable waste).
ore grade (n)- concentration of a metal in an orebody.

ore minerals (n)- minerals (galena, sphalerite) that form the economic portion of the mineral deposit.

ore reserves (n) - economically mineable part of a measured or indicated mineral resource.

outline (n) – a line showing the shape of something.

overburden rock (n)- rock overlying the mineral deposit and is removed.

overseeing (n)- supervision or management.

P

precaution (n)- a measure taken in advance to avert possible harm or to secure good results.

percentage (n)- result obtained by taking a given percent of a given quantity.

percolating (n) –process of passing slowly through a material that has small holes in it.

placer (n) – a glacial or alluvial deposit of sand or gravel containing eroded particles of valuable minerals.

possible ore (indicated) (n) - may indicate enough information to infer that ore extends for some way into only partially explored ground and that it may amount to a certain volume and grade.

precious metals (n)- any of the less common and valuable metals often used to make coins and jewelry.

precipitating (n)- a substance that is precipitated (become insoluble) from a solution or gas.

pre-feasibility (n) – a comprehensive study of the viability of a mineral project that has advanced to a stage where the mining method has been established and an effective method of mineral processing has been determined.

protore (n) - mineral material in which an initial but uneconomic concentration of metals has occurred that may by further natural processes be upgraded to the level of ore.

proved ore (measured) (n) – ore in which there is practically no risk of failure of continuity.

Q

quarry (ing) (n) – a place from which stones or sand are dug out.

R

raise (n) - a secondary or tertiary inclined opening, vertical or near-vertical opening driven upward form a level to connect with the level above, or to explore the ground for a limited distance above one level.

rearrangement (n) – a chemical reaction involving a change in the bonding sequence within a molecule.

reconnaisance (n) – exploration of an area, especially one made to gather necessary information.

recovery (n)- act of obtaining usable substances from unusable substances.

reduction (n) – the amount by which anything is decreased.

refining (n) – purifying or improving.

related non-metals (n) – any of those elements lacking the characteristics of a metal.

removal (n)– a taking away or being taken away.

reposition (n) – replacement.

reserve (n)- that part of the reserve base which could be economically extracted at the time of determination (include only recoverable materials).

residual deposits (n) – a mineral deposit formed by the weathering of pre-existing rocks and the removal of disintegrated material.
residual (solution) (n) – a quantity left over at the end of a process.

resistance (n) – opposition of some force, thing, etc. to another or others.

resources (n)– a concentration of naturally occurring solid, liquid, or gaseous forms of the Earth's crust in such form and amount that economic extraction of a certain concentration is currently or potentially feasible.

reworking (n) – any geologic material that has been removed or displaced by natural agents from its origin and incorporated in a younger formation.

rich in (n) – having valuable resources.

risk **(**n)- the likelihood that illness, injury, or even death might result

rock dust machine (n) – a machine that distributes rock dust over the interior surfaces of a coal mine by means of air to prevent coal dust explosions.

rock splitter (n) – a person who splits rough dimension stone into smaller units, such as paving blocks, ashlar, or rubble.

roof bolt (n) – a long steel bolt driven into the roof of underground excavations to support the roof, preventing and limiting the extent of roof falls.

S

safety (n)- the quality of averting or not causing injury, danger or loss.

safety inspector (n)– an engineer who controls the whole mining process to be safe for the workers and environment.

shaft (n)- a primary vertical or non-vertical opening through mine strata used for ventilation or drainage and/or for hoisting of personnel or materials; connects the surface with underground workings.

shaft mine (n)– an underground mine in which the main entry or access is by means of a vertical shaft.

shaft pillar (n) – a large area of a ore seam which is left unworked around the shaft bottom to protect the shaft from damage by subsidence.

shuttle car (n) – a self-discharging truck, used for receiving coal from the loading or mining machine and transferring it to an underground loading point, mine railway or belt conveyor system.

silver (n)- metallic chemical element, nearly white, lustrous, soft, very ductile, malleable and an excellent conductor of heat and electricity.

slope (n)- a belt conveyor incline.

smelting (n) – (metallurgy) any process of melting, especially to extract a metal from its ore.

solidification (n) – a process of a substance becoming solid, hard or firm.

speculative resources (n)- undiscovered resources that may occur either of deposits in favorable geologic settings where mined discoveries have not been done or deposits as yet unrecognized for their economic potential.

stope (n)- underground spaces produced by stoping.

stoping (n)- removal of the wanted ore from an underground mine leaving behind an open space.

stripping ratio (n)- unit amount of spoil or waste that must be removed to gain access to a similar amount of ore or mineral material.

sublevel (n) – an intermediate level opened a short distance below the main level (or 4.6 -6.1m. level below the top of the ore body, preliminary to caving the ore between it and the level above).

subeconomic resources (n)- part of identified resources that does not correspond to criteria of reserves and marginal reserves.

supergene (n)- enrichment occurring relatively near the surface.

surface mine (n) – a mine in which the coal lies near the surface and can be extracted by removing the covering layers of rock and soil.

surface mining (n) – a way of extracting the coal which lies near the surface and can be extracted by removing the covering layers of rock and soil.

surrounding rock (country rock) (n) – rock native to an area.

T

tailing (n)- refuse or dross (шлак) remaining after ore has been processed.

tonnage (n) - weight measured in tons.

truck (n) – AmE a large motor vehicle for carrying goods in large quantities.

U

unconsolidated (n)- loose or unstratified.

underground mining (“deep" mine)- (n)– a way of extracting coal or other minerals which are located several hundred feet below the earth's surface.

undesirable substance (n)- the present of harmful substances in ore and gangue minerals.

undiscovered resources (n)- resources the existence of which are only possible deposits.

unmined ore (n) – discovered, but eventually not mined because of the small size or the high costs of mining.

V

viability (n)– a capacity for developing under favorable conditions.

W

wall rock (n) – a rock that is immediately adjacent to a mineral vein, fault or igneous intrusion.

warning (n)- smth. that serves to give notice or advice of danger, possible harm or anything else unfavorable.

waste dump (n) – a site for the disposal of waste material by burial.

waste rock (n)- valueless rock that must be fractured and removed in order to gain access to or upgrade ore.

wasting asset (n) – a fixed asset, such as a mine, that diminishes in value over time.

winze (n) - secondary or tertiary vertical or near-vertical opening sunk from a point inside a mine for the purpose of connecting with a lower level or of exploring the ground for a limited depth below a level.

UNITS and ABBREVIATIONS

Units

With few exceptions the units used are all SI (Systeme International), which has been in common use by engineers and scientists since 1965. The principal exceptions are:

- for commodity prices still quoted in old units, such as Troy ounces for precious metals and the short ton (= 2000 lb.);
- when there is uncertainty about the exact unit used, e.g. tons in certain circumstances might be short or long (2240 lb);
- degrees Celsius (centigrade);
- centimeters (cm) which like C as they are so useful.

The following SI prefixes are used: k = kilo-, 10^3; M = mega-, 10^6 (million); G = giga - , 10^9(billion is never used as it has different meanings on either side of the Atlantic\ биллион (миллион миллионов) ; миллиард (тысяча миллионов)

Abbreviations

ASTM	American Society for Testing Materials
AAV	aggregate abrasion value
ACV	aggregate crushing value
AIV	aggregate impact value
BCM	bank cubic meters
BS	British Standard
CGF	Consolidated Gold Fields
CIF	Carriage, insurance and freight
CIPEC	Conseil Inter-governmental des Pays Exportateurs de Cuivre (Intergovernmental Council of Copper Exporting Countries)
EEC	European Economic Community (this is the correct name of what is sometimes referred to as the EC or European Community)

ERT	Emergency Response Team
FOB	Freight on broad
GIS	Geographic information systems
GPS	Global Positioning Satellite
JORC	Joint Ore Reserves Committee
LCM	loose cubic meters
LHD	load-haul-dump
LME	London Metal Exchange
MEC	Market economy countries
MSH	Mine safety and health
NPV	net present value
OECD	Organization for Economic Cooperation and Development
OHS	Occupational Health & Safety
OPEC	Organization of Petroleum Exporting Countries
PFE	percent frequency effect
PGM	Platinum group metals
ppb	parts per billion
ppm	parts per million
REE	Rare earth elements
REO	Rare earth oxides
RMR	rock mass rating
ROM	run-of-mine
RQD	rock quality designation
SG	specific gravity
SOW	scope of work
t p. a.	Tonnes *per annum*
t p. d.	Tonnes *per diem*
UTM	Universal Transverse Mercator
VMS	volcanic associated massive sulfide (deposits)
WGS	World Geodetic System

ENGLISH-RUSSIAN DICTIONARY

A

abundance	относительное содержание; распространённость
accident	несчастный случай
adit level	горизонт штольни
adit portal	устье штольни
alteration	изменение пород по сложению и составу; метаморфическое вытеснение
arc flash	вспышка дуги
asset	актив(ы)

B

base metal	обычный (неблагородный) металл
bedding	напластование, наслоение; залегание
blaster	взрывник
brattice	вентиляционная перемычка (деревянная)
breakdown	разрушение горных пород
breather tube	вентиляционная труба
broken ore	раздробленная руда
bulk	масса; объем; большая часть, основная часть
bulldozer	бульдозер
burning off	выжигание

C

cable bolt	тросовой анкер
cake	спёкшаяся масса (неспрессованного порошка)
caution	предупреждение
coal seam	пласт угля, угольный пласт
commercial value	рыночная стоимость
commodity	предмет потребления
concentration	обогащение (руды)
conductivity	удельная проводимость; электропроводность
confined	заключенный; замкнутый
contact line	линия контакта
contamination	загрязнение
continuous mining	непрерывная выемка

contract company	подрядчик
copper	медь
core sample	керн
coupler	соединение
crane	(грузо) подъемный кран
crane	(грузо)подъемный кран
cross-section	поперечный разрез; поперечное сечение; профиль
crushed stone	бутовый камень, бут; щебень
cumulative production	суммарная [накопленная] добыча
cutting and channeling machine	роликогибочно-выемочный комбайн

D

danger	угроза, опасность
delineate (v)	схематически изображать
demonstrated resources	достоверные запасы
depletion	истощение (запасов месторождения), обеднение
deposition	отложение; осаждение
development raise	нарезной восстающий
differentiation	дифференциация
dip	падение; линия падения (пласта)
dislodging	отбойка (породы)
drag	тормозящий момент
drag rope	тяговый канат
dragline	скребковый экскаватор
dragline bucket	ковш драглайна
dragline mining	бестранспортная система разработки с перевалкой вскрыши драглайном
dragline operator	оператор скребкового экскаватора
dredge	экскаватор
dredge operator	оператор экскаватора
drilling-machine operator	оператор бурильной машины

E

economic feasibility	экономический анализ
economic uncertainty	экономическая неустойчивость
electric power generation	производство электроэнергии
electrolytic reduction	электролитическое восстановление
elevation	высота
encroach upon	захватывать, вторгаться; обводнять, затоплять (о краевой воде)

engineering technician	техник
enrichment	обогащение (повышение концентрации полезного компонента)
environmental impact	воздействие на окружающую среду
epigenetic	эпигенетический
equipment	оборудование; оснащение
exploration	разведка
explosive(s)	взрывчатые вещества
extraction	добыча; извлечение
F	
fault	сброс; сдвиг (породы); разрыв, разлом, трещина
feasibility	экономический анализ
feature	особенность; характерное свойство; отличительный признак 2. деталь; часть
ferroalloy (metals)	ферросплав
filler (paint)	наполнитель
fissionable (metals)	расщепляемый, способный к ядерному делению
fold	складка
foliation	сланцеватость, листоватость, слоистое строение
foul air	воздух с высоким содержанием диоксида углерода
foundry sands	формовочный песок
fracture	трещина; разлом; перелом; излом; разрыв
froth	пена
G	
gangue	пустая порода; породные примеси
geological assurance	геологический запас
geologist	геолог
gold	золото
grade	сорт
grain distribution	гранулометрический состав
grinding	измельчение, дробление
groundwater	подземные воды
grout	жидкий раствор
grout hose	шланг для цементного раствора
H	
hard-rock mining	разработка твёрдой породы
haulage drift (level)	откаточная выработка

haulage level	откаточный горизонт
hazard	(потенциальная) опасность
health issue	вопрос здравоохранения
hoist coupler	подъёмная соединительная муфта
hoist rope	подъёмный канат
host rock	вмещающая порода
hydraulic mining	гидравлическая разработка
hypogene	гипогенный
hypothetical resources	предполагаемые запасы
I	
identified reserves	изученные (установленные) запасы
incline shaft	шахта \ шток
industrial mineral	промышленный минерал
inflow water	приточные воды
infrastructure	инфраструктура
insulating rock	изолирующая порода
intercept	пересечение
intergrowth	прорастание, срастание
invaded	проникновение
investigation	расследование
iron	железо
L	
label	метка; (маркировочный) знак; отметка; обозначение
leaching	выщелачивание
lead	свинец
life cycle	срок службы
lineation	линейчатость
load-haul-dump	загрузка – обкатка - разгрузка
loading machine operator	оператор погрузочной машины
loading station	швейч
longwall machine	забойная машина
longwall mining	разработка длинными забоями
low-grade	низкий сорт
M	
machinery	машинное оборудование; машины
maintenance information	информация о техническом обслуживании
maintenance service	техническое обслуживание
marginal resources	ресурсы на границе рентабельности
marketing	сбыт, продажа
mechanical engineer	инженер - механик

mercury	ртуть
metal ore	рудный металл
mill (mineral dressing plant)	обогатительный завод
mine development	подготовка шахты или рудника к эксплуатации
mineral deposit	месторождение полезных ископаемых
mineral resources	минеральные ресурсы
mineral resources	минеральные ресурсы
mineral separation	обогащение
mineralization	минерализация; оруденение
mineralogical form	минералогическая форма
mining engineer	горный инженер
N	
nature	характер; свойство
non-metal mining	нерудная промышленность
nonmetallic mineral	полезные нерудные ископаемые
non-renewable resources	невозобновляемые ресурсы
nugget	самородок (золота)
O	
occurrence	залегание, месторождение
open pit	открытая разработка \ карьер
operating instruction	инструкция по эксплуатации
ore	руда
ore bin	бункер \ резервуар-накопитель
ore character	особенность руды
ore dressing	обогащение руды
ore grade	качество руды; сорт руды
ore mineral	рудный минерал
ore mineral	рудный минерал
(metal) ore mining	горнорудное дело
ore reserves	рудные экономические запасы
orebody	рудное тело
outcrop	обнажение пород
overburden rock	порода вскрыши
overlying rock	покрывающая порода
overseeing	наблюдение
oversight	контроль, надзор
P	
panning	промывание (золотоносного песка) в лотке
percentage	процент; процентное отношение

percolating	перколяционный
placer	(золотой) прииск, россыпь
platinum	платина
plugging	закупоривание
plunge	погружение
possible ore (inferred)	возможные, неразведанные запасы руды
precautions	мера предосторожности
precious metal	драгоценный металл
precipitating	выделение; выкристаллизовывание; выпадание
precipitation	осаждение; выпадение осадка
pre-feasibility	предпосылка экономического анализа
probable ore (indicated)	предполагаемый запас руды
procedure	образ действия; порядок осуществления действия; процедура
protore	первичная руда
proved ore (measured)	достоверные запасы
Q	
quarry	открытая разработка, карьер
R	
radon	радон
raise	штольня (при проходке туннеля); гезенк
reading (s)	данные из таблицы
rearrangement	перегруппировка
reconnaissance	первоначальная \ предварительная разведка
recovery	извлечение
redeposition	переотложение (оруденелость)
reduction	уменьшение; снижение
refining	афинирование, очистка; аффинаж (благородных металлов)
removal	выемка
reposition	переставлять
representation	обозначение
reserves	
residual deposit	остаточное отложение
residual solution	остаточный раствор
resistance	сопротивление; сопротивляемость
resources	запасы
reworking	повторная [вторичная] обработка
rich in (minerals)	богатый ископаемыми

risk	риск
roadheader	проходческий комбайн
rock formation	образование горных пород
rock-dust (machine)	породная пыль
roof bolter	оператор машины для постановки анкерной крепи
roof bolter	оператор машины для постановки анкерной крепи
runoff	сток
run-of-mine	рядовой

S

safety	безопасность
safety inspector	инспектор по технике безопасности
scale	масштаб
seepage	выход на дневную поверхность
shaft pillar	предохранительный целик шахтного ствола
shaft station	околоствольный двор
showering	охлаждение
shuttle car	самоходная вагонетка
silver	серебро
slope	наклонная выработка
sluicing	сепарация (минералов или металлов) в потоке воды
smelting	плавка, выплавка, плавление
solid line	сплошная линия
solidification	отвердевание; застывание; загустевание
speculative resources	предполагаемые запасы
sterling	чистое серебро
splitter (rock)	тот, кто занимается раскалыванием, расщеплением, делением на части, распределением и т. п.
stope	выемочная камера
strike	простирание
stripping(waste-to-ore) ratio	коэффициент вскрыши
study	анализ
subeconomic resources	нерентабельные запасы
sublevel	промежуточный уровень
sump	зумпф \ отстойник
supergene	гипергенный, супергенный
supporting pillar	колонковая опора

surface mining	разработка открытым способом
surrounding rock	вмещающая порода
T	
tailing	хвосты, отходы обогащения
tape	лента
target testing	опробование
thrust fault	взброс; открытый сброс; надвиг
tonnage	тоннаж
tools	инструментальные средства, инструментарий
total resources	общие ресурсы
trace	очень малое количество вещества
truck	грузовик
U	
unbroken ore	нераздробленная руда
unconsolidated	неуплотнённый; рыхлый
underground mining	подземные горные работы
undesirable substance	нежелательное вещество
undiscovered resources	вероятные [прогнозные] запасы
unmined ore	неразрабатываемая руда
V	
valuable mineral	полезный минерал
value	величина; значение
vertical shaft	вертикальный шахтный ствол
viability	жизнеспособность
W	
wall rock	боковая порода; вмещающая порода
warning	предупреждение
waste dump	породный отвал \ карьера
waste product	отходы
waste rock	пустая порода
wasting asset	истощимые активы
winze	гезенк \ подземная выработка
working platform	рабочая платформа

Учебное издание

АБРАМОВА Раиса Николаевна
БОЛСУНОВСКАЯ Людмила Михайловна
БАРАНОВА Анастасия Викторовна.

ГЕОЛОГИЯ РУДНЫХ МЕСТОРОЖДЕНИЙ И РАЗВЕДКА ПОЛЕЗНЫХ ИСКОПАЕМЫХ

Часть 1

Горное дело

Учебное пособие

Издано в авторской редакции

Научный редактор
доктор геолого-минералогических наук,
профессор В.Г. Ворошилов

Отпечатано в Издательстве ТПУ в полном соответствии с качеством предоставленного оригинал-макета

Подписано к печати 00.00.2011. Формат 60x84/16. Бумага «Снегурочка».
Печать XEROX. Усл. печ. л. 7,78. Уч.-изд. л. 7,05.
Заказ . Тираж 100 экз.

Национальный исследовательский Томский политехнический университет
Система менеджмента качества
Издательства Томского политехнического университета сертифицирована
NATIONAL QUALITY ASSURANCE по стандарту BS EN ISO 9001:2008

ИЗДАТЕЛЬСТВО ТПУ. 634050, г. Томск, пр. Ленина, 30
Тел./факс: 8(3822)56-35-35, www.tpu.ru