

**НАВЧАЛЬНО-НАУКОВИЙ ЦЕНТР  
ГУМАНІТАРНОЇ ОСВІТИ**

**Кафедра «Іноземні мови»**

**МЕТОДИЧНІ ВКАЗІВКИ**

**з розвитку навичок читання та комунікативної  
компетенції для студентів 2 курсу**

**“МІЙ ФАХ – ЕЛЕКТРИЧНІ СИСТЕМИ ТА  
КОМПЛЕКСИ ТРАНСПОРТНИХ ЗАСОБІВ”**

**(англійська мова)**

**Харків 2012**

Методичні вказівки розглянуто та рекомендовано до друку на засіданні кафедри “Іноземні мови” 29 грудня 2010 р., протокол № 5.

Видання підготовлено відповідно до програми навчальної дисципліни і є складовою частиною навчально-методичного комплексу дисципліни “Англійська мова”.

Метою даних методичних вказівок є розвиток навичок читання та комунікативної компетенції, розширення словникового запасу з загальної теми “Мій фах – електричні системи та комплекси транспортних засобів”.

Методичні вказівки складаються з чотирьох розділів, які включають в себе: основний текст з введенням нових слів та словосполучень та додаткові тексти та післятекстові вправи. Різноманітні післятекстові вправи спрямовані на закріплення навичок читання, усного мовлення, оволодіння новою лексикою. Методичні вказівки вміщують вправи творчого характеру.

Укладачі:

викладачі Т.В. Пилаєва,  
В.В. Кочина

Рецензент

доц. С.М. Донець

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**УКРАЇНСЬКА ДЕРЖАВНА АКАДЕМІЯ  
ЗАЛІЗНИЧНОГО ТРАНСПОРТУ**

**ГУМАНІТАРНИЙ ФАКУЛЬТЕТ**

Кафедра “Іноземні мови”

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## **LESSON 1**

### **Exercise 1**

*Listen to the following words and word combinations. Repeat them after the speaker. Try to memorize them.*

1 to establish (syn. To set up)	засновувати;
2 to train specialists	готувати спеціалістів;
3 the sphere of activity	сфера діяльності;
4 electric power systems and transport facility complexes	електричні системи та комплекси транспортних засобів;
5 theoretical mechanics	теоретична механіка;
6 electrical equipment	електричне устаткування;
7 the Chair of Electric Traction Systems	кафедра «Системи електричної тяги»;
8 applied mechanics	прикладна механіка;
9 theoretical fundamentals of electrical engineering	теоретичні основи електротехніки;
10 microprocessor technology	мікропроцесорна техніка;
11 electric rolling stock (ERS)	електричний рухомий склад;
12 construction, dynamics and strength of ERS	конструкція, динаміка та міцність ЕРС;
13 exploitation and maintenance	експлуатація та ремонт;
14 backbone of technical progress	основа технічного прогресу;
15 volume of traffic	обсяг перевезень;
16 to be engaged in research work.	займатися науково-дослідною роботою;
17 fundamentals of reliability and diagnostics of ERS	основи надійності та діагностики електричного рухомого складу.

### **Exercise 2**

*Listen to and translate the following sentences in which the new words and word combinations are used.*

- 1 The Mechanical Faculty is one of the oldest. It was established in 1930.
- 2 The Mechanical Faculty trains railway mechanical engineers.
- 3 The sphere of activity of a railway mechanical engineer is rather broad.
- 4 In 1992 the Chair of Electric Traction systems was set up on the base of the Chair of Locomotives.
- 5 My speciality is electric power systems and transport facility complexes.
- 6 Electrification is the backbone of technical progress.
- 7 An electric engineer deals with the electrical equipment of electric locomotives.
- 8 The laboratories of the Chair of Electric Traction Systems provide us with excellent opportunities for studies and research.
- 9 A lot of students who specialize in the field of electric power systems and transport facility complexes are engaged in research work.
- 10 We are delivered special courses, such as: applied mechanics, theoretical mechanics, construction, dynamics and strength of ERS, electric rolling stock control systems, exploitation and maintenance of ERS, fundamentals of reliability and diagnostics of ERS.

### **My Speciality**

I study at the Ukrainian State Academy of Railway Transport. I study at the Mechanical Faculty which is one of the oldest. It was established in 1930. In 1992 the Chair of Electric Traction systems was set up on base of the Chair of Locomotives. The Mechanical Faculty trains railway mechanical engineers. The sphere of activity of a railway mechanical engineer is rather broad. I specialize in the field of electric power systems and complex transport facility.

We are delivered general educational, general engineering and special subjects. No engineer can do without the knowledge of mathematics, physics, computer technology and foreign languages. Such general engineering subjects as theoretical mechanics, applied mechanics, theoretical fundamentals of electrical engineering are of primary importance for mechanical engineer. Besides general engineering subjects we are delivered special courses, such as: electrical apparatus and machines, construction, dynamics and

strength of ERS, electric rolling stock control systems, exploitation and maintenance of ERS, fundamentals of reliability and diagnostics of ERS, fundamentals of management and marketing, automatic control theory, design and dynamics of rolling stock , etc. The students get profound knowledge in electrical engineering and study the latest achievements in the sphere of electronics on the base of which new rolling stock control systems are developed.

My speciality is electric power systems and transport facility complexes. This speciality is of primary importance for the technical progress in railway transport. Electrification is rightly considered the backbone of technical progress. Scientific and technical progress in railway transport will continue to give priority to the electrification of main lines and to increasing the sphere of electric traction in transportation.

There are a lot of well equipped laboratories at the Chair of Electric Traction Systems. They provide us with excellent opportunities for studies and research. The basic problems for research are: designing a new electric rolling stock, static converters, asynchronous traction motors developing, automated control systems and electrical schemes. A lot of students who specialize in the field of electric power system and transport facility complexes are engaged in research work.

The graduates who specialize in the field of electric power systems will work at locomotive depots and industrial enterprises, at electric locomotive-building works and at plants manufacturing equipment for electric rolling stock, at designing and research institutes and at railway higher educational establishments as well.

### ***Exercise 3***

*Listen to the following sentences and give English equivalents for the Ukrainian words and word combinations given in brackets.*

- 1 I specialize in the field of ( систем електричної тяги).
- 2 We are delivered such general educational subjects as (теоретична механіка, прикладна механіка, теоретичні основи електротехніки та ін.).
- 3 My speciality is (електричні системи керування).

- 4 Besides general engineering subjects we are delivered special courses, such as (електричні апарати та машини, конструкція, динаміка та міцність ЕРС, експлуатація та ремонт ЕРС та інші).
- 5 We are given every opportunity (для навчання та науково-дослідної роботи).
- 6 (Сфера діяльності) of a railway mechanical engineer is rather broad.
- 7 My speciality (дуже важлива) for the technical progress in railway transport.
- 8 Electrification is rightly considered (основою технічного прогресу).

#### ***Exercise 4***

*Answer the following questions*

- 1 What higher educational establishment do you study at?
- 2 What is your faculty?
- 3 What speciality have you chosen and why?
- 4 When was the Mechanical Faculty established?
- 5 What specialists does your faculty train?
- 6 What field do you specialize in?
- 7 What general educational subjects are you delivered?
- 8 What special courses do you study?
- 9 What is your speciality?
- 10 What is considered the backbone of technical progress?
- 11 What are the basic research problems solved at the laboratories at the Chair of Electric Traction Systems?
- 12 Where will the graduates who specialize in the field of electric traction systems work?

#### ***Exercise 5***

Express your agreement or disagreement with the following statements. Use the speech patterns given below:

Yes, you are right

Yes, that's right/true.

I quite agree with you./ I fully agree with you.

I am sorry but I disagree with you.

I'm afraid I can't agree with you.

I'm afraid you are wrong.



Do you really think so?  
Let me think for a moment.  
Well, let me see.

- 1 I am a first year student of the Ukrainian State Academy of Railway Transport.
- 2 The faculty I study at is the Mechanical Faculty. It was established in 1945.
- 3 The ATC Faculty trains railway mechanical engineers.
- 4 No engineer can do without the knowledge of literature, history, computer technology and foreign languages.
- 5 Electrification is rightly considered the backbone of technical progress
- 6 The graduates who specialize in the field of electric power systems will work at locomotive depots and industrial enterprises, at theatres, cinemas, libraries.
- 7 My speciality is electric power systems and transport facility complexes.
- 8 Such general engineering subjects as theoretical mechanics, applied mechanics, theoretical fundamentals of electrical engineering are of primary importance for mechanical engineer.
- 9 There is only one well equipped laboratory at the Chair of Electric Traction Systems.

### ***Exercise 6***

Complete the sentences.

- 1 In 1992 the Chair of Electric Traction systems was set up on.....
- 2 I specialize in the field of .....
- 3 No engineer can do without the knowledge of .....
- 4 Such general engineering subjects as theoretical mechanics, applied mechanics, theoretical fundamentals of electrical engineering .....
- 5 . The students get profound knowledge in electrical engineering and study the latest achievements in the sphere.....
- 6 Electrification is .....of technical progress.
- 7 There are a lot of well equipped laboratories at.....

- 8 ..... designing a new electric rolling stock, static converters, asynchronous traction motors developing, automated control systems and electrical schemes.
- 9 The graduates who specialize in the field of electric power systems will work at .....

***Exercise 7***

*Give the Comparative and Superlative Degrees:*

Old, broad, theoretical, general, late, new, electric, technical, complicated, automatic, wide, different, excellent, high.

***Exercise 8***

*Translate the following groups of derivatives and explain word-building in each case.*

- 1 Educate-education-educational-educationalist- educative
- 2 Mechanic- mechanical- to mechanize- mechanism
- 3 Engine – engineer – engineering
- 4 Technical – technicality – technically – technician – technique
- 5 electric – electrical – electrician – electricity – to electrify
- 6 equip – equipping – equipment
- 7 manual – manufacture – manufacturer
- 8 study – student – studentship

***Exercise 9***

*Find synonyms in the two columns of the words and give their Ukrainian equivalents.*

- |                       |                    |
|-----------------------|--------------------|
| 1 General             | 1 significant      |
| 2 To continue         | 2 to come to know  |
| 3 To study            | 3 to be engaged in |
| 4 To establish        | 4 profession       |
| 5 Specialist          | 5 to learn         |
| 6 Investigation       | 6 to need          |
| 7 Speciality          | 7 many             |
| 8 A lot of            | 8 to set up        |
| 9 To be occupied with | 9 to go on         |

- |               |             |
|---------------|-------------|
| 10 Important  | 10 common   |
| 11 To require | 11 expert   |
|               | 12 research |

***Exercise 10***

*Find antonyms in the two columns of the words and give their Ukrainian equivalents.*

- |             |               |
|-------------|---------------|
| 1 important | 1 Narrow      |
| 2 broad     | 2 Low         |
| 3 reliable  | 3 Regress     |
| 4 progress  | 4 New         |
| 5 old       | 5 Early       |
| 6 establish | 6 Few         |
| 7 late      | 7 Unreliable  |
| 8 a lot of  | 8 Unimportant |
| 9 high      | 9 Destroy     |

***Exercise 11***

*Form 8 sentences combining suitable parts of the sentence given in columns 1 and 2.*

- |                 |  |
|-----------------|--|
| 1 Research      | 1 is a particular form of power that makes a vehicle move.   |
| 2 Laboratory    | 2 is a machine that uses heat or other kinds of energy to produce power, especially in order to make a vehicle move            |
| 3 Rolling stock | 3 Is a branch of knowledge, especially one studied in a school, college or university  |
| 4 Traction      | 4 Is the engines, carriages and wagons that are used on a railway  |
| 5 Compressor    | 5 Is a detailed study of a subject or an aspect of a subject   |
| 6 Engineer      | 6 is a building or a room that contains special scientific equipment. Scientists use them to do experiments or to do research. |

- |           |  |
|-----------|--|
| 7 Engine  | 7 is a machine or part of a machine that squeezes gas or air and makes it take up less space   |
| 8 Subject | 8 is a skilled person who uses scientific knowledge to design and construct machinery, engines, electrical devices or roads and bridges. |

### ***Exercise 12***

Now let's play a snowball game. The first student starts the game saying one sentence about your speciality. The second one repeats the first sentence and adds his own. The next student repeats the first and the second sentences and adds his own sentence. The game continues until all the students take the floor. The last student repeats all that has been said on the topic. Try to use short sentences to better memorize them.

### ***Exercise 13***

Retell the topic "My speciality is electric power systems and transport facility complexes"

### ***Exercise 14***

Try to explain the choice of your speciality.

- What do you want to be? Why? How did you decide what to be?
- Was it always your ambition to do this?
- What do you have to do to get this job?
- Are you well-suited to your job? Why do you think so?
- What position would you like to get?

## ***LESSON 2***

### ***RAILWAY POWER SUPPLY***

#### ***Exercise 1***

*Study the meaning of the following words:*

- 1 propel – приводити до руху, просувати;  
propulsion – рушійна сила;

- 2 power supply – енергопостачання;
- 3 traction (diesel, electric) - тяга (дизельна, електрична);
- 4 steam locomotives (engines) - парові локомотиви;
- 5 efficient - ефективний;
- 6 power station (plant) - електростанція;
- 7 produce electric current - виробляти електричний струм;
- 8 tractive effort (power) - тягова сила;
- 9 air pollution - забруднення атмосфери ;
- 10 air pollutant - забруднюючий агент;
- 11 turbotrain - турбопоїзд;
- 12 gas-turbine engine - газотурбінний двигун;
- 13 power car - ; вагон енергопостачання;
- 14 horse power (hp, HP) - кінська сила; потужність.

### ***Exercise 2***

*Answer the following questions:*

- 1 What types of engines may trains be propelled by?
- 2 What types of locomotives - steam, diesel or electric - may be used for heavy mainline service?
- 3 What type of tractive power did the first locomotives run on?
- 4 What type of locomotive - diesel or electric - is more expensive to build?
- 5 Have you heard of trains propelled by gas-turbine engines? Give your examples, if any.

### ***Exercise 3***

*Read and translate the text using the words from exercise 1.*

## **RAILWAY POWER SUPPLY.**

Trains may be propelled by various types of engines: diesel, electric or aircraft ones. Hence, railway **power supply** is based on diesel or electric **traction**.

First locomotives were steam ones, they made railways the dominant means of inland transport in the last century. Without it we might not have our present national networks of railways. However, nowadays steam locomotives are on their way out in many counties.

The reason is that, first of all, diesel and electric locomotives which replaced former steam engines, are available for work over much longer periods, and can maintain a higher average speed and are less costly. In fact, steam engines were never **efficient** in turning coal into energy - only about 7 per cent of the available heat was used (the same coal could be better used in a **power station** to produce electric **current** to drive an electric locomotive.

### **Diesels or Electrics?**

The diesel and electric locomotives have some common features. As well as the electrics (electric locomotives), the diesels(diesel locomotives) are always ready for service because the diesel engine can be started within a minute or two in any weather and can be in operation for perhaps a week without visiting a **depot**. As well as the electrics, the diesels are capable of developing a high **tractive effort** at low speeds and, therefore,can start and accelerate heavy trains. These features allow the diesel locos to be used for heavy mainline service.

On the other hand, the diesel locomotive is more expensive to build and maintain than the electric of equal power since the diesel locomotive carries a **power plant** on itself. In addition, the diesel engine is an **air pollutant prime mover**, so the diesel traction should not be recommended for use on suburban lines round large cities. Noise and vibration are also considered the drawbacks of the diesel locomotive. Another disadvantage of the diesel locomotive is that the diesel engine runs on organic fuel the supplies of which are not inexhaustible. Diesel traction is normally employed today on nonelectrified trunk lines and on lines where traffic is not dense enough to justify electrification.

The history of railway traction is abundant in types of energy used for starting trains. In the second half of the 20th century aerospace engineers designed turbo trains the operation of which was based on the technology of flight. The new American turbo train had an aircraft-type gas-turbine engine and developed a speed of 157 miles/h on standard jointed rail tracks. In France turbo trains began running between Paris and Cherbourg in 1971. Each **power car** of the train carrying a pair of gas turbines contained a driver's cab which had been specially designed to give the maximum driving efficiency and control. On Paris-Lyon route gas-turbine locomotives developed a

maximum speed of 300 km/h. British Advanced Passenger Train (APT) consisted of two aerodynamically-styled power cars each fitted with four 300-h.p engines.

**Exercise 4**

*a) Make a list of advantages of diesel locomotives. Use the text to help you:*

- 1 can start heavy trains
- 2 \_\_\_\_\_
- 3 \_\_\_\_\_
- 4 \_\_\_\_\_

*b) Make a list of disadvantages of diesel locomotives. Use the text to help you:*

- 1 expensive
- 2 \_\_\_\_\_
- 3 \_\_\_\_\_
- 4 \_\_\_\_\_

*c) Now name all the common features of diesels and electrics. What are the advantages of electrics?*

**Exercise 5**

*Scan the text and say what type of traction it deals with.*

**Natural Gas Railcar Debut**

German Rail (DB) is claiming world first, by operating passenger trains powered by natural gas which is said to produce very few harmful emissions compared with a diesel-powered train. The project has aroused such interest that DB and French National Railways (SNCF) now plan to develop a new natural gas lightweight railcar.

Two 30 to 40 year old two-axle lightweight diesel railcars belonging to DB's subsidiary and operating on the Baltic island of Usedom were converted to natural gas propulsion. The conversion involved the replacement of the diesel engine on each railcar with an

Otto engine with spark plugs which can be powered by compressed natural gas.

An advantage of natural gas is that the railcars can travel about 750 km more on a full tank than they could when they were diesel powered. The environmentally-friendly propulsion concept fulfilled all the expectations during trials in the foothills of the Alps. Measurements showed that emissions of nitric oxide were cut by about 97 %. Carbon monoxide by 84 % and hydrocarbons by about 70%. Another advantage of natural gas over diesel is that there is no soot emission from the exhaust pipe. The natural gas engines are also quieter than their diesel counter - parts.

The German and foreign rail vehicle industry has taken notice of this propulsion technology, and is considering whether to develop and offer new generation lightweight railcars with natural gas propulsion", said Mr Roland Heinisch, DB's board member for research, technology and traction.

### ***Exercise 6***

*Translate the following sentences paying attention to modal verbs and their equivalents:*

- 1 To improve passenger service there must be more ticket windows at railway stations.
- 2 The electrified lines of Russia are able to cater more than 50 per cent of the entire cargohaulage.
- 3 Steam locomotives were built for many different tasks but they were not able to haul very heavy trains at high speeds.
- 4 It is necessary that the traction motor characteristics should meet operating conditions.
- 5 Electrified railways are to be found in different countries of the world.
- 6 There existed a number of projects of strange railways in the past; according to one of them the power sources were to be installed along the track.
- 7 All types of locomotives have to satisfy a number of technical and economic requirements.
- 8 It is quite necessary that electric traction should be widely used in mountains as well as in tunnels.



- 9 Track circuits should not be influenced by electric supply circuits.
- 10 A more frequent service ought to be introduced at peak periods on heavily-used suburban lines.

### **LESSON 3**

#### ***Exercise 1***

*Study the meaning of the following words.*

- 1 capacity – здатність, продуктивність, потужність ;  
Syn. productivity;
- 2 operating parameters – експлуатаційні параметри;
- 3 rolling stock – рухомий склад;
- 4 eight-axle locomotives – восьмивісні локомотиви;
- 5 overhead (contact) wire – контактний дріт;
- 6 catenary - контактна мережа;
- 7 third (conductor) rail – контактна (струмопровідна) рейка;
- 8 electrical substation – електрична підстанція;
- 9 electrical cables – електричні кабелі ;
- 10 running rails – ходові рейки;
- 11 density of traffic – напруженість перевезень;
- 12 direct current (D.C.) – постійний струм;
- 13 alternating current (A.C.) – змінний струм;
- 14 transmit – передавати;
- 15 voltage – напруга;
- 16 rectify – випрямляти (струм);
- 17 distribute – розподіляти;
- 18 frequency – частота;
- 19 transform – перетворювати;  
Syn. turn (into), convert;
- 20 feed – забезпечувати (струмом);  
Syn. supply
- 21 emergency – аварія.

### ***Exercise 2***

*Make nouns from the verbs with the help of the suffixation and translate them into Ukrainian*

*transform -перетворювати — transformation -перетворювання*  
operate, electrify, transmit, rectify, distribute, consider, compete,  
restrict,  
pollute.

### ***Exercise 3***

*Answer the questions:*

- 1 What does the future of railways depend on? What's your opinion?
- 2 What kind of traction - electric or diesel - results in the increase in the speed of trains?
- 3 Does electric traction provide the improvement of labour conditions?
- 4 Is the electric power supply system a costly business?
- 5 What types of current do you know? What current is most often used in our everyday life?
- 6 Is the high voltage of the substation lowered for transmission over the railway network, to your mind?

### ***Exercise 4***

*Read the text and translate it into Ukrainian.*

## **RAILWAY ELECTRIFICATION**

The key to the increase *of train capacity* in recent years has undoubtedly been the impressive spread of electrification. Numerous studies and tests as well as practical railway experience show that electric traction has many advantages, especially on lines carrying high-density traffic. The replacement of diesel traction by electric one leads to an all-round improvement in the main *operating parameters* and the reduction in cost. There is an increase in the average speed of trains, a useful increase in traffic *capacity, line capacity*, increased automation and higher *productivity* and a reduction *of rolling stock* requirements. Thus, as compared to diesels, under average conditions,

the use of *eight-axle electric locomotives* results in the increase in the speed of trains by 15-25 per cent.

Undoubtedly, railway future lies in electrification. The conversion of railways to electric traction provides the improvement of labour conditions, the reduction of *air pollution* the electrification of settlements situated along the railway lines. Electric traction promotes the *automation and mechanization* in track laying and repairs.

The reliability of electric traction is a function of combined reliability of the locomotives and power supply, especially the *overhead contact wire*. Along its whole length the track on which electric locomotives run must have either an overhead contact wire (*catenary*) or *an extra rail (third or third and fourth rail)* from which the train can continuously pick up power. Overhead contact wire is connected with *electrical substations and cables* to bring the power to the track. As to the extra rail, it is placed in the track between the two running rails. This power supply system makes railway electrification a costly business, therefore it is justified only on railways with a high *density of traffic*. It should be noted, that the third rail system is particularly essential for underground railways because of a limited space available in tunnels.

Electric railways may use either *direct or alternating current (D.C. or A.C.)*.

The current supplied from power stations is always alternating one which can *be transmitted* at high *voltage*. This high voltage is lowered at a substation to one suitable for transmission over the railway network. If the railway uses the third rail distribution the substation also has to *rectify* the supply turning it into direct current at a comparatively low voltage.

When alternating current is supplied, it is distributed by an overhead catenary at a high voltage, 25 kV, and at the normal industrial *frequency* of a country. High voltage is first transformed to a lower voltage in the locomotive and used to feed a.c. or d.c. motors. (It is important that apparatus for rectification should be small because of the limited space of the locomotive.) At the present state of development almost all electrified railways are supplied by alternating current at 25 kV having frequency of 50 Hz (Herz). Direct current supply causes restrictions on speed, weight of trains. Hence -limited

traffic and line capacity, increased power supply and high cost. Electrified lines of alternating current have higher efficiency (power losses for traction are 5-6 % less), weights of trains are practically unlimited. Fulfilling the same work a.c. lines require 15-20 less locomotives and locomotive crews. As has been calculated, traffic expenses on a.c. lines are almost 20 less than on d.c. lines. Instead of formerly used direct current of 3 kV and 1,5 kV many countries nowadays use alternating current as *tractive power* for trains.

At present there are the following tractive lines in Ukraine : 3000 V d.c. line and 3000 V a.c. line, frequency 50 Hz (high-voltage lines); 100 V d.c. and 650 V d.c. (having voltage after the primary transformation of high voltage). The former two lines are customary for our railways, the 650 V d.c. line is introduced additionally for reserve supply in case of damage of the main power supply systems. The line 100 V d.c. using the power of accumulated batteries is designed for use in emergency situations.

### ***Exercise 5***

*a) Make a list of advantages alternating current power supply. Use the text to help you.*

1 higher efficiency (power losses 5-6 % less)

2 \_\_\_\_\_

3 \_\_\_\_\_

*b) Make a list of disadvantages of direct current power supply. Use the text to help you.*

1 causes restrictions in speed

2 \_\_\_\_\_

3 \_\_\_\_\_

### ***Exercise 6***

*Describe the process of transmission of electric current to the railway network system by way of the third rail distribution. Your explanation will consist of several steps. The verbs will help you.*

- 1 \_\_\_\_\_ place
- 2 \_\_\_\_\_ connect
- 3 \_\_\_\_\_ transform
- 4 \_\_\_\_\_ rectify
- 5 \_\_\_\_\_ turn into
- 6 \_\_\_\_\_ feed

### ***Exercise 7***

*Try to guess the meaning of the words in bold type. Check your answers with a dictionary.*

It is a well-known fact that electric trains perform **valuable** service on trunk lines with dense traffic. But electric **haulage** is costly because it needs a whole system of electrical substations and either a catenary or a conductor rail. The third rail system is particularly **essential** for underground railways because of a limited space **available** in tunnels.

The conductor rail system proves quite successful under normal conditions, but a great difficulty arises on open sections. The matter is that under **unfavourable** winter conditions the third rail may be covered with ice and it becomes difficult to transfer electric current from the conductor rail to the train.

To **eliminate** this difficulty a special equipment was devised which could remove ice. At first this equipment was **manually** operated. But the process was relatively slow and inefficient.

In **recent** years, the manually-operated equipment has been converted to semi-automatic working.

### ***Exercise 8***

*Define the function of the verb “to have” in the following sentences, translate into Ukrainian.*

- 1 Every engineer working in the field of signalling has to know the principles of track circuit operation.
- 2 Many new electronic devices have been developed to provide the safety of high-speed traffic.
- 3 One of the new systems proposed for carrying passengers in towns is the “Never-Stop” Railway which has no rails but runs with rubber-tyred wheels.

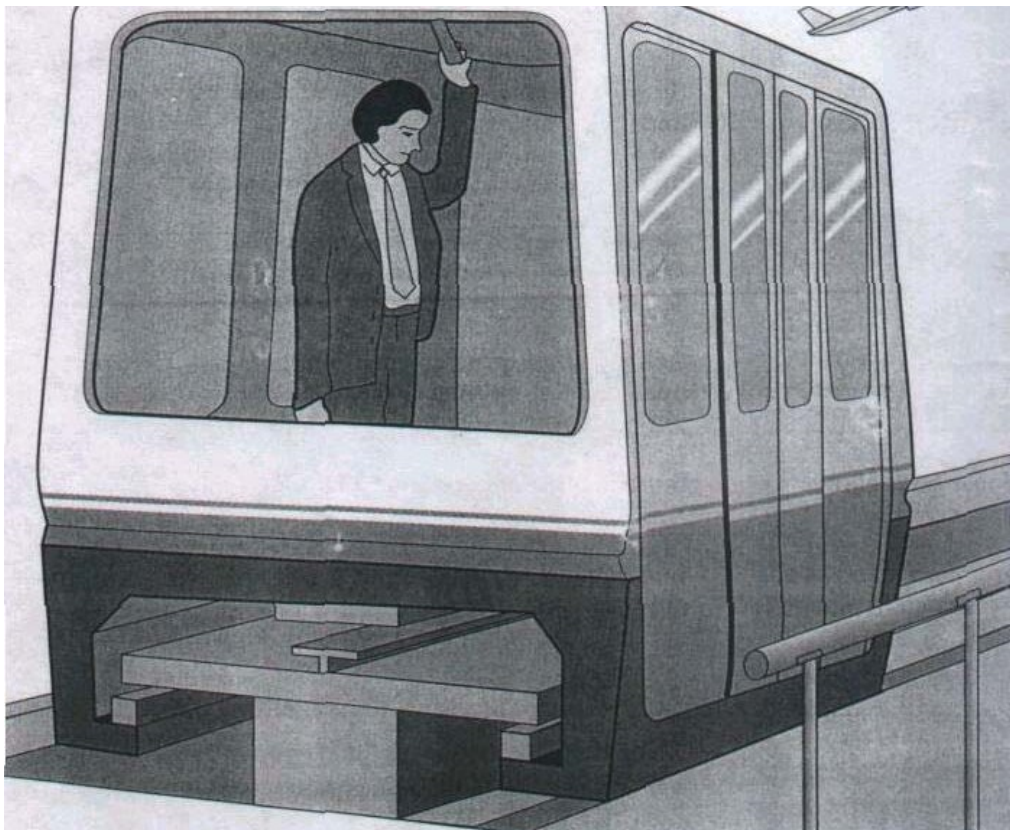
- 4 Our country has many locomotive building works producing all types of locomotives.
- 5 Technical investigations have shown that today it is possible to build very powerful diesel locomotives.
- 6 The old bridge had to be moved from piers to carry the diverted traffic during the reconstruction.
- 7 With the introduction of Computer Traffic Control the safety of railway operation has greatly increased.
- 8 It was reported by foreign press that multiple-wheel cars would have a bright future.
- 9 All types of locomotives have to satisfy a number of technical and economic requirements.

## ***LESSON 4***

### **MAGLEV TRAIN**

#### ***Exercise 1***

*Study this diagram of a Maglev train. What differences can you name between this and a conventional train?*



### ***Exercise 2***

*Now read the following text to check how many of the differences you have noted are mentioned. Add any other differences you find to your list.*

### ***Exercise 3***

*While reading guess the meaning of the following words and expressions: to float, magnetic attraction, magnetic poles, even distance, linear induction motor, electromagnetic windings (coils), to interact.*

NOTES: to levitate – підійматися; damper – амортизатор; concrete – бетон; to shift – тут: переміщатися.

## **MAGNETIC LEVITATION TRAIN**

A MAGLEV (magnetic levitation) train does not run along a track in the normal way. Instead, magnetic fields lift it above the track, so that the train 'floats' along.

Because they have no wheels, axles, suspension, dampers, or brakes, Maglev vehicles are light and compact. They are also pollution-free, as no fuel is burned within the train, and cheap to maintain.

The Maglev system at Birmingham Airport carries passengers from the terminal to the railway station and the National Exhibition Centre. The cars are made of lightweight fibreglass, carried on an aluminium chassis. All the electrical equipment which powers the cars is situated under the floors or the seats. Each car can take 32 passengers and their luggage, up to a weight of 8 tonnes. The trains travel at a maximum speed of 42km/h.

A concrete guideway above the ground supports a T-shaped track for the two-car Maglev trains. The train is lifted from the track by magnetic attraction. This is the force by which two opposite magnetic poles attract each other (just as two of the same poles 20 repel each other). Powerful electromagnets at each corner of the train exert a pulling force which lifts the train upwards so that it floats 15 mm above the track.

As people get on and off, the weight of the train varies. It may drop closer to the track than the required 15mm, or rise further from it.

To keep it at an even distance from the track, the force is varied by a microprocessor. Each train is driven by an electric motor called a linear induction motor. Electromagnetic windings, or coils, on the train generate a magnetic field in which the magnetic poles shift along the train. The field induces electric current in the track, which in turn generates its own magnetic field. The two fields in the track and the train interact so that the shifting field pulls the floating train along the track.

***Exercise 4***

*Make a list of the advantages of the Maglev train. You may use the text to help you.*

***Exercise 5***

*Now list the disadvantages. You may use the text to help you.*

***Exercise 6***

*Look through the text once again and try to find things which can be used with the attribute “magnetic”. Make up your own sentences with these words and find the ones in the text.*

***Exercise 7***

*Dealing with unfamiliar words.*

*Answer this question using the extract from the text below.*

Why are Maglev trains so light?

*Because they have no wheels, axles, suspension, dampers, or brakes, Maglev vehicles are light and compact.*

In your answer, you may have used the word *dampers*. Do you know what it means? Do you need to know its exact meaning.?

We can ignore unfamiliar words which do not help with our reading purpose. Some words we cannot ignore, but often an approximate rather than exact meaning of a word is all that is required. Sometimes we can work out the approximate meaning of a word from its context. For example, we can say that *dampers* are probably:

1 heavy (not light)

2 large (not compact)



3 part of the undercarriage (same set as wheels, axles, suspension, and brakes)

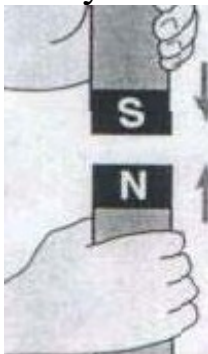
Try to work out (to guess) the meaning of any of the words printed in **bold** in this text whose meaning you do not know. Check your answers with a dictionary.

When first introduced, linear motors were seen as a major technological **breakthrough**. However, disappointingly few practical applications have been found for this new development. An earlier **innovation**, the Wankel engine, was **radically** different from conventional engines, having a rotary piston and no valves. Wankel engines were **adopted** by the Mazda car company. However, Wankel engines are now **rarely** used because of problems with fuel consumption and maintenance. The Wankel story illustrates the **risks** involved in developing any new product - success can mean a market **lead** over competitors but failure means that expensive development costs must be **written** off with no result. Sadly, technological superiority does not **guarantee** success. Betamax video tapes, technically better than their rivals, **gave way** to VHS because of better marketing.

### *Exercise 8*

#### *Language study Prediction*

Study this diagram. What will be the result of this action?



#### **Action Result**

Two magnets are held together with opposite poles facing.

When an action is always followed by the same result, we can link them like this:

*If/When two magnets are held together with opposite poles facing, they **attract** each other.*

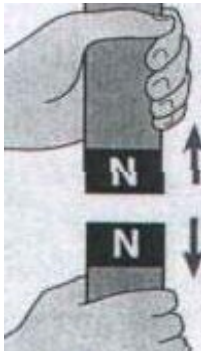
or

*If/When two magnets are held together with opposite poles facing, they **will attract** each other.*

When an action is always followed by the same result, the statement becomes a general principle or law. Using the law, we can predict what will happen in particular cases.

### **Exercise 9**

*Predict the result of the action illustrated here.*



#### **Action Result**

Two magnets are held together with like poles facing.

Now write the principle illustrated.

If two magnets \_\_\_\_\_.

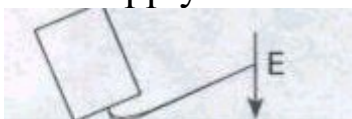
### **Exercise 10**

*Predict the results of each of these actions. Then link each action and result in a sentence.*

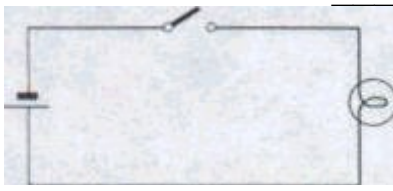
#### **Action Result**

1 A steel bar is subjected to tensile forces. The bar \_\_\_\_\_

2 We apply an effort at E. The block \_\_\_\_\_



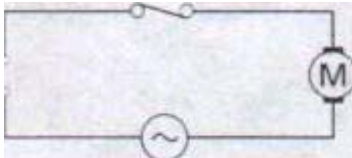
3 The switch is closed. \_\_\_\_\_



6 V 6 V 3 W

4 The switch is pressed. \_\_\_\_\_

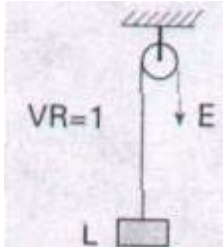
150mA



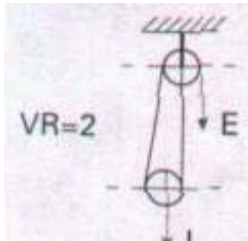
240V

240 V,  
750 W

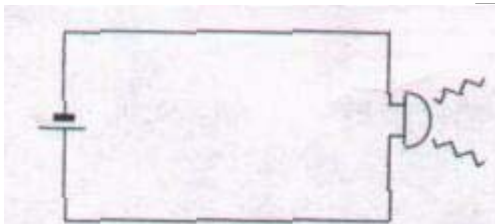
5 We move the effort by one meter. The load \_\_\_\_\_



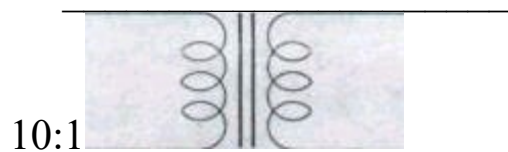
6 We move the effort by 50 centimeters. \_\_\_\_\_



7 The circuit is broken. \_\_\_\_\_

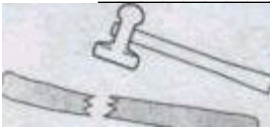


8. 120 V ac is applied across the primary.



10:1

8 We apply an impact load to a brittle body. \_\_\_\_\_



9. We apply 24 V ac to the transformer primary. \_\_\_\_\_

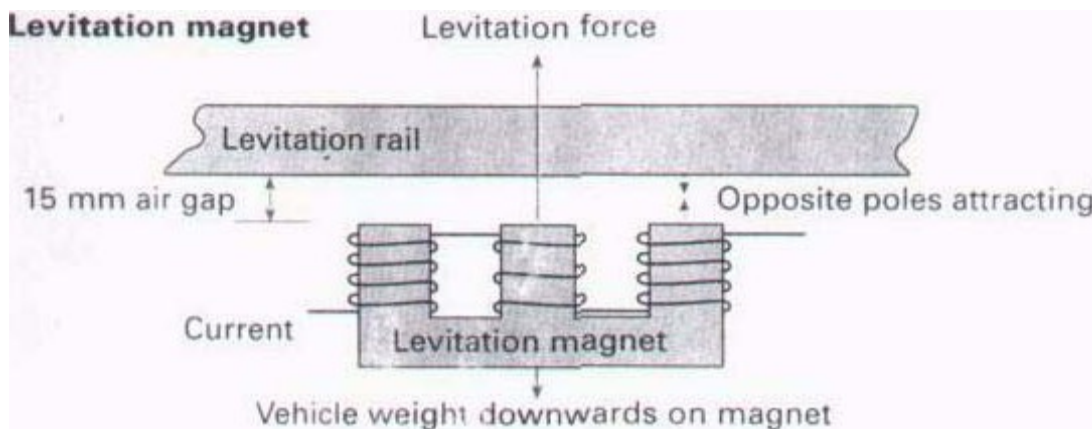


1:2

### ***Exercise 11***

#### ***Explanations***

Study this diagram. It shows how a Maglev train is supported without physical contact with the track. Can you explain how this works?



The explanation consists of a series of at least six steps. The first step is:

**1** Current flows through the magnet coil.

The last step is:

**6** The train is lifted.

Can you think of any of the steps in between?

Explanations consist of a series of steps. Some steps in an explanation have cause and effect links; others have time links. Here are some of the steps which explain how the train is lifted. What kinds of links are there between the stages?

**1** Current flows through the magnet coil.

**2** The current creates a magnetic field round the poles.

**3** The field induces a current in the track.

- 4 The track becomes magnetized.
- 5 The two magnets attract each other.
- 6 The train is lifted.

You can show cause and effect links in these ways:

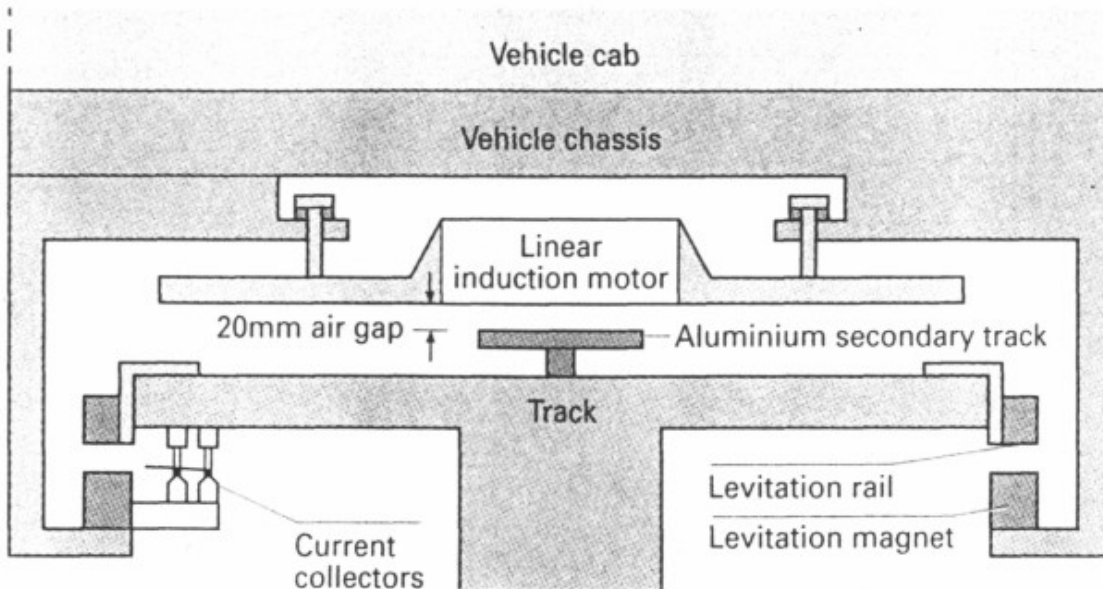
1+2 *Current flows through the magnet coil, **creating** a magnetic field round the corners.*

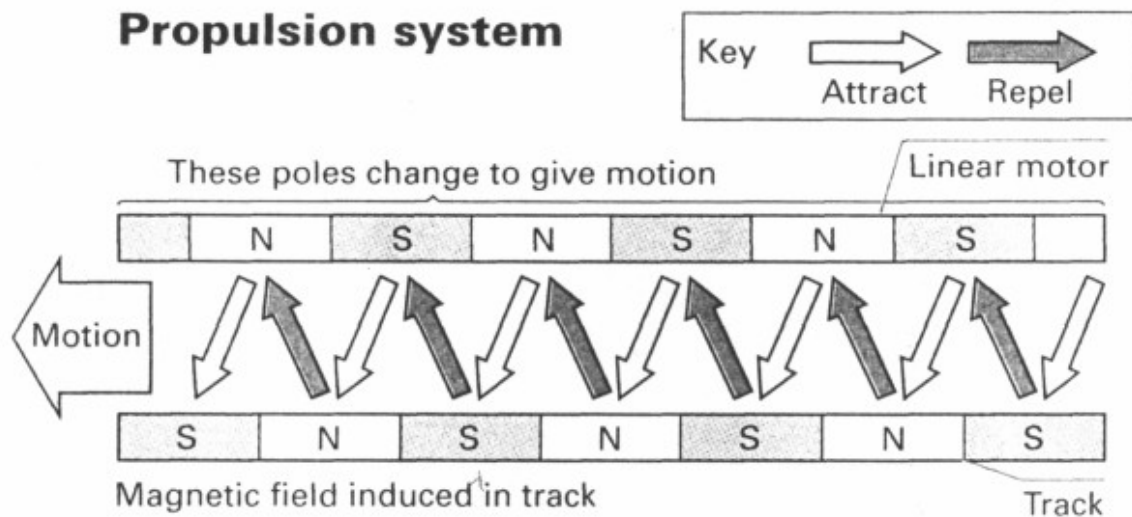
3+4 *The field induces a current in the track; **therefore** the track becomes magnetized.*

5+6 *The two magnets attract each other, **(thereby)** lifting the train. Thereby can be omitted from the last example.*

### **Exercise 12**

*Study these diagrams. They explain how the propulsion system operates.*





The train is propelled by a linear-induction motor mounted under the vehicle.

The current creates a linear travelling field which constantly reacts with the aluminium secondary track, causing relative motion. To stop the train the current is moved.

*Try to complete the blanks in this set of steps which form an explanation of the propulsion system.*

- 1 Current \_\_\_\_\_ through the motor coils.
- 2 The current creates \_\_\_\_\_ fields in the motor.
- 3 The fields - \_\_\_\_\_ currents in the track.
- 4 The track becomes \_\_\_\_\_.
- 5 The current through the linear motor \_\_\_\_\_.
- 6 The magnetic \_\_\_\_\_ in the motors shift.
- 7 There is \_\_\_\_\_ and repulsion between the new motor fields and the track fields.
- 8 The motor pulls the train along the \_\_\_\_\_ to line up the fields.
- 9 The \_\_\_\_\_ through the coils changes and the process is repeated.

### ***Exercise 13***

*Define the function of infinitives in the following sentences, translate them into Ukrainian.*

- 1 The driving cars of the experimental British train were to be fitted with 4 gas-turbine engines.
- 2 To put this train into service will be possible only after a series of special tests.

- 3 High-speed traffic requires the permanent way to be excellently laid and carefully maintained.
- 4 To increase the speed of trains is a complicated problem.
- 5 The linear electric motor to be used on the Japanese railways will greatly increase the speed of trains.
- 6 The new instruments to be introduced on the substations will increase the reliability of the electric machines and the auxiliary apparatus.
- 7 It should be noted that speed control devices are used to provide definite speeds under certain conditions.
- 8 An electric locomotive contains electrical control equipment needed to control the electrical energy supplied to the motors.
- 9 Passenger and freight traffic is supposed to increase.

***Exercise 14***

*Choose the form of infinitives in the following sentences with the help of the table given below.*

The Infinitive

	<i>Active</i>	<i>Passive</i>
<i>Indefinite</i>	to take	to be taken
<i>Perfect</i>	to have taken	to have been taken
<i>Continuous</i>	to be taking	
<i>Perfect Continuous</i>	to have been taking	

- 1 She was believed (to feel) unwell for some time.
- 2 He seems (to read) a lot. He seems (to read) now. He seems (to read) since morning. He seems (to read) all the books in the library.
- 3 I want (to take) you to the concert. I want (to take) to the concert by my father.
- 4 I am glad (to do) all the work yesterday.
- 5 She seems (to work) at this problem ever since she came here.
- 6 I am sorry (to break) your pen.
- 7 He began writing books not because he wanted (to earn) a living: he wanted (to read) and not (to forget).

- 8 He seems (to know) French very well: he is said (to spend) his youth in Paris.
- 9 The woman pretended (to read) and not (to hear) the bell.
- 10 They seemed (to quarrel): I could hear angry voices from behind the door.
- 11 Perhaps it would upset her (to tell) the truth of the matter.
- 12 Her ring was believed (to lose) until she happened (to find) during the general cleaning. It turned out (to drop) between the sofa and the wall.



## **МЕТОДИЧНІ ВКАЗІВКИ**

з з розвитку навичок читання та комунікативної компетенції  
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(англійська мова)

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