МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ДЕРЖАВНИЙ ВИЩИЙ НАВЧАЛЬНИЙ ЗАКЛАД
«НАЦІОНАЛЬНИЙ ГІРНИЧИЙ УНІВЕРСИТЕТ»

ІНОЗЕМНА (АНГЛІЙСЬКА) МОВА

МОДУЛЬ 2

ЗАВДАННЯ І ВПРАВИ ДЛЯ ПРАКТИЧНИХ ЗАНЯТЬ ТА САМОСТІЙНОЇ РОБОТИ

Дніпропетровськ
2013

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ФАКУЛЬТЕТ МЕНЕДЖМЕНТУ

кафедра іноземних мов

ІНОЗЕМНА (АНГЛІЙСЬКА) МОВА

МОДУЛЬ 2

«Стратегії пошуку інформації в іншомовних друкованих та електронних джерелах та їх дослідження»

для бакалаврів галузі знань 0505 Машинобудування та матеріалообробка

ЗАВДАННЯ І ВПРАВИ ДЛЯ ПРАКТИЧНИХ ЗАНЯТЬ ТА САМОСТІЙНОЇ РОБОТИ

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НГУ

2013

Іноземна (англійська) мова. Модуль 2 «Стратегії пошуку інформації в іншомовних друкованих та електронних джерелах та їх дослідження». Завдання та вправи до практичних занять та самостійної роботи для бакалаврів галузі знань 0505 Машинобудування та матеріалообробка / М.Л. Ісакова. – Д.: Національний гірничий університет, 2013. – 74с.

Автор: М.Л. Ісакова, доцент

Затверджено до видання редакційною радою ДВНЗ «НГУ» (протокол № 2 від 02.07.2013) за поданням кафедри іноземних мов (протокол № 10 від 13.06.2013).

Методичні матеріали призначено для практичних занять бакалаврів галузі знань 0505 Машинобудування та матеріалообробка (гірничотехнічних спеціальностей) з навчальної дисципліни «Іноземна (англійська) мова», Модуль 2 «Стратегії пошуку інформації в іншомовних друкованих та електронних джерелах та їх дослідження». Мета методичних рекомендацій: удосконалення комунікативних умінь та навичок володіння іноземною (англійською) мовою при спілкуванні на професійно-орієнтовані теми та оволодіння новітньою фаховою інформацією через іноземні джерела.

Методичні матеріали містять автентичні тексти, що представляють актуальну інформацію про видобувну та переробну промисловість країни, мова якої вивчається, також містяться завдання та вправи для розвитку словарного запасу та розширення діапазону функціональних зразків, в кінці подається список термінів в алфавітному порядку. Граматичні явища і вправи для їх засвоєння наводяться в кожному розділі.

Відповідальна за випуск завідувач кафедри іноземних мов
проф. Кострицька С.І.

Unit 1

By the end of Unit 1 you will be able to:

a) describe trends and graphs using a wide variety of vocabulary

b) recognise passive constructions in professional-oriented text and interpret their meaning into your native language appropriately

c) use passive constructions correctly to talk about professionally-oriented topics

Lead-in

1. Answer the question: What influenced your choice of profession? Share your ideas with your partner.

2. Work in pairs, write down 3 advantages and 3 disadvantages of your future profession.

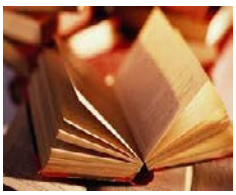
3. Work in groups of 4 to make a common list. Prepare a small presentation, use phrases from Word bank – Comparison and Contrast (p. 61) – to help you.

Pre-reading Discuss with a partner your guesses on the questions given below:

1. Are mineral resources limited?

2. What are the approximate figures for oil, coal and other mineral resources?

3. What are the consequences for different industries?



While-reading

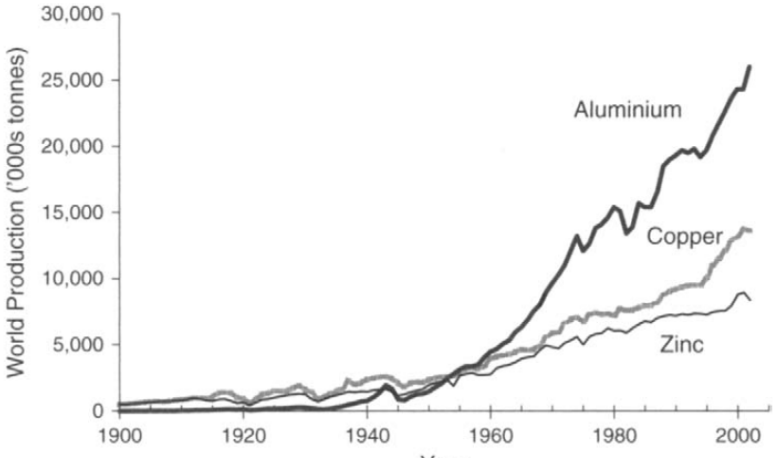
1. Check your guesses with the text.

2. Look through the text and find countries and minerals that are mentioned. Circle the countries and <u>underline</u> the minerals.

Metallic ore processing

Metals (Part 1)

The *enormous* **growth** of industrialisation from the eighteenth century onward led to *dramatic* **increases** in the annual output of most mineral commodities, particularly metals. Copper output **grew** *by a factor* of 27 in the twentieth century alone, and aluminium by an *astonishing* factor of 3800 in the same period. Figure 1.1 shows the world production of aluminium, copper and zinc for the period 1900-2002 (data from USGS, 2005).



All these metals suffered to a greater or lesser extent when the Organisation of Petroleum Exporting Countries (OPEC) **quadrupled** the price of oil in 1973-74, ending the great postwar industrial boom. The situation **worsened** in 1979-81, when the Iranian revolution and then the Iran-Iraq war **forced** the price of oil **up** from $13 to nearly $40 a barrel, plunging the world into another and deeper recession, while early in 1986 a **glut** in the world's oil supply **cut** the price from $26 a barrel in December 1985 to below $15 in 1986. Iraq's invasion of Kuwait in 1990 **pushed** the price **up** again, from $16 in July to a **peak** of $42 in October, although by then 20% of the world's energy was being provided by natural gas.

In 1999, overproduction and the Asian economic crisis **depressed** oil prices to as low as $10 a barrel from where it has **climbed** *steadily* to a record figure of over $60 a barrel in 2005, driven largely by demand especially from the

emerging Asian economies, particularly China.

These large **fluctuations** in oil prices have had a *significant* impact on metalliferous ore mining, due to their, influence both on the world economy and thus the demand for metals, and directly on the energy costs of mining and processing. It has been estimated that the energy cost in copper production is about 35% of the selling price of the metal.

The price of metals is governed mainly by supply and demand. Supply includes both newly mined and recycled metal, and recycling is now a significant component of the lifecycle of some metals- about 60% of lead supply comes from recycled sources. There have been many prophets of doom over the years pessimistically predicting the imminent exhaustion of mineral supplies, the most extreme perhaps being the notorious "Limits to Growth" report to the Club of Rome in 1972, which forecast that gold would run out in 1981, zinc in 1990, and oil by 1992. In fact major advances in productivity throughout the 20th century greatly increased both the resource and the supply of newly mined metals, through geological discovery and reductions in the cost of production. This actually **drove down** metal prices in real terms, which **reduced** the profitability of mining companies and **had a damaging effect** on economies heavily dependent on mining, particularly those in Africa and South America. This in turn **drove** *further* **improvements** in productivity and technology. Clearly mineral resources are finite, but supply and demand will generally **balance** in such a way that if supplies **decline** or demand increases, the price will increase, which will motivate the search for new deposits, or technology to render marginal deposits economic, or even substitution by other materials. Interestingly gold is an exception, its price having not changed much in real terms since the sixteenth century, due mainly to its use as a monetary instrument and a store of wealth.

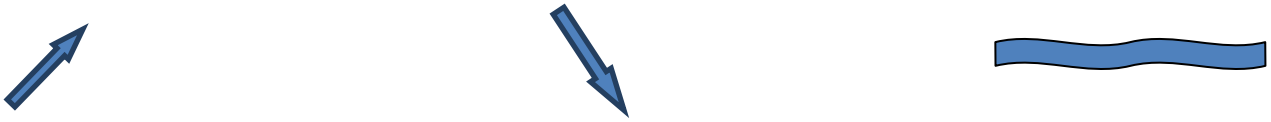
Estimates of the crustal abundances of metals are given in Table 1.1, with the actual amounts of some of the most useful metals, to a depth of 3.5 km.

Table 1.1 Abundance of metal in the oceans

Element	*Abundance* (%)	*Amount in* 3.5 km *of crust* (tonnes)	*Element*	*Abundance* (%)	*Amount in* 3.5 km *of crust* (tonnes)
(Oxygen)	46.4		Vanadium	0.014	10^{14}–10^{15}
Silicon	28.2		Chromium	0.010	
Aluminium	8.2	10^{16}–10^{18}	Nickel	0.0075	
Iron	5.6		Zinc	0.0070	
Calcium	4.1		Copper	0.0055	10^{13}–10^{14}
Sodium	2.4		Cobalt	0.0025	
Magnesium	2.3	10^{16}–10^{18}	Lead	0.0013	
Potassium	2.1		Uranium	0.00027	
Titanium	0.57		Tin	0.00020	
Manganese	0.095	10^{15}–10^{16}	Tungsten	0.00015	10^{11}–10^{13}
Barium	0.043		Mercury	8×10^{-6}	
Strontium	0.038		Silver	7×10^{-6}	
Rare earths	0.023		Gold	$<5 \times 10^{-6}$	
Zirconium	0.017	10^{14}–10^{16}	Platinum metals	$<5 \times 10^{-6}$	$<10^{11}$

3. Fill in the line graph with information from the text.

4. Classify the words in **bold** into three groups according to the trends. Then describe the graph above.



5. Fill in the table with the words in **bold** and in *italics* in correct cells. Use your dictionary to fill in the rest of the cells for each word (not every word can form all parts of speech).

Noun	Verb	Adjective/participle I	Adverb
e.g. **growth**	to grow (grew, grown)	growing	-------
			significantly

6. Work with the Table 1.1. in the text above. Underline the minerals extracted in Ukraine and write down the translation of the elements when necessary.

Post-reading Work individually to answer the question. Then discuss with your partner. Use Discussion language p. …

1. What do you think are the consequences of oil price fluctuations?
2. What are possible problems connected with drop in the price of metals and stability of the price of gold for Ukraine?

Grammar in context

1. Look through the text above and find the sentences, put the verbs in brackets in correct form. Translate the sentences and explain the use of Tenses.

1. 20% of the world's energy (provide)_____ by natural gas.
2. It (estimate) _____ that the energy cost in copper production is about 35% of the selling price of the metal.
3. The price of metals (govern) _____ mainly by supply and demand.

2. Read the sentences from the text and identify the voice (active or passive), tense (Past, Present or Future: Simple, Continuous or Perfect) and transitivity (transitive or intransitive).

1. Iraq's invasion of Kuwait in 1990 pushed the price up again.
2. Figure 1.1 shows the world production of aluminium, copper and zinc for the period 1900-2002.
3. These large fluctuations in oil prices have had a significant impact on metalliferous ore mining.
4. This actually drove down metal prices in real terms.
5. Estimates of the crustal abundances of metals are given in Table 1.1.

3. Transform the sentences from Task 2: passive into active and active (where possible) into passive. Translate the sentences.

Over to you …

Which of the minerals from Table 1.1 are found in Ukraine? What is their annual production? Prepare a mini-presentation about one of the minerals from Table 1.1. Use graphic information and be prepared to comment on it. Use passive constructions.

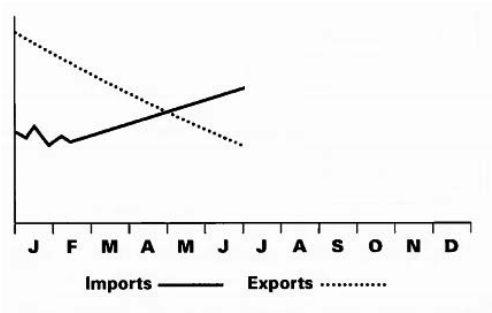
End-of-unit quiz

This is the end of Unit 1. Try this quick quiz to check you have understood everything.

1. Match the descriptions (1-3) with the appropriate line graphs (a-c) and complete them with the information from the corresponding description.

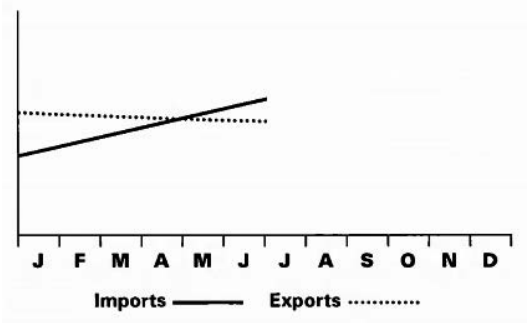
1) Imports of oil rose steadily during the first half of the year, while exports of copper declined slightly. From July onwards, both imports of oil and exports of copper remained reasonably steady, although exports of copper fluctuated slightly towards the end of the year.

a)



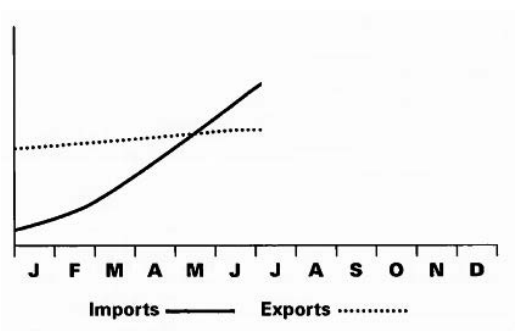
2) Imports of oil rose sharply from January until the end of June while exports of copper increased only slightly. In the second half of the year, exports of copper declined but imports of oil continued to rise, not leveling off until the end of the year.

b)



3) After a short period of fluctuation, imports of oil rose steadily throughout the year. Exports of copper, on the other hand, declined dramatically, although they recovered slightly towards the end of the year.

c)



2. Correct grammar mistakes in the sentences. Consult grammar reference if necessary:

1. As can seen from Table 1.1, a significant proportion of minerals are found in the ocean crust.
2. Most coal-seams were form over 300 million years ago by the decomposition of vegetable matter.
3. The term "mineral" has often used in a much more extended sense to include anything of economic value which is extracted from the earth.
4. Silver, copper, and mercury is found native as well as in the form of sulphides, carbonates, and chlorides.
5. The naturally occurring compounds are known as minerals, most of which have given names according to their composition.

3. Write down as many minerals as you can without looking at Table 1.1.

Unit 2

By the end of Unit 2 you will be able to:

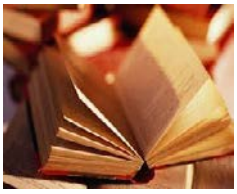
a) use a range of terminology to talk about mining methods and criteria of their choice

b) use linking words to add ideas, sequence and link ideas to transform plain text into tables and tables into plain text

Lead-in Work in pairs to answer the questions:

As you have learnt from Unit 1, the Earth crust is rich in minerals, but is every deposit economical to develop? What does it depend on? Report your ideas to the class.

Pre-reading What stages of metallic ore processing can you name? Work with a partner to make a list. Be ready to present the list to another pair, use phrases from the Word Bank – Linking, Sequencing, Adding ideas (p. 62-63).



While-reading

1. Look through the text and check your guesses with the information from the text.

2. Read the text again and underline mining methods, explain the reasons of choosing this or that method.

3. Classify mineral processing methods using the criteria below. Prepare to tell the class about one of mining methods or mineral treatment. Use linking phrases from the Word bank – Linking, Sequencing, Adding ideas (p. 62-63).

Mining or mineral treatment method	Grade of ore	Costs	Energy consumption

Metals (Part 2)

The deposit will be economic to work, and can be classified as an ore deposit if:
Contained value per tonne > (total processing costs + losses + other costs) per tonne

A major cost is mining, and this can vary enormously, from only a few pence per tonne of ore to well over £50/t. **High-tonnage operations** are cheaper in terms of **operating costs** but have higher initial **capital costs**. These capital costs are paid off over a number of years, so that hightonnage operations can only be justified for the **treatment** of deposits large enough to allow this. Small **ore bodies** are worked on a smaller scale, to reduce overall capital costs, but capital and operating costs per tonne are correspondingly higher (Ottley, 1991).

Alluvial mining is the cheapest method and, if on a large scale, can be used to mine ores of very low contained value due to **low grade** or low metal price, or both. For instance, in S.E. Asia, tin ores containing as little as 0.01% Sn are mined by alluvial methods. These ores had a contained value of less than £1/t but very low processing costs allowed them to be economically worked.

High-tonnage **open-pit** and **underground blockcaving** methods are also used to treat ores of low contained value, such as low-grade copper ores. Where the ore must be mined selectively, however, as is the case with underground **vein-type deposits**, mining methods become very expensive, and can only be justified on ores of high contained value. An underground selective mining cost of £30/t would obviously be hopelessly uneconomic on a tin ore of alluvial grade, but may be economic on a hard-rock ore containing 1.5% tin, with a contained value of around £50/t.

In order to produce metals, the ore minerals must be broken down by the action of heat (pyrometallurgy), solvents (hydrometallurgy) or electricity (electrometallurgy), either alone or in combination, the most common method being the

pyrometallurgical process of **smelting**. These chemical methods consume vast quantities of energy. Treatment of 1 t of copper ore, for instance, consumes in the region of 1500-2000 kWh of electrical energy, which at a cost of say 5 p/kW h is around £85/t, well above the contained value of all current copper ores.

Smelters are often remote from the mine site, being centred in areas where energy is relatively cheap, and where access to roads, rail or sea-links is available for **shipment** of fuel and supplies to, and products from, the smelter. The cost of transportation of mined ore to remote smelters could in many cases be greater than the contained value of the ore.

Mineral processing is usually carried out at the mine site, the plant being referred to as a **mill** or **concentrator**. The essential purpose is to reduce the **bulk of the ore** which must be transported to and processed by the smelter, by using relatively cheap, low-energy physical methods to separate the valuable minerals from the **waste (gangue) minerals**. This **enrichment** process considerably increases the contained value of the ore to allow economic transportation and smelting. Compared with chemical methods, the physical methods used in mineral processing consume relatively small amounts of energy. For instance, to **upgrade** a copper ore from 1 to 25% metal would use in the region of 20-50 kW h t^{-1}. The corresponding reduction in weight of around 25:1 proportionally lowers transport costs and reduces smelter energy consumption to around 60-80 kW h in relation to the weight of mined ore. It is important to realise that, although the physical methods are relatively low energy users, the reduction in bulk lowers smelter energy consumption to the order of that used in mineral processing, and it is significant that as **ore grades** decline, the energy used in mineral processing becomes an important factor in deciding whether the deposit is **viable** to work or not.

Mineral processing reduces not only smelter energy costs but also smelter metal losses, due to the production of less **metal-bearing slag**. Although

technically possible, the smelting of extremely lowgrade ores, apart from being economically unjustifiable, would be very difficult due to the need to produce high-grade metal products free from deleterious **impurities**. These impurities are found in the gangue minerals and it is the purpose of mineral processing to reject them into the **discard** (tailings), as smelters often impose penalties according to their level. For instance, it is necessary to remove arsenopyrite from tin concentrates, as it is difficult to remove the contained arsenic in smelting and the process produces a low-quality tin metal.

Against the economic advantages of mineral processing, the losses occurred during **milling** and the cost of milling operations must be charged. The latter can vary over a wide range, depending on the method of treatment used, and especially on the scale of the operation. As with mining, largescale operations have higher capital but lower operating costs (particularly labour and energy) than small-scale operations. As labour costs per tonne are most affected by the size of the operation, so, as capacity increases, the energy costs per tonne become proportionally more significant, and these can be more than 25% of the total milling costs in a 10,000 t d^{-1} concentrator.

Losses to **tailings** are one of the most important factors in deciding whether a deposit is viable or not. Losses will depend very much on the **ore mineralogy** and **dissemination**, and on the technology available to achieve efficient concentration. Thus, the development of **froth flotation** allowed the exploitation of vast low-grade copper deposits which were previously uneconomic to treat. Similarly, the introduction of **solvent extraction** enabled Nchanga Consolidated Copper Mines in Zambia to treat 9 Mt/yr of flotation tailings, to produce 80,000 t of finished copper from what was previously regarded as waste (Anon., 1979).

4. Classify the words in **bold** into groups:

occurrence and extraction of minerals	mineral processing

5. Write down the following figures from Units 1 and 2 using words.

1. £50/t_____
2. 0.01%_____
3. 20-50 kW h t^{-1}_____
4. 25:1_____
5. 1.5%_____
6. 1991_____
7. 9 Mt/yr_____
8. 10^{-14} – 10^{-16}_____
9. $7x10^{-6}$_____
10. $<5x10^{-6}$_____

Grammar in context

1. Match the words to make a meaningful compound adjective from the text above, then find the nouns they modify. Then translate the phrases.

e.g. high-tonnage operations -

high- quality_____
vein- grade_____
metal- pit _____
low- bearing _____
open- tonnage _____
low- type _____

Post-reading Work in small groups to answer the questions: What do you know about the fact that Chinese companies buy out Donetsk spoil banks? Do you think it is worth selling mine waste to China or rather wait till Ukraine has this equipment?

Over to you …

Translate Table 1.3 and be ready to present the information from this table in writing and speaking. Use phrases from the Word bank - Linking, Sequencing, Adding ideas (p. 62-63).

Table 1.3 Costs per metric tonne milled for a 100,000 t/d copper concentrator

Item	*Cost – US$ per tonne*	*Percent cost*
Crushing	0.088	2.8
Grinding	1.482	47.0
Flotation	0.510	16.2
Thickening	0.111	3.5
Filtration	0.089	2.8
Tailings	0.161	5.1
Reagents	0.016	0.5
Pipeline	0.045	1.4
Water	0.252	8.0
Laboratory	0.048	1.5
Maintenance support	0.026	0.8
Management support	0.052	1.6
Administration	0.020	0.6
Other expenses	0.254	8.1
Total	3.154	100

End-of-unit quiz

This is the end of Unit 2. Try this quick quiz to check you have understood everything.

1. Rewrite the following using figures:

a) five by ten in the seventh_____

b) nought point oh six nine per cent_____

c) less than three times ten in the eighth_____

d) twelve to one_____

e) eleven megaton per year_____

2. Divide the line into meaningful words and phrases and identify mining methods and mineral treatment methods and comment on the reasons of their choice:

solventextractionfrothflotationmillingmineralprocessingenrichmentalluvialminingsmeltingopenpitundergroundblockcaving

Unit 3

By the end of Unit 3 you will be able to:

a) draw and describe a circuit diagram using a wide range of vocabulary

b) draw a plan of the text using scan reading

c) use discussion phrases to talk about professionally oriented topics

Lead-in Work in pairs to answer the questions:

What happens after ore is removed from the earth? Work with a partner to draw a diagram to explain the processes. Present the diagram using phrases from the Word Bank – Sequencing ideas (p. 62)

Pre-reading

Work individually. Look at the photo and explain what this is, where it is used and with what purpose.

Pair work. Work with a partner to share your guesses and to discuss your ideas. Use from the Word Bank – Discussion phrases (p. 65)

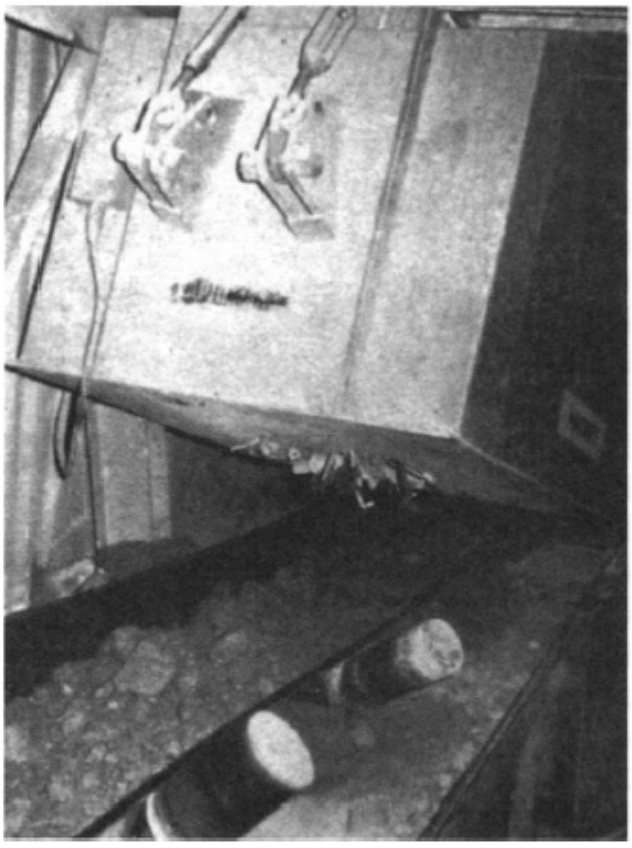
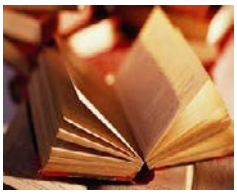


Figure 2.1 Conveyor guard magnet



While-reading

1. Look through the text and check your guesses. Report to the class.

2. Make a plan of the text below: use simple or complex plan.

3. Work in groups of 4 (A, B, C and D). Rewrite the terms in columns according to part of speech. Translate the terms and share with your partners. Then underline the words meaning problems.

verb – A	noun – B	gerund – C	adj./ part I, II – D
e.g. **jam**	**crusher**	**choking**	**ground**

The removal of harmful materials

Ore entering the mill from the mine (**run-of-mine ore**) normally contains a small proportion of material which is potentially harmful to the mill equipment and processes. For instance, large pieces of iron and steel broken off from mine machinery can **jam** in the **crushers**. Wood is a major problem in many mills as this is **ground** into a fine pulp and causes **choking** or **blocking** of **screens**, etc. It can also choke **flotation cell ports**, consume flotation reagents by absorption and decompose to give **depressants**, which render valuable minerals **unfloatable**.

Clays and **slimes** adhering to the ore are also harmful as they **hinder** screening, filtration, and **thickening**, and again consume valuable flotation reagents.

All these must be removed as far as possible at an early stage in treatment. Hand sorting from conveyor belts has declined in importance with the development of mechanized methods of dealing with large tonnages, but it is still used when plentiful cheap labour is available. Crushers can be protected from large pieces of **"tramp" iron** and steel by **electromagnets** suspended over **conveyor belts** (Figure 2.1). These powerful electromagnets can pick up large pieces of **iron** and **steel** travelling over the belt and, at intervals, can be swung away from the belt and unloaded. Guard magnets, however, cannot be used to remove tramp iron from **magnetic ores**, such as those containing magnetite, nor will they remove **non-ferrous metals** or non-magnetic steels from the ore. **Metal detectors**, which measure the electrical conductivity of the material being conveyed, can be fitted over or around conveyor belts. The electrical conductivity of ores is much lower than that of metals and fluctuations in electrical conductivity in the conveyed material can be detected by measuring the change that tramp metal causes in a given electromagnetic field. When a metal object causes an alarm, the belt automatically stops and the object can be removed.

Large pieces of wood which have been "flattened out" by passage through a

primary crusher can be removed by passing the **ore feed** over a **vibrating scalping screen**. Here the **apertures** of the screen are slightly larger than the maximum size of particle in the crusher discharge, allowing the ore to fall through the apertures and the flattened wood particles to ride over the screen and be collected separately.

Wood can be further removed from the pulp discharge from the grinding mills by passing the pulp through a **fine screen**. Again, while the ore particles pass through the apertures, the wood collects on top of the screen and can be periodically removed.

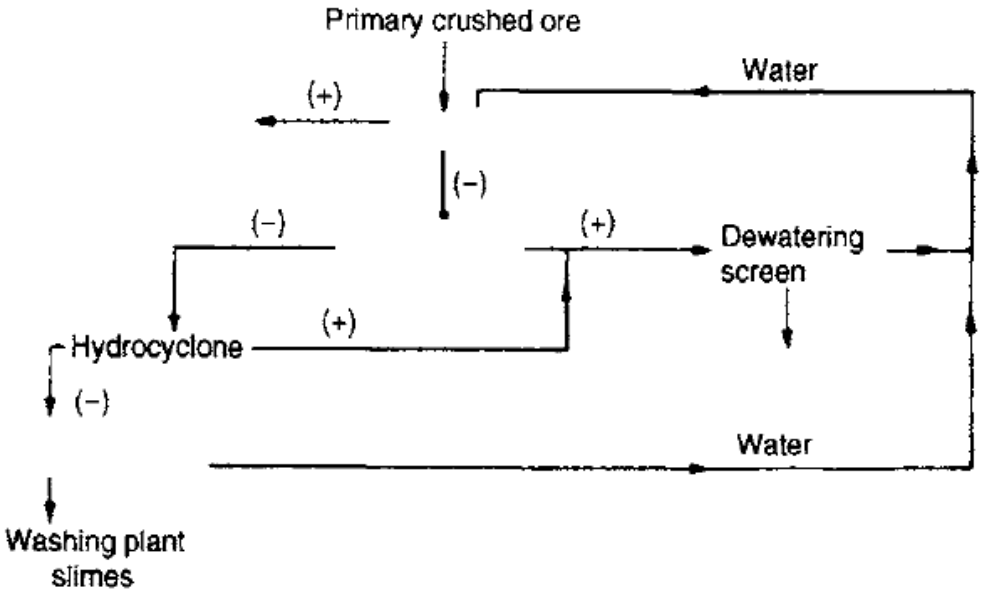
Washing is normally performed after primary crushing as the ore is then of a suitable size to be passed over **washing screens**. It should always precede secondary crushing as slimes severely **interfere** with this stage.

The ore is passed through high-pressure jets of water on mechanically vibrated screens. The screen apertures are usually of similar size to the particles in the feed to the grinding mills. In the circuit shown in Figure 2.2 material passing over the screen, i.e. washed ore, is transported to the secondary crushers. Material passing through the screens is classified into **coarse** and **fine fractions** by a **mechanical classifier** or **hydrocyclone** or both. The coarse product from the classifier, designated "washing plant sands", is either routed direct to the grinding mills or is dewatered over vibrating screens before being sent to **mill storage**. A considerable load, therefore, is taken off the **dry crushing section**. The fine product from classification, i.e. the "slimes", may be partially dewatered in shallow large diameter settling tanks known as **thickeners** and the thickened pulp is either pumped to **tailings disposal** or, if containing values, pumped direct to the concentration process, thus removing load from the grinding section. In the circuit shown, the thickener overflows are used to feed the high-pressure washing sprays.

Wood pulp may again be a problem in the above circuit, as it will tend to float in the thickener, and will **choke** the **water spray nozzles** unless it is removed by retention on a fine screen.

Post-reading Fill in the circuit using the information from the text and the stages below. Then explain how the cycle of ore processing works using the circuit, use phrases expressing sequence (p. 62)

Washed ore Thickener Screen Mechanical classifier Washing plant sands



Grammar in context

1. Look through the text and write 12 noun phrases from the words below (4 of them are 3-word phrases)

port nozzle conveyor iron metal flotation cell ore feed washing mill plant guard magnet tailings mill detector spray conveyor equipment mine belt tramp machinery sand storage disposal water

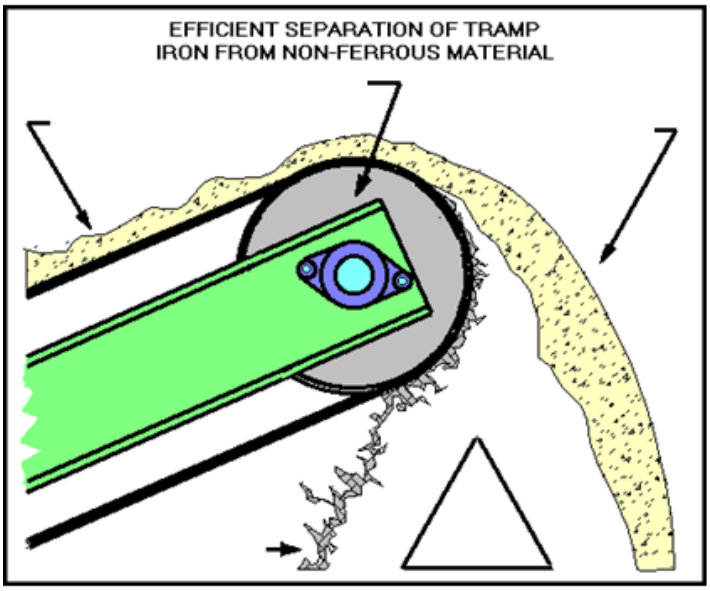
2. Translate the following pairs of phrases and explain the difference:

belt conveyor _____ conveyor belt _____

sand plant _____ washing plant sand _____

Over to you…

Label the diagram and explain the working principle of the separator below. Think of advantages and disadvantages of this separator in comparison with the separator in Fig. 2.1.



cleaned material

tramp material

magnetic pulley

contaminated material

Advantages	Disadvantages

End-of-unit quiz

This is the end of Unit 3. Try this quick quiz to check you have understood everything.

1. Put the words in the box in correct order and translate

diameter	tank	shallow	settling	large

2. Without looking at the text explain the purpose of the following machines. Then put them in correct order according to the technological process of ore treatment:

mechanical classifier thickener vibrating scalping screen
electromagnet crusher washing screen

1.
2.
3.
4.
5.

3. Write down words and phrases connected with problems that could occur at the mill.

Unit 4

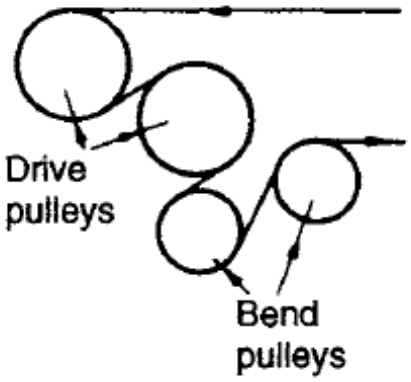
By the end of Unit 4 you will be able to:

a) tell about the purpose of a machine or equipment using various constructions

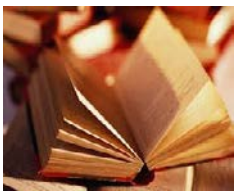
b) use scan reading to find details in the text

Lead-in What do you know about early ways of ore transportation from the mine? What animals or devices were used before electricity was invented?

Pre-reading Work individually. Look at the figure and explain what this is, where it is used and with what purpose.



Pair work. Work with a partner to share your guesses and to discuss your ideas. Use from the Word Bank – Discussion phrases (p. 65)



While-reading

1. Look through the text and check your guesses.

2. Scan the text to find the answers to the following questions as fast as possible:

1) What materials are used to make a belt conveyor?

2) How does the transported material influence the choice of the working slope?

3) What are the main requirements for the feed chute installation?

4) How is gravity used to prevent sag?

5) What are the main differences between a tripper and a shuttle belt?

3. Work in groups of 3. Choose one device and fill in the table with the information from the text about the purpose of this device. Then share the information with your partners. Fill in the table from your partners' words.

Device	Purpose
1.	
2.	
3.	
4.	
5.	

4. Work in groups of 3. Fill only one column with the words in **bold**. Share with your partners to fill in all three columns.

Transportation equipment	Properties of material	Conditions

Ore transportation (Part 1)

In a mineral processing plant, operating at the rate of 400,000t d^{-1}, this is equivalent to about 28t of solid per minute, requiting up to 75 m 3 min^{-1} of water. It is therefore important to operate with the minimum upward or horizontal movement and with the maximum practicable **pulp density** in all of those stages subsequent to the addition of water to the system. The basic philosophy requires maximum use of gravity and continuous movement over the shortest possible distances between processing units. Dry ore can be moved through **chutes**, provided they are of sufficient **slope** to allow easy sliding, and sharp turns are avoided. Clean **solids** slide easily on a 15-25º steel-faced slope, but for most ores, a 45-55º working slope is used.

The ore may be difficult to control if the slope is too steep.

The **belt conveyor** is the most widely used method of handling **loose bulk materials**. Belts now in use are with **capacities** up to 20,000t h^{-1} and single **flight** lengths exceeding 15,000m, with feasible speeds of up to 10 m s^{-1}.

The standard rubber conveyor belt has a foundation of sufficient strength to withstand the **driving tension** and **loading strains**. This foundation, which may be of cotton, nylon, or steel cord, is bound together with a rubber matrix and completely covered with a layer of vulcanised rubber.

The carrying capacity of the belt is increased by passing it over **troughing idlers**. These are **support rollers** set normal to the travel of the belt and inclined upward from the centre so as to raise the edges and give it a trough-like profile. There may be three or five in a set and they will be rubbercoated under a loading point, so as to reduce the **wear** and **damage** from impact. Spacing along the belt is at the maximum interval which avoids excessive **sag**. The **return belt** is supported by horizontal straight idlers which overlap the belt by a few inches at each side. To induce motion without slipping requires good contact between the belt and **drive pulley**. This may not be possible with a single 180º turn over a pulley and some form of "snubbed pulley" drive or "tandem" drive arrangement may be more effective (Figure 2.3). The belt system must incorporate some form of **tensioning device** to adjust the belt for **stretch** and **shrinkage** and thus prevent undue sag between idlers, and slip at the drive pulley. In most mills, gravity-operated arrangements are used which adjust the tension continuously (Figure 2.4). Hydraulics have also been used extensively, and when more refined belt-tension control is required, especially in starting and stopping long conveyors, **load-cell-controlled electrical tensioning devices** are used.

Several methods can be used to minimise loading shock on the belt. A typical arrangement is shown in Figure 2.5 where the fines are screened on to the belt first and provide a cushion for the larger pieces of rock.

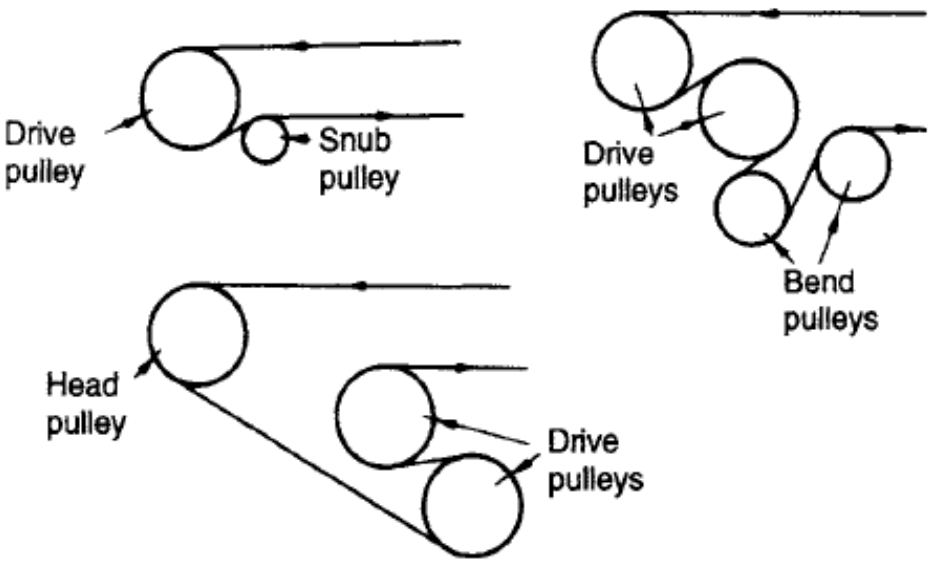


Figure 2.3 Conveyor-belt drive arrangements

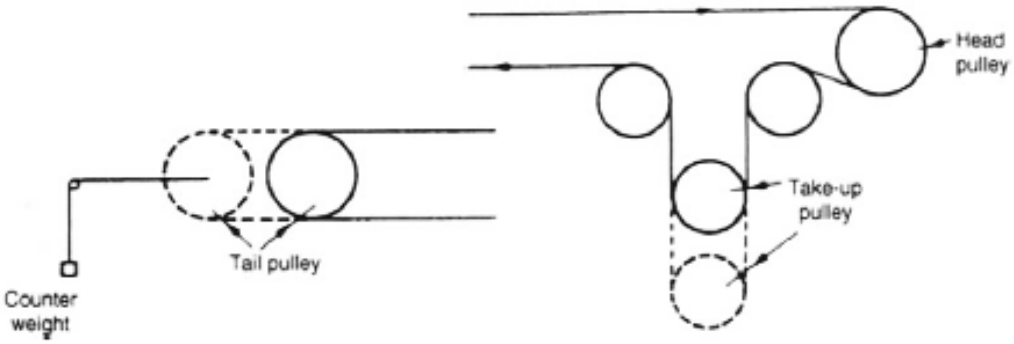


Figure 2.4 Conveyor-belt tensioning systems

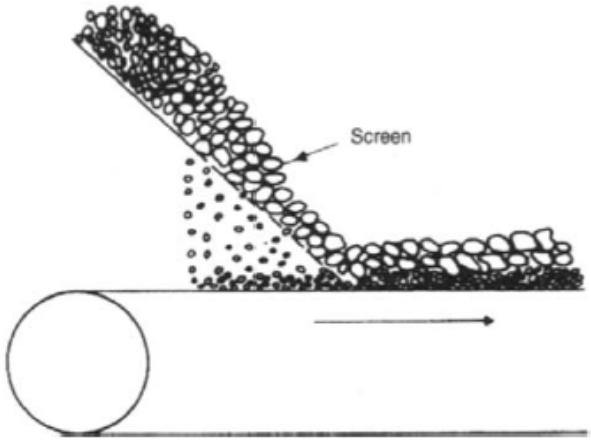


Figure 2.5 Belt-loading system

Feed chutes must be designed to deliver the bulk of the material to the centre of the belt and at a **velocity** close to that of the belt. Ideally it should be the same, but in practice this condition is seldom obtained, particularly with wet sand or sticky materials. Where conditions will allow, the angle of the chute should be as great as possible, thereby allowing it to be gradually placed at lesser angles to the belt until the correct speed of flow is obtained. The material, particularly if it is heavy, or lumpy, should never be allowed to strike the belt vertically. **Baffles** in transfer chutes, to guide material flow, are now often remotely controlled by hydraulic cylinders.

The conveyor may discharge at the **head pulley**, or the load may be removed before the head pulley is reached. The most satisfactory device for achieving this is a **tripper**. This is an arrangement of pulleys by which the belt is raised and doubled back so as to give it a localised discharge point. It is usually mounted on wheels, running on tracks, so that the load can be delivered at several points, over a long bin or into several bins. The discharge chute on the tripper can deliver to one or both sides of the belt. The tripper may be moved by hand, by head and tail ropes from a reversible **hoisting drum**, or by a motor. It may be automatic, moving backwards and forwards under power from the belt drive.

Shuttle belts are reversible self-contained conveyor units mounted on carriages, which permit them to be moved lengthwise to discharge to either side of the feed point. The range of distribution is approximately twice the length of the conveyor. They are often preferred to trippers for permanent storage systems because they require less head room and, being without reverse bends, are much easier on the belt.

Post-reading After learning the information in ***Grammar corner*** present the information in Table 1 from Task 3. Use “to” of purpose and other ways of expressing purpose.

Grammar in context

1. Match beginnings (A) with endings (C) using appropriate linking words or phrases (B). Check your result with the text above. Explain your choice.

A	B	C
The most satisfactory device	to	adjust the belt for stretch and shrinkage.
Baffles in transfer chutes,	so that	be moved lengthwise to discharge to either side of the feed point.
The belt system must incorporate some form of tensioning device	to	achieving this is a tripper.
Several methods can be used	which permit them to	the load can be delivered at several points, over a long bin or into several bins.
It is usually mounted on wheels, running on tracks,	for	guide material flow, are now often remotely controlled by hydraulic cylinders.
Shuttle belts are reversible self-contained conveyor units mounted on carriages,	to	minimise loading shock on the belt.

2. Choose the correct form (a-c). Explain your choice.

1. To …….. motion without slipping requires good contact between the belt and drive pulley.

a) for introduce b) induce c) introducing

2. This is an arrangement of pulleys by which the belt is raised and doubled back so as ……it a localised discharge point.

a) to give b) giving c) to giving

3. They will be rubbercoated under a loading point, so …… the wear and damage from impact.

a) reducing b) to reducing c) as to reduce

4. Feed chutes must be designed to …… the bulk of the material to the centre of the belt and at a velocity close to that of the belt.

a) deliver b) delivering c) so for delivering

5. The standard rubber conveyor belt has a foundation of sufficient strength …… the driving tension and loading strains.

a) for withstand b) to withstand c) so as for withstanding

6. These are support rollers inclined upward from the centre so as ……the edges and give it a trough-like profile.

a) to raising b) for raising c) to raise

3. Choose 5 sentences from Task 1 and 2 above for transformation, use different way of expressing purpose.

Over to you…

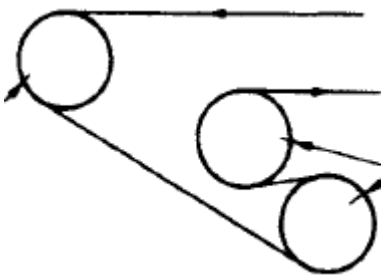
Think of 3 objects that you use every day. Give an accurate description of these objects and explain their purpose as if to an alien, but do not name the objects. Use “to” of purpose and other ways of expressing purpose. Be prepared to present these descriptions to the class for the rest to guess.

e.g. this is a rectangular object usually standing on a platform or hanging on the wall to watch and listen to in order to find out information. Guess what is it?

End-of-unit quiz

This is the end of Unit 4. Try this quick quiz to check you have understood everything.

1. Without looking at the text label the diagram and explain the working principle of the device.



drive pulleys

head pulley

2. Without looking at the text write 10 two-word transportation devices as you can from the words in the box. Explain the purpose of these devices.

idler support drum head belt device drive pulley shuttle return tensioning belt hoisting belt troughing discharge chute conveyor pulley roller

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

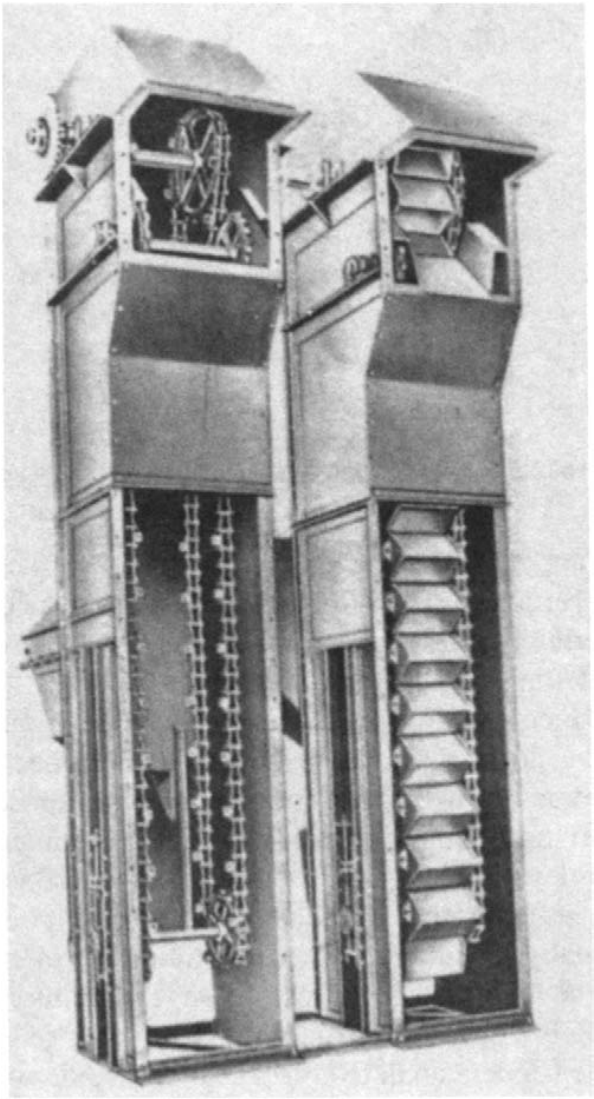
Unit 5

By the end of Unit 5 you will be able to:

a) use vague language to talk about things that you do not know for sure

b) use defining clauses to talk about professional topics

Lead-in In the previous unit you learnt about ore transportation. And what if there is not enough space for belt conveyor? Think individually, then share your ideas with a partner. Be ready to present your ideas to the class – use words and phrases from the Word Bank (Sequencing p. 62, Vague language p. 66)



Pre-reading Describe working principle and the purpose of the device in Fig. 2.6. Use Vague language p. …

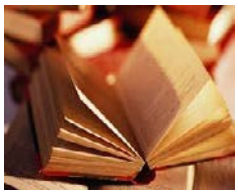
Choose the most appropriate name for Fig. 2.6. from a-c.

Figure 2.6

a) Bucket gravity elevator

b) Gravity bucket elevator

c) Elevator bucket gravity



While-reading

1. Look through the text and check your guesses.

2. Work in pairs (A and B) to answer the questions with the information from the text and share the information with your partner. Be ready to explain the factors influencing the transportation process using vague language – Word Bank p. …:

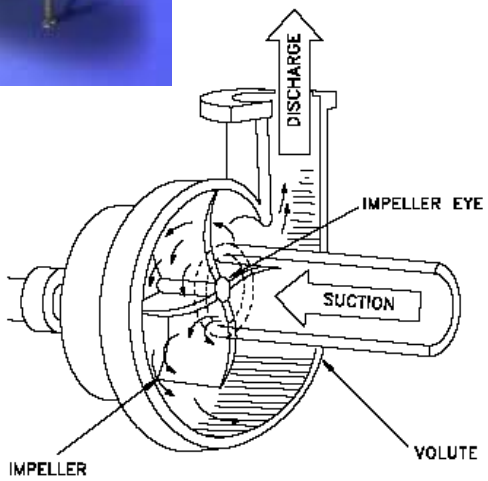
What are the main factors influencing the installation of:

A) launders B) piping?

3. Match the pictures with conveyor types and explain the working principle.

shuttle belt *belt conveyor* *sandwich conveyor*

screw conveyor *centrifugal pump*



4. Find the information in the text to add to the Table in Unit 4 Task 3. Work in pairs. Choose one device and fill in the table with the information from the text about the purpose of this device. Then share the information with your partner. Fill in the table from your partner' words.

5. Work in groups of 3 (A-C) to classify the words in **bold** into groups. Then share the information with your partners.

Transportation equipment – A	Properties of transported material – B	Conditions – C

Ore transportation (Part 2)

Where space limitation does not permit the installation of a belt conveyor, _____ can be used (Figure 2.6). These provide only low handling rates with both horizontal conveying and elevating of the material. The elevator consists of a **continuous line** of buckets attached by pins to two **endless roller chains** running on tracks and driven by **sprockets**. The buckets are **pivoted** so that they always remain in an upright position and are dumped by means of a ramp placed to engage a **shoe** on the bucket, thus turning it into the dumping position.

Sandwich conveyor systems can be used to transport solids at steep inclines from 30 to 90º. The material being transported is "sandwiched" between two belts which hold the material in position and prevent it from sliding back down the conveyor even after the conveyor has stopped or tripped. As pressure is applied to material to hold it in place, it is important the material has a reasonable **internal friction angle**. The advantage of sandwich belt conveyors is that they can transport material at **steep angles** at similar speeds to conventional belt conveyors.

Screw conveyors are another means of transporting **dry or damp particles** or solids. The material is pushed along a trough by the rotation of a **helix**, which is mounted on a **central shaft**. The action of the screw conveyor allows for virtually any degree of mixing of different materials and allows for the transportation of material on any incline from the horizontal to vertical. The main limitation of screw conveyors is their capacity, which has a maximum rate of about 300 m^3/h. (Perry, 1997).

Hydraulic transport of the ore stream normally takes over from dry transportation at the **grinding stage** in most modem mills. Pulp may be made to flow through open **launders** by gravity in some cases. Launders are gently sloping troughs of r**ectangular, triangular or semicircular** section, in which the solid is carried in

suspension, or by sliding or rolling. The slope must increase with particle size, with the solid content of the suspension, and with **specific gravity** of the solid. The effect of depth of water is complex; if the particles are carried in suspension, a deep launder is advantageous because the rate of solid transport is increased. If the particles are carried by rolling, a deep flow may be disadvantageous.

In plants of any size, the pulp is moved through piping via centrifugal pumps. Pipelines should be as straight as possible to prevent **abrasion** at bends. The use of oversize pipe is dangerous whenever slow motion might allow the solids to **settle** and hence **choke** the pipe. The factors involved in pipeline design and installation are complex and include the **solid-liquid ratio**, the average pulp density, the density of the solid constituents, the size analysis and particle shape, and the **fluid viscosity**.

Centrifugal pumps are cheap in capital cost and maintenance, and occupy little space (Wilson, 1981; Pearse, 1985). Single-stage pumps are normally used, lifting up to 30m and in extreme cases 100 m. Their main disadvantage is the high velocity produced within the **impeller chamber**, which may result in serious wear of the impeller and chamber itself, especially when **coarse** sand is being pumped.

Post-reading Fill in the table with information about two devices from texts Units 4 and 5. Prepare to give a mini-presentation. Use Word Bank p. 67 to help you.

device	possible problems/limitations	advantages
1. **2.**		

Grammar in context

1. Choose the correct variant. Explain your choice.

1) The main limitation of screw conveyors is their capacity ***which / that / ,which*** has a maximum rate of about 300 m^3/h.

2) The material is pushed along a trough by the rotation of a helix ***which / that / ,which*** is mounted on a central shaft.

3) The material being transported is "sandwiched" between two belts ***which / that / ,which*** hold the material in position and prevent it from sliding back down the conveyor even after the conveyor has stopped or tripped.

2. Find and underline four more examples of using defining clauses in the text above. Translate and explain the use.

3. Choose appropriate ending (a-e). Connect the sentences using ***which / that / ,which*** . Explain your choice.

1. The forms in **that / which / ,which**
2. The term "mineral" is often used in a much more extended sense to include anything of economic value **that / which / ,which**
3. Granite **that / which / ,which**
4. It has been estimated **that / which / ,which**
5. There is good evidence to suggest **that / which / ,which**

a) is one of the most abundant igneous rocks, is composed of three main mineral constituents, feldspar, quartz, and mica.

b) the energy cost in copper production is about 35% of the selling price of the metal.

c) metals are found in the crust of the earth and as sea-bed deposits depend on their reactivity with their environment, particularly with oxygen, sulphur, and carbon dioxide.

d) certain microorganisms could be used to enhance the performance of conventional mineral.

e) is extracted from the earth.

Over to you…

Prepare a mini-presentation about transportation devices, use information from the table above. Use “to” of purpose and defining relative clauses to link your ideas. Use phrases for making a presentation.

End-of-unit quiz

This is the end of Unit 5. Try this quick quiz to check you have understood everything.

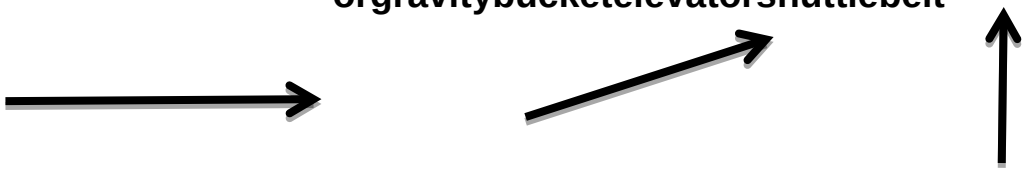
1. Name the shapes

2. Match adjectives from Units 4 and 5 with opposite meanings:

dry	disadvantageous
horizontal	fine
solid	bending
upright	damp
advantageous	vertical
straight	dumping
steep	gentle
backward	liquid
coarse	forward

3. Divide the line into meaningful words, translate the terms. Then rewrite the conveyor types into 3 columns according to the working angle:

beltconveyorscrewconveyorcentrifugalpumpreturnbeltsandwichconveyorgravitybucketelevatorshuttlebelt



Unit 6

By the end of Unit 6 you will be able to:

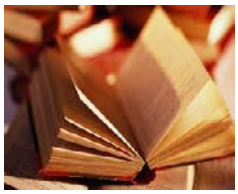
a) organize your written and spoken text using linking phrases and make short presentations

b) understand the meaning and use of various –ing forms accurately

Lead-in Work in pairs to answer the questions:

Do you have supplies of food in your fridge? If yes, for what period of time? What does it depend on? What are possible problems connected with making big supplies?

Pre-reading What do you think about ore supplies – storage of ore in special reservoirs? What is the optimal amount – one day, one shift, one week/month/year? What are the possible problems connected with ore storage? Discuss in pairs, use Discussion Phrases (p. 65). Report to class.



While-reading

1. Check you guesses with the text. Then fill in the table with the information from the text.

FOR ore storage	AGAINST ore storage

2. Look at Figures 2.7 and 2.8 and answer the questions using information from the text:

1) What is shown in the figures?

2) What is the purpose of these constructions?

3) What is the difference between constructions in Fig. 2.7 and Fig. 2.8?

3. Rewrite linking words and phrases in *italics* from the text into appropriate column of the table according to their meaning:

reason	
contrast	
consequence	
connection	***e.g.*** both … and …
condition	
comparison	
advice	
purpose	

Ore storage

The necessity for storage arises from the fact that different parts of the operation of mining and milling are performed at different rates, some being intermittent and some continuous, some being subject to frequent **interruption** for repair, and others being essentially batch processes. *Thus*, unless reservoirs for material are provided between the different steps, the whole operation is rendered spasmodic and, consequently, uneconomical.

For various reasons, at most mines, ore is hoisted for only a part of each day. *On the other hand*, grinding and **concentration circuits** are most **efficient** when running continuously. Mine operations are more subject to unexpected interruption than mill operations, and **coarse-crushing machines** are more subject to **clogging**

and **breakage** than **fine crushers**, grinding mills and concentration equipment. *Consequently*, both the mine and the coarse-ore plant should have a greater hourly capacity than the fine crushing and grinding plants, and storage reservoirs should be provided between them. Ordinary mine **shutdowns**, expected or unexpected will not generally exceed a 24 h duration, and ordinary coarse-crushing plant repairs can be made within an equal period if a good supply of **spare parts** is kept on hand. *Therefore*, if a 24 h supply of ore that has passed the coarse-crushing plant is kept in reserve ahead of the mill proper, the mill can be kept running independent of shutdowns of less than a 24 h duration in mine and coarse-crushing plant. *It is wise to* provide for a similar mill shutdown and, *in order to* do this, the reservoir between coarsecrushing plant and mill must contain at all times unfilled space capable of holding a day's tonnage from the mine. This is not economically possible, *however*, with many of the modem very large mills; there is a trend now to design such mills with smaller storage reservoirs, often supplying less than a two-shift supply of ore, the philosophy being that storage does not do anything to the ore, and can, in some cases, have an **adverse effect** by allowing the ore to **oxidise**. Unstable sulphides must be treated with minimum delay, and wet ore cannot be **exposed to extreme cold** as it will **freeze** and be difficult to move.

Storage has the advantage of allowing blending of different ores *so as to* provide a consistent feed to the mill. *Both* tripper *and* **shuttle conveyors** can be used to blend the material into the storage reservoir. If the units shuttle back and forth along the pile, the materials are layered and mix when reclaimed. *If* the units form separate piles for each quality of ore, a blend can be achieved by combining the flow from selected feeders onto a **reclaim conveyor**.

Depending on the nature of the material treated, storage is accomplished in **stockpiles**, **bins**, or **tanks**.

Stockpiles are often used to store coarse ore of low value outdoors. In

designing stockpiles, *it is* merely *necessary to know* the **angle of repose** of the ore, the volume occupied by the broken ore and the tonnage.

Although material can be reclaimed from stockpiles by **front-end loaders** or by **bucket-wheel reclaimers**, the most economical method is by the reclaim tunnel system, *since* it requires a minimum of manpower to operate (Dietiker, 1978). It is especially suited for blending by feeding from any combination of openings. Conical stockpiles can be reclaimed by a tunnel running through the centre, with one or more feed openings discharging via **gates**, or feeders, onto the **reclaim belt**. The amount of **reclaimable material**, or the live storage, is about 20-25% of the total (Figure 2.7). Elongated stockpiles are reclaimed in a similar manner, the live storage being 30-35% of the total (Figure 2.8).

For continuous feeding of crushed ore to the grinding section, **feed bins** are used for transfer of the coarse material from belts and rail and road trucks. They are made of wood, concrete, or steel. They must be easy to fill and must allow a steady fall of the ore through to the **discharge gates** with no "**hanging up**" of material or opportunity for it to **segregate** into coarse and fine fractions. The discharge must be adequate and drawn from several alternative points if the bin is large.

Pulp storage on a large scale is *not as easy as* dry ore storage. **Conditioning tanks** are used for storing suspensions of fine particles to provide time for chemical reactions to proceed. These tanks must be agitated continuously, *not only* to provide mixing *but also* to prevent **settlement** and **choking up**. **Surge tanks** are placed in the **pulp flow-line** when it is necessary to smooth out small operating variations of feed rate. Their content can be agitated by stirring, by blowing in air, or by circulation through a pump.

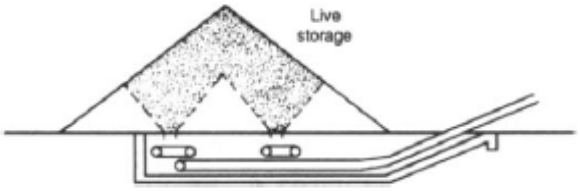


Figure 2.7 Reclamation from conical stock pile

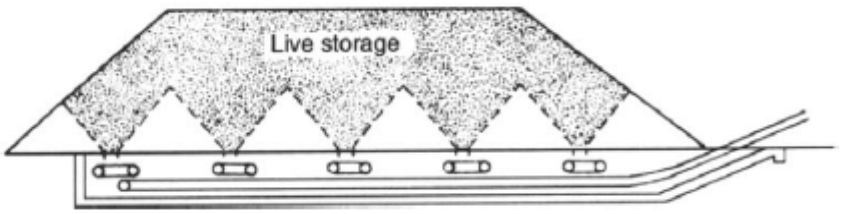


Figure 2.8 Reclamation from elongated stock pile

4. Classify words in **bold** in the following categories:

machines/ parts of machines	problems

Post-reading Work in groups of 3. Prepare a mini presentation of the text above. Talk about storage equipment and possible problems connected with ore storage. Use linking words and presentation language (Word Bank p. 67)

Grammar in context

1. Work in groups of 3. Find 5 –ing forms in the text above and identify their roles in the sentences, underline the –ing forms using different lines. Explain your choice to your partners and translate the –ing forms with minimal context.

e.g. Depending on the nature of the material treated, storage is accomplished in stockpiles, bins, or tanks. – ***в зависимости от материала.***

On the other hand, grinding and concentration circuits are most efficient when running continuously. **– *цикл измельчения; работающий бесперебойно.***

2. Fill in the gaps with the words from the box. Identify their role using different lines. Translate the words with minimal context.

blowing	clogging	mixing	choking	grinding	coarse-crushing	stirring

1. Mine operations are more subject to unexpected interruption than mill operations, and …… machines are more subject to …… and breakage than fine crushers, ……. mills and concentration equipment.
2. These tanks must be agitated continuously, not only to provide …….. but also to prevent settlement and …… up.
3. Their content can be agitated by ……, by ……. in air, or by circulation through a pump.

3. Choose appropriate form of the word. In some cases both variants are appropriate. Explain your choice.

1. *Conditioning / condition* tanks are used for *storage / storing* suspensions of fine particles to provide time for chemical *reacting / reactions* to proceed.

2. If the units form *separating / separate* piles for each quality of ore, a blend can be achieved by *combining / combination* the flow from *selected / selecting* feeders onto a reclaim conveyor.

3. The reservoir between *coarse-crushed / coarse-crushing* plant and mill must *contain / containing* at all times unfilled space capable of *held / holding* a day's tonnage from the mine.

4. The necessity for *storage / storing* arises from the fact that different parts of the *operating / operation* of *mining / mined* and *mill / milling* are performed at different rates, some being intermittent and some continuous, some being subject to frequent *interrupting / interruption* for repair, and others *being / are* essentially batch processes.

Over to you… Use Internet-search to find out how the issue of ore storage is treated in Ukraine. What are the problems with ore storage and how are they solved?

End-of-unit quiz

This is the end of Unit 6. Try this quick quiz to check you have understood everything.

1. Put the presentation phrases in logical order:

a) Good afternoon. Let me start by saying a few words about …

b) I'll be happy to answer your questions at the end.

c) If you have any questions, I'd be pleased to answer them.

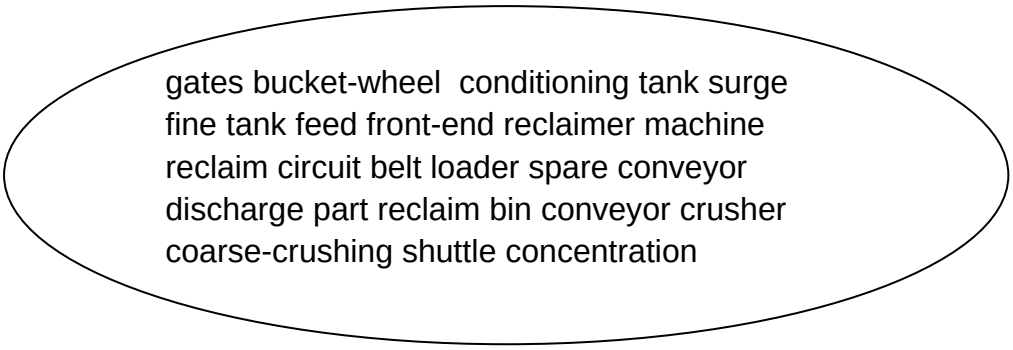
d) If you look at this graph you can see …

e) Thank you for your attention.

f) That brings me to the end of my presentation.

g) The purpose of the presentation is to …

2. Make up as many words and phrases meaning equipment or part of equipment as you can, use the words from the pool:



3. Fill in the gaps using linking words and phrases from the box and translate.

so as to	not only	but it also	thus	since	consequently

1. An ore can be described as an accumulation of mineral in sufficient quantity …….. be capable of economic extraction.
2. ……. is fine grinding energy intensive, ……leads to increased media costs.
3. Rupture of the bond will increase the crack length, ……increasing the stress concentration and causing a rapid propagation of the crack through the matrix.
4. The abundance of metals in the oceans is related to some extent to the crustal abundances, …….they have come from the weathering of the crustal rocks.
5. Unless reservoirs for material are provided between the different steps, the whole operation is rendered spasmodic and, …….., uneconomical.

Unit 7

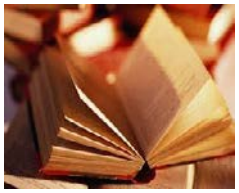
By the end of Unit 7 you will be able to:

a) use critical thinking to restore information in logical order

b) express condition using “if” and other ways of expressing condition

Lead-in Have you ever fed a two-year-old child? What is special about feeding a small child: serving size, timing? What mechanism could you think of to help mothers feed their small children? What would you call this mechanism?

Pre-reading Compare a two-year-old child with a primary crusher. What are similarities and differences? Do you know any special feeding devices for a primary crusher?



While-reading

1. Quickly look through the text to check you guesses. Then answer the questions: What is feeding? What types of feeders can you name? What does a typical feeder consist of?

2. Now read more carefully and answer the questions: What is the main purpose of feeders? What are possible problems connected with feeding? How are they solved?

3. Use critical thinking and put parts of the text (A-F) in logical order.

Feeding

A This so-called "packing of the crushing chamber" is just as serious as tramp iron in the crusher and can cause major damage. It is common practice, therefore, to "scalp" the feed to the crusher, heavy-duty screens known as **grizzlies** normally preceding the crushers and removing fines and **undersize**. Primary crusher feeds, which scalp and feed in one operation, have been developed, such as the **vibrating grizzly feeder**.

B A typical feeder consists of a small bin, which may be an integral part of a large bin, with a gate and a suitable conveyor. Feeders of many types have been designed, notably **apron**, belt, chain, roller, **rotary**, revolving disc, and vibrating feeders.

C Feeders are necessary whenever it is desired to deliver a uniform stream of dry or **moist** ore, since such ore will not flow evenly from a storage reservoir of any kind through a gate, except when regulated by some type of mechanism.

D Primary crushers depend for normal operation on the fact that broken rock contains a certain amount of **voidage**. If all the feed goes to a **jaw crusher** without a **preliminary** removal of fines, there can be danger when there has been segregation of coarse and fine material in the bin. Such fines could pass through the upper zones of the crusher and drop into the finalising zone so as to fill the voids. Should the bulk arriving at any level exceed that departing, it is as though an attempt is being made to compress solid rock.

E In the primary crushing stage, the ore is normally crushed as soon as possible after its arrival at the surface. **Skips**, lorries, trucks, and other **handling vehicles** are **intermittent** in arrival whereas the crushing section, once started, calls for **steady** feed. Surge bins provide a convenient holding arrangement able to receive all the intermittent loads and to feed them steadily through gates at controllable rates.

F Feeding is essentially a conveying operation in which the distance travelled is short and in which close regulation of the **rate** of passage is required. Where succeeding operations are at the same rate, it is unnecessary to interpose feeders. Where, however, principal operations are interrupted by a storage step, it is necessary to provide a feeder.

Post-reading Prepare a small report about the main principles that are used in feeders. Comment on how gravity is used in feeders. Talk about possible problems with feeders.

Grammar in context

1. Fill in the gaps with the words from the box. Explain your choice and translate the sentences.

if	should	where	whenever

1. ……. the bulk arriving at any level exceed that departing, it is as though an attempt is being made to compress solid rock.
2. …….. succeeding operations are at the same rate, it is unnecessary to interpose feeders.
3. ……. all the feed goes to a jaw crusher without a preliminary removal of fines, there can be danger when there has been segregation of coarse and fine material in the bin.
4. Feeders are necessary …….it is desired to deliver a uniform stream of dry or moist ore.

2. Transform the sentences above using another way of expressing condition.

3. Read the real-life situations and think of possible consequences to you personally. Use “if” and other ways of expressing condition. See p. 64.

1. You come back home late, your clothes is torn and dirty.
2. You are not ready with your home-assignment in higher mathematics and you are late for class.
3. You move to another city 500 km from your current place of living.
4. You have an argument with your best friend over your girl- / boy-friend.
5. You win a grant for free education abroad.
6. You are from a small town and get lost in Dnipropetrovsk.

Over to you…

Match the descriptions (1-4) with the pictures (a-c), then fill in the table with the information from descriptions. Be ready to give a short presentation about the peculiarities of application of different kinds of feeders. Use “to” of purpose, “if” and other ways of expressing conditions.

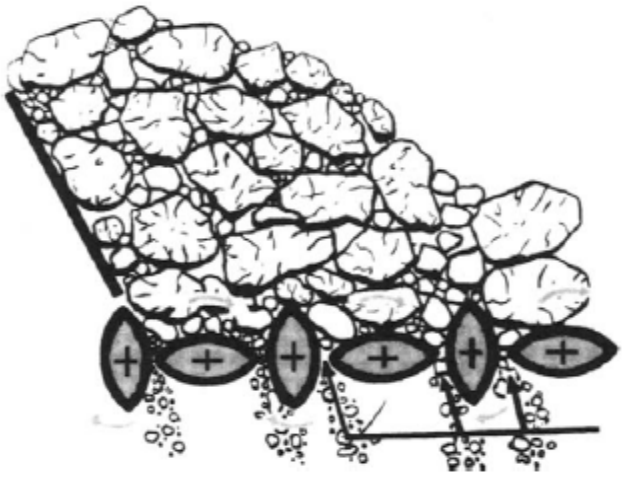
1) The chain-feeder (Figure 2.9) is sometimes used for smooth control of bin discharge. This consists of a curtain of heavy loops of chain, lying on the ore at the outfall of the bin at approximately the angle of repose. The rate of feed is controlled automatically or manually by the chain sprocket drive such that when the loops of chain move, the ore on which they rest begins to slide.

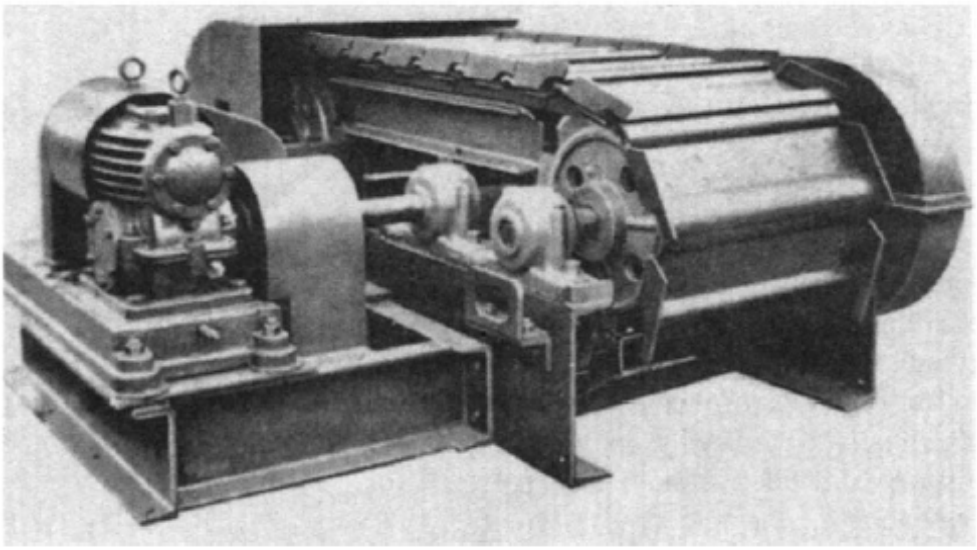
2) The elliptical bar feeder (Figure 2.10) consists of elliptical bars of steel which form the bottom of a receiving hopper and are set with the long axes of the ellipses in alternate vertical and horizontal positions. Material is dumped directly onto the bars which rotate in the same direction, all at the same time, so that the spacing remains constant. As one turns down, the succeeding one turns up, imparting a rocking, tumbling motion to the load. This works loose the fines, which sift through the load directly on to a conveyor belt, while the oversize is moved forward to deliver to the crusher. This type of feeder is probably better suited to handling high clay or wet materials such as laterite, rather than hard, abrasive ores.

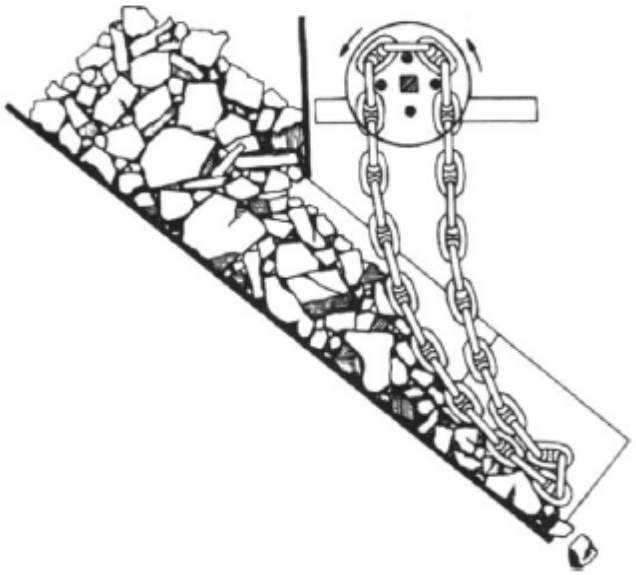
3) The apron feeder (Figure 2.11) is one of the most widely used feeders for handling coarse ore, especially jaw crusher feed. It is ruggedly constructed, consisting of a series of high carbon or manganese steel pans, bolted to strands of heavy-duty chain, which run on steel sprockets. The rate of discharge is controlled by varying the speed or by varying the height of the ribbon of ore by means of an adjustable gate.

4) Belt feeders are essentially short belt conveyors, used to control the discharge of material from inclined chutes. They frequently replace apron feeders for fine ore and are increasingly being used to handle coarse, primary crushed ore. They require less installation height, cost substantially less, and can be operated at higher speeds than apron feeders.

Feeder type	Working principle	Material to feed







End-of-unit quiz

This is the end of Unit 7. Try this quick quiz to check you have understood everything.

1. Put parts of words together to make the names of feeding devices:

griz ap in rol ron be ler rot lt cha ary zly

_____

_____

2. Without looking at the text, write down the reasons for using 3 of the above mentioned feeders. Use **if** or any other way of expressing condition.

1 _____

_____

2 _____

_____

3 _____

_____

3. Answer the questions using **if** or any other way of expressing condition:

Under what condition will you:

exceed the speed limit when driving a car?

skip English class?

lie to your parents?

disobey an order from your teacher?

ask for food?

walk a long distance to university?

not pay fare on a bus / tram?

Unit 8

By the end of Unit 8 you will be able to:

a) read for details to restore the original text using critical thinking

b) talk about current situation of mineral processing in Ukraine

Lead-in Work in pairs to answer the questions:

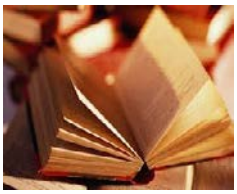
What do you know about mineral processing in Ukraine? What minerals are extracted and in what amounts?

Pre-reading Work in groups of 3-4 to answer the questions:

1. Which minerals are extracted in the biggest amount in Ukraine? What are the tendencies of mineral production (up, down)?

2. What Ukrainian enterprise represents exemplary ore dressing technology?

3. Which ore feeding technologies are used in Ukraine?



While-reading

1. Look through the extracts and check your guesses.

2. Work in 4 groups to put the sentences (a-p) in 4 texts according to the topic. NB: Each sentence takes its correct place in the text (**first** sentence will go **first** in its own text, **second** one will take **second** place in its original text and so on).

1. a) Ukraine is rich in natural resources: coal, iron ore, manganese, nickel and uranium, and others. **b)** Furthermore, gravel grinding plants at the Alcho deposit (Russian Federation) and in Pliseck, Rakytnoe and Sosnovec in Ukraine were put into operation. **c)** At the same time ferrosilicon rose by 30%; silicomanganese, by 27%; iron ore, by 18%; limestone, by 14%; and crude steel, by 12%. **d)** It guards the outlets of 2,000-ton vertical ore pockets. In other installations, 35-ton loads are dumped straight into the Feeder.

2. e) FLSmidth has proved its efficiency in handling the heaviest rock and ore feeds to primary crushers, bin storage feeds to secondary crushers and hopper, bin and chute control feeds to conveyors and elevators. **f)** Production of ferromanganese increased by 116%; feldspar, by 72%; manganese ore and concentrate, by 71%; sulfuric acid, by 46%; kaolin, by 42%; nitrogen, by 36%. **g)** Also more than 5% of world reserves of iron ore are concentrated in Ukraine. **h)** Technologies supplied by the unit, which are well known in the countries of the Commonwealth of Independent States (CIS) as well as in Vietnam, are intended for both mining and enrichment of minerals and raw materials (coal, iron ore, etc.) and mining and dressing of materials for building industry (gravel, sand, etc.).

3. i) An important achievement in the technologies for ore dressing and preparation is the iron ore crushing line at the Zaporozhye Steel and Iron Works. **j)** The reserves of sulfur are the largest in the world, the reserves of mercury ore are the second largest. **k)** It is difficult for the uninitiated to understand how completely the Ross Chain Curtain curbs the most violent rush of material into a quiet, steady flow. **L)** However production of aluminum decreased by 50%; kaolinitic clays, by 14%; peat, by 14%; crude petroleum, by 11%.

4. m) In 2010, production of mineral commodities generally increased owing to a recovery from the slowdown in economic activity in 2008 and 2009 that began as a result of the world financial crisis. **n)** This exclusive yielding top-control principle of operation ensures a remarkable long life to the equipment, and minimal power consumption. **o)** The unit specializes in the raw materials technology supplies both for the surface and underground mining. **p)** There are oil and gas deposits but their reserves are not significant (the reserves of these fossil fuels were partly depleted during the Soviet period).

3. In your groups look at the sources and match them with the original texts above. Then think of an appropriate title for your text.

Sources:

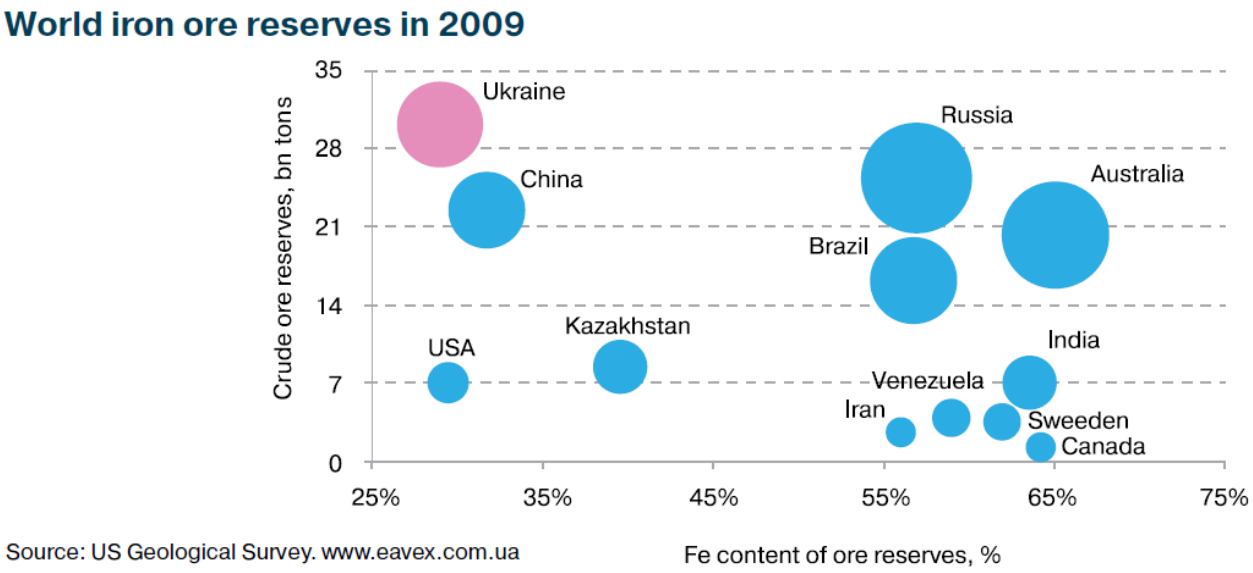
1. **http://ukrainetrek.com/about-ukraine-nature/ukraine-natural-resources**
2. **http://minerals.usgs.gov/minerals/pubs/country/2010/myb3-2010-up.pdf**
3. **http://www.alta.eu/media/company-profile-pdf/**
4. **http://www.flsmidth.com/en-US/Products/Product+Index/All+Products/Underground+Mining/RossChainFeeders/RossChainFeeders**

Post-reading In your groups prepare a mini-presentation for the whole class. Draw slides or diagrams if necessary.

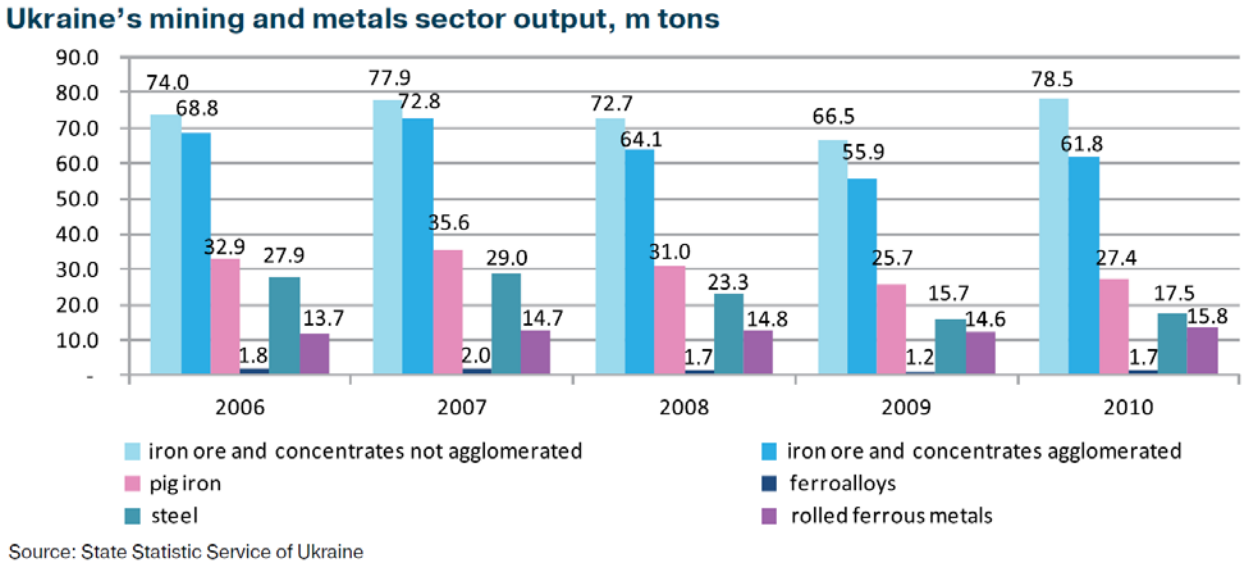
Over to you…

Study the chart and prepare a short presentation of the information, add any necessary details and considerations. Concentrate only on one of the following topics: a) mineral production; b) ore storage; c) ore transportation; d) ore feeding. Use Word Bank (Expressing opinion p. 68, Vague language p. 66, Sequencing p. 62).

Ukrainian mining and beneficiation companies (also referred to as GOKs) extract iron ore via both underground and open pit mining. Ore mined from underground has ferrum content of 50-60%, while ferrum content of crude ore mined from open pits is only around 26-33%.



The diagram below demonstrates Ukraine's metals and mining sector output and structure in dynamics.



The further development and growth of the mining and metals industry in Ukraine is highly dependent on the global and domestic demand, timelines of technological changeover, and ability to produce new marketable metal products that would be a descent substitute to the imported metals and alloys.

http://investukraine.com/wp-content/uploads/2012/06/Metals-and-Mining_www.pdf

Word Bank

1. Comparison and Contrast

compared to / with used when comparing things or people, especially when comparing numbers or amounts:

• This year's profits are much higher **compared to/with** last year's.

by comparison / in comparison when compared with another thing, person etc:

• Young male drivers have far more accidents **by/in comparison with** other groups.

next to / beside *preposition* used when comparing things or people, especially when there is a surprising difference between them:

• Our problems seem trivial **next to** those faced by people in the developing world.

• Their achievements **pale beside** his. (=they seem much less important)

as against / as opposed to *conjunction* used when you are comparing two figures or pieces of information, in order to show how they are different:

• The company achieved sales of $404 million, **as against** $310 million in the previous year.

•**unlike** *preposition* used when saying that people or things are different:

•• The drug has very few side effects, **unlike** other drugs that are used to treat this illness.

in contrast / by contrast used when mentioning the difference between two things, people, countries etc that you are comparing:

• **In contrast to** the south of the island, the north is still untouched by tourism.

• Studies show that each execution costs $3.5 million. **By contrast** it costs about $600,000 to keep someone in prison for life.

in proportion to / in relation to used when considering the relationship between the amount or size of something compared to another thing:

• People from Sweden pay the highest rates of tax **in proportion/ relation to** their incomes.

2. Linking and Sequencing

firstly / first *adverb* used when mentioning the first in a list of reasons, arguments, or parts of an essay:

• There are two main reasons why people choose this type of investment. **Firstly**, it is relatively safe. Secondly, it offers a good rate of interest.

first of all used especially when the first thing that you mention is the most important thing:

• People are living longer for several reasons. **First of all**, there have been enormous advances in medical science. Secondly, our diets are now much healthier.

secondly / second *adverb* used when mentioning the second in a list of reasons:

• Many people are concerned about the problems associated with nuclear energy. Firstly, what do you do with all the nuclear waste? **Secondly**, how can we prevent nuclear materials from falling into the hands of terrorists?

thirdly / third *adverb* used when mentioning the third in a list of reasons, arguments, or parts of an essay:

• There are many things we can do to help protect our environment. First of all, we can use our cars less. Secondly, we can recycle more. **Thirdly**, we need to develop new sources of energy which cause less pollution.

STUDY NOTE: Grammar

When you are giving a long list of reasons or parts in an essay, it sounds rather repetitive to say **Firstly**... **Secondly**... **Thirdly** ... **Fourthly**... **Fifthly** etc. It sounds much more natural to vary the language and use other phrases instead of numbers, for example **In addition** ... **Furthermore/moreover** ... **Lastly** ...

e.g. There are many reasons for switching to wind power. **Firstly**, it causes much less damage to the environment than fossil fuels such as oil and coal. **In addition**, wind power comes from a renewable energy source, and there will always be more wind available. **Furthermore**, wind turbines and windmills are much more graceful and attractive to look at than power stations. **Last but not least**, they are very cheap to run.

3. Adding ideas

Words meaning 'and' or 'also'

and *conjunction* used when joining two words or clauses in one sentence, or in one part of a sentence:

• She studied physics **and** biology at university.

• The information was checked **and then** rechecked.

• His stay in London was **both** happy **and** successful.

STUDY NOTE: Grammar

Don't use **and** at the beginning of a sentence

also *adverb* used when adding another fact about someone or something, or when mentioning another person or thing:

• Smoking causes lung cancer. It has **also** been linked to heart disease.

• The country's mineral resources consist **not only** of diamonds **but also** of oil.

(=used when you want to emphasize that something else is also important)

STUDY NOTE: Grammar

Don't write 'also can'. For example, don't write 'You also can go swimming, walking or cycling.' when you mean: **You can also go** swimming, walking or cycling.

Don't use **also** with two negative statements. Use **not** ... **either**. For example, don't write 'She does **not** drink. She also does **not** smoke.' when you mean: She does not drink. She does **not** smoke **either**.

too / as well *adverb* used when you are adding another fact about someone or something:

• Wind energy is cheap. It is good for the environment **too**.

• The long hours at work began to affect his health. They affected his personal life **as well**.

not to mention used when adding something at the end of a sentence, which adds to the main idea of what you have just said:

• Big 4-wheel-drive vehicles cause so much environmental damage through pollution, **not to mention** the danger they pose to pedestrians and cyclists.

4. Expressing condition

if *conjunction* used when talking about the possibility that something might happen or be true:

• **If** the scientists' predictions are correct, average global temperatures could rise by 6 degrees.

• The patient should be kept in the same position, **if possible**.

• The injury needed to be treated immediately. **If not**, infection could set in.

STUDY NOTE: Grammar

When using **if** to **talk about the future**, you normally **use the simple present tense**. For example, don't say 'If it will rain, the game will be canceled', when you mean: **If it rains,** the game will be canceled.

unless *conjunction* if something does not happen, or if someone does not do something:

• **Unless** something is done quickly, developing countries will fall even further behind Western countries.

otherwise *adverb* used when saying that there will be a bad result if someone does not do something, or if something does not happen:

• The committee needs to act quickly, **otherwise** there could be a serious problem.

in case in order to deal with something that might happen:

• Doctors have to take out insurance to protect themselves **in case** they are sued.

• It is best to keep a medical kit ready **in case of emergency**.

assuming that if what you think will happen is true:

• **Assuming that** the present trend continues, the world population is likely to rise to over 8 billion.

on condition that used when you agree to do something only if someone first agrees to do something else:

• He was offered the job **on condition that** he went on a month-long training course.

5. Discussion phrases

Asking someone's opinion

What do you think (about/of)?

What is your opinion/view?

How do you see it?

How does it look/seem from you point of view?

Active listening

I see.

Really?

Indeed.

Is that so?

How interesting?

Agreement

That would be very nice.

Of course.

That's no problem.

I agree entirely.

Right.

Disagreement

I'm not sure I agree with you. I mean…

I see what you mean, but …

No, but really …

That's all right for you, but …

Well, yes, but …

Yes, but on the other hand, …

Interrupting

Excuse me.

May I say something?

May I speak (now)?

6. Vague language

approximately *adverb* used when saying that a number or amount is not exact, and it may be a little more or a little less:

• **Approximately** 30% of adults who have the disease will die from it.

about *adverb* used when saying that a number or amount is not exact, and it may be a little more or a little less:

• They arrived at **about** 10 o'clock in the evening.

roughly *adverb* approximately - used especially when you are trying to give someone a general idea of the size, number, or amount of something:

• The two countries are **roughly** the same size.

or more

10 years / 20% / 100 kilos etc or more used when the total may be a lot more, and you want to emphasize that this is a large amount:

• It can take **6 months or more** to get a visa.

• Olson weighed 250 pounds **or more**.

not certain / uncertain *adjective* [not before noun] not sure about something:

• **I am not certain that** the figures are accurate.

• People often feel **uncertain about** how to deal with this type of situation.

not sure / unsure *adjective* [not before noun] if you are **not sure** about something, you do not know exactly what it is, whether it is true, what to do etc:

• **I am not sure whether** this story is true or not.

• Scientists are **not entirely sure that** (=not completely sure) life does exist in other parts of the universe.

Degrees of certainty

-	can't be		0	might be		must be	+
isn't		might not be			may be		is

7. Presentation

A Introducing the topic

Today	I'm going to... *(talk about...)*
	I'd like to... *(describe...)*

The aim of my presentation this morning is to... *(explain...)*

I've divided my presentation into...	*(three parts.)*
My talk will be in...	

B Referring to questions

Feel free to interrupt me if there's anything you don't understand.

If you don't mind, we'll leave questions till the end.

C Introducing each section

So, let's start with... *(objectives...)*

Now let's move on to... *(the next part...)*

Finally... *(let's consider...)*

D Referring to visual information

This	transparency	shows...
	diagram	

If you look at this graph you can see...

What is interesting in this slide is...

I'd like to draw your attention to... *(this chart...)*

E Concluding

That concludes my talk.

If you have any	I'd be pleased	to answer them.
questions	I'll do my best	

Thank you for your attention.

J Dealing with questions

I'm glad you asked that question.

Can I get back to you on that later? I'm afraid I don't have...

(the information at present).

8. Expressing opinion

in my opinion / in my view used when giving your opinion about something:

• Their concerns are, **in my opinion**, fully justified.

• **In my opinion**, the cathedral is one of the world's most beautiful churches.

• **In my view**, the court made the right decision.

I think that used when giving your opinion about something:

• **I think that** everyone should be able to own their own home.

• **I think that** hunting should be banned.

it seems to me that used when saying that you think that something is probably true. You use this especially when you have considered a situation carefully and want to give your overall opinion about it:

• **It seems to me that** there is some truth in her argument.

I believe that used about strongly held beliefs, for example about moral issues:

• **I believe that** the death penalty is morally wrong.

Describing trends

balance U1

climb U1

cut U1

decline U1

depress U1

drive down U1

drive improvements U1

fluctuation U1

force up U1

glut U1

grow U1

growth U1

have a damaging effect U1

increase U1

peak U1

push up U1

quadruple U1

reduce U1

worsen U1

Glossary

"tramp" iron U3

abrasion U5

adverse effect U6

alluvial mining U2

angle of repose U6

aperture U3

apron U7

baffle U4

belt conveyor U4

bin U6

breakage U6

bucket-wheel reclaimer U6

bulk of the ore U2

capacity U4

central shaft U5

centrifugal pump U5

choke U3, U5

choking U3

choking up U6

chute U4

clay U3

clogging U6

coarse fractions U3

coarse U5

coarse-crushing machine U6

concentration circuit U6

concentrator U2

conditioning tank U6

continuous line U5

conveyor belt U3

crusher U3

damage U4

depressant U3

discard U2

discharge gate U6

dissemination U2

drive pulley U4

driving tension U4

dry crushing section U3

efficient U6

endless roller chain U5

enrichment U2

exposed to extreme cold U6

feed bin U6

fine crusher U6

fine fractions U3

fine screen U3

flight U4

flotation cell port U3

fluid viscosity U5

freeze U6

front-end loader U6

froth flotation U2

gate U6

grind U3

grinding stage U5

grizzly U7

handling vehicle U7

hanging up U6

head pulley U4

helix U5

hinder U3

hoisting drum U4

hydrocyclone U3

impeller chamber U5

impurities U2

interfere U3

intermittent U7

internal friction angle U5

interruption U6

jam U3

jaw crusher U7

launder U5

load-cell-controlled electrical tensioning device U4

loading strains U4

loose bulk material U4

low grade U2

magnetic ore U3

mechanical classifier U3

metal-bearing slag U2

mill U2

mill storage U3

milling U2

mineral processing U2

moist U7

non-ferrous metal U3

open-pit U2

ore bodies U2

ore feed U3

ore grades U2

ore mineralogy U2

oxidise U6

pivot U5

preliminary U7

pulp density U4

pulp flow-line U6

rate U7

reclaim belt U6

reclaim conveyor U6

reclaimable material U6

r**ectangular** U5

return belt U4

rotary U7

run-of-mine ore U3

sag U4

sandwich conveyor U5

screen U3

screw conveyor U5

segregate U6

semicircular U5

settle U5

settlement U6

shoe U5

shrinkage U4

shutdown U6

shuttle belt U4

shuttle conveyor U6

skip U7

slime U3

slope U4

smelting U2

solid-liquid ratio U5

solids U4

solvent extraction U2

spare part U6

specific gravity U5

sprocket U5

steady U7

steep angle U5

stockpile U6

stretch U4

support roller U4

surge tank U6

tailings U2

tailings disposal U3

tank U6

tensioning device U4

thickener U3

thickening U3

treatment U2

triangular U5

tripper U4

troughing idler U4

underground blockcaving U2

undersize U7

unfloatable U3

upgrade U2

vein-type deposits U2

velocity U4

viable U2

vibrating grizzly feeder U7

vibrating scalping screen U3

voidage U7

washing screen U3

waste (gangue) minerals U2

water spray nozzle U3

wear U4

Answer key to Unit 8 While-reading

Text 1. a, j, g, p

Text 2. m, f, c, L

Text 3. i, b, o, h

Text 4. e, n, k, d.

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