МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
МИКОЛАЇВСЬКИЙ НАЦІОНАЛЬНИЙ АГРАРНИЙ УНІВЕРСИТЕТ

Факультет культури й виховання

Кафедра іноземних мов

АНГЛІЙСЬКА МОВА

методичні рекомендації
для аудиторної та самостійної роботи здобувачів початкового рівня (короткий цикл) вищої освіти ОПП «Електроенергетика, електротехніка та електромеханіка» спеціальності 141 «Електроенергетика, електротехніка та електромеханіка» денної форми здобуття вищої освіти

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ПЕРЕДМОВА

Метою даних методичних рекомендацій Мета цих методичних рекомендацій — надати здобувачам вищої освіти матеріал з професійної тематики, а також систему вправ і завдань для оволодіння і систематизації лексико-граматичного матеріалу з дисципліни «Іноземна мова за професійним спрямуванням (англійська)» в обсязі програми для вищих навчальних закладів здобувачів вищої освіти освітнього ступеня «Молодший бакалавр» початкового рівня спеціальності 141 «Електроенергетика, електротехніка та електромеханіка» денної форми навчання. Подані методичні рекомендації написані англійською мовою.

Оволодіння іноземною мовою дуже важливо в теперішній час у євро-інтеграційних процесах України, де іноземна мова повинна стати важливим елементом професійної підготовки студентів. Методичні рекомендації спрямовані на розвиток навичок читання та перекладу з професійної тематики у здобувачів вищої освіти агроінженерного факультету МНАУ. Методичні рекомендації складаються з текстів, які освідчують різноманітні теми з фізики та енергетики. До кожного тексту додається лексика і система вправ, на базі яких проводиться активізація мовленнєвих одиниць.

Для укладання методичних рекомендацій автори спиралися на сучасну автентичну літературу, матеріали українських авторів, а також використовувавали інтернет-сайти з вибраної тематики. Методичні рекомендації написані на достатньому методичному рівні. Методичні рекомендації підготовлені відповідно до програми для вищих навчальних закладів і розраховані на 30 годин аудиторних занять.

ЗМІСТ

Electrical circuit.

1. Read and translate the following text.

Electric circuit" The electric circuit is the subject to be dealt with in the present article. But what does the above term really mean? We know the circuit to be a complete path that carries the current from the source of supply to the load and. then carries it again from the load back to the source. The purpose of the electrical source is to produce the necessary electromotive force required for the flow of current through the circuit. The path along which the electrons travel must be complete otherwise no electric power can be supplied from the source to the load. Thus we close the circuit when we switch on our electric lamp. If the circuit is broken or, as we generally say "opened" anywhere, the current is known to stop everywhere. Hence, we break the circuit when we switch off our electrical devices. Generally speaking, the current may pass through solid conductors, liquids, gases, vacuum, or any combination of these. It may flow in turn over transmission lines from the power-stations through transformers, cables and switches, through lamps, heaters, motors and so on. There are various kinds of electric circuits such as: open circuits, closed circuits, series circuits, parallel circuits and short circuits.

1. Fill in the blanks with the words and phrases:

Complete, fuse, open circuit, supplied, transmission line, fault, closed circuit, conductor, load, switch, safety device, short circuit, carry, cables.

1. The current does not flow if there is an ……
2. A fuse is a ……
3. Our laboratory is …… with electrical materials.
4. A new high voltage …… was put into operation in Siberia.
5. We tested the new …… in the high voltage laboratory.
6. The current flows when there is a ……
7. Copper is the best …… of electricity.
8. The …… of the electrical system was caused by lightning.
9. The ability to …… electrical charges is known as conduction.
10. This circuit consists of some …… paths.
11. A …… placed in an electrical circuit serves as a means of protection.
12. The …… of the power-stations often varies.
13. A …… is dangerous as it sometimes causes.
14. A …… is used to break the circuit.

2. Connect the word combinations:

Electric - path
various - device
single - kinds
safety - circuit
carrying - capacity

3. Find the end of the sentences:

1. The circuit is …
2. The purpose of the electric circuit is…

3. When we switch off our electric devices, …
4. The current may pass through …
5. There are various kinds of electric circuits, such as…
6. The lamps in your room and your house are generally connected…
7. The short circuit is produced…
8.The fuse …

a.open circuits, closed circuits, series circuits, parallel circuits and short circuits.
b.must be placed in every circuit, where there is a danger of overloading the line.
c.complete path which carries the current from the source of supply to the load and then carries it again from the load back to the source.
d.we break the circuit.
e.when the current is allowed to return to the source of supply without control and without doing the work that we want it to do.
f.solid conductors, liquids, gases, vacuum.
g.in parallel.
h.to produce the necessary electromotive force.

4. Translate into Ukrainian.

Electric circuit" The electric circuit is the subject to be dealt with in the present article. But what does the above term really mean? We know the circuit to be a complete path which carries the current from the source of supply to the load and then carries it again from the load back to the source. The purpose of the electrical source is to produce the necessary electromotive force required for the flow of current through the circuit. The path along which the electrons travel must be complete otherwise no electric power can be supplied from the source to the load.

5. Compete the following sentences.

A: Current flows, such conditions, circuit is considered, parallel circuit.

1. When electrical devices are connected so that the … from one device to another, they are said to be connected in series.
2. Under … the current flow is the same in all parts of the circuit, as there is only a single path along which it may flow.
3. The electrical bell … to be typical example of a series circuit.
4. The… provides two or more paths for the passage of current.

B: 1. Now we shall turn our attention to the short _____ called "the short".
2. The short circuit is produced when the _____ to return to the source of supply without control and without doing the work that we want it to do.
3. The short circuit often _____ fault or wire fault.
4. Under certain _____, the short may cause.

6. Learn by heart heard the following words and phrases.

electric circuit - електрична схема
current - струм
purpose of the electrical source - призначення електричний джерело
electrical source - електричний джерело
the parallel circuit - в паралельної ланцюга

the electrical bell circuit - електрична схема дзвінка
the short circuit - коротке замикання
certain conditions - певні умови

7. Fill in the blanks with the words and phrases:
electric circuit, really mean, the current from, purpose of the electrical source, electrons travel.

1. Electric circuit" The … is the subject to be dealt with in the present article.
2. But what does the above term …?
3. We know the circuit to be a complete path which carries the source … of supply to the load and. then carries it again from the load back to the source.
4. The … is to produce the necessary electromotive force required for the flow of current through the circuit.
5. The path along which the … must be complete otherwise no electric power can be supplied from the source to the load.

8. Зробіть заперечні та запитальні речення.
1. Peter can make a shelf.
2. Ann could go there yesterday.
3. His friends will be able to help him on Sunday.
4. Our pupils can read and speak English.
5. The tourists will be able to reach the village before dark.
6. I can show you the way to the park.
7. He could buy the ticket before-hand.
8. You will be able to catch the train.

9. Дайте відповідь на запитання за зразком.
Зразок: Ask your classmate if he can sing. – Can you sing?
Ask your classmate:
1. if he can speak French;
2. if he could play the piano last year;
3. if he can run 100 meters in 13 seconds;
4. if he will be able to come to your place tomorrow;
5. if he can go to Kiev by plane;
6. if his friends can play ice-hockey;
7. if he can repair a radio set.

10. Перефразуйте речення в минулий та майбутній часи.
Зразок: I may keep this magazine till Monday. – I shall be allowed to keep this magazine till Monday. – I was allowed to keep this magazine till Monday.
1. We may occupy this room.
2. He may stay away from school.
3. The tourists may spend the night in the camp.
4. You may see their documents.
5. She may work in the laboratory.
6. The pupils may go home.
7. I may be present at the meeting.

Properties of Electric Current and Electric Circuit

1. Read and translate the following text.

The flow of electrons through a circuit is called electric current. The strength of the current depends on the rate at which electrons move in the conductor. But we cannot see the effect produced by the electric current apart from[1] the conductor through which it flows. If a magnet is suspended near a conductor carrying current, the magnet will deflect. Any piece of iron put near a conductor will become magnetized. A body carrying electric current becomes magnetized. Thus, to deflect a magnet, to magnetize iron and to heat the body are properties of electric current.

The properties influencing the flow of electricity in the circuit are resistance, inductance and capacitance.

2. Study the following vocabulary and do the tasks that follow.

apart from – вне

first of all – перш за все

3. Translate into Ukrainian.

Resistance is a property of a circuit to oppose the flow of electricity through it. The resistance of a conductor to the flow of electric current depends on a number of factors. First of all, that is the material of the conductor. Different materials offer different resistance to the flow of current. Metals generally have resistance and are good conductors. Materials, which offer a very high resistance, are used as insulators. Resistance is also affected by the length of the conductor.

4. Complete the following sentences.

1. The flow of electrons through a circuit is called _____.
2. The strength of the current depends on the rate at which _____ move in the conductor.
3. But we cannot see the effect produced by the electric _____ the conductor through which it flows.
4. If a magnet is suspended near a conductor carrying _____, the magnet will deflect.
5. Any piece of iron put near a conductor will become _____.

5. Define the terms:

electric current

move in the conductor

properties influencing

different materials

6. Translate into English.

Індуктивність показує здатність електричного струму для створення магнітного поля. Якщо змінний струм, магнітне поле, утворене цим струмом створює в контурі струм самоіндукції, який тече в напрямку, протилежному струму в електричної ланцюга. Індуктивність залежить від властивостей ядра і структури котушки. Одиницею індуктивності є Генрі.

7. Перефразуйте речення використовуючи дієслово may.
Зразок: I nearly lost my way. – I might have lost my way.
1. I nearly forgot about it.
2. It nearly killed him.
3. He nearly broke the window.
4. She nearly fell asleep.
5. I nearly caught cold.

8. Зробить слідуючи речення запитальними.
1. You must air the room twice a day.
2. Children must sleep nine hours a day.
3. The pupils must clean their classrooms.
4. She must help her mother about the house.
5. We must read English book every day.
6. Everybody must go for sports.
7. All children must go to school.
8. You must come to school in time.

9. Перефразуйте речення в минулий та майбутній часи.
Зразок: I must go there at once. – I had to go there at once. – I shall have to go there at once.
1. I must catch up with my class.
2. The man must sell his house.
3. She must turn off the radio.
4. You must be there at nine.
5. The girl must water flowers.
6. They must get up at six.
7. His sister must go shopping.
8. We must work in the reading-hall.
9. They must stay at home.
10. You must pay for it.

Elements of Electric and Radio Circuits

1. Read and translate the following text.

An electric circuit is a path along which electricity can flow. An electric circuit consists of a source of energy or power source, a receiver of energy and two conductors connecting the receiver and the power source terminals. The electric source produces the necessary electromotive force (e.m.f.) required for the flow of current through the circuit. The circuit should be complete; otherwise no electric current can flow through it. If the circuit is broken or “opened”, the

Fundamentally, two types of circuits are possible, according to the way in which the circuit elements are joined. To understand the difference between the circuit connections is not difficult. When electrical devices are connected one after another so that the current flows successively through each element, we say they are connected in series. Under such conditions the current flow is the same in all parts of the circuit, as there is only a single path along which it may flow. The electric bell circuit is a typical example of a series circuit.

2. Study the following vocabulary and do the tasks that follow.
side by side – рядом
in such a way - таким чином

3. Define the terms:
a path along which electricity
The circuit should be complete
electric current
Radio differs

4. Translate into Ukrainian.
The parallel circuit provides two or more paths for electric current. The parallel circuit elements are connected side by side[1] in such a way[2] that the total current flowing through the circuit is the sum of currents flowing through each circuit element individually.

5 Complete the following sentences.
1. The parallel circuit provides two or more paths for _____.
2. The parallel circuit elements are connected _____ in such a way that the total current flowing through the circuit is the sum of currents flowing through each circuit element individually.
3. The lamps in your room are generally connected in_____.

6. Зробить питальні та заперечні речення.
1. Her father has to wear spectacles.
2. The woman has to go to the post-office.
3. You had to return home.
4. The girl had to catch up with her class.
5. They have to live in one room.
6. The boy had to write with a pencil.
7. They had to work at night.
8. I had to wait for them.

7. Перефразуйте речення використовуючи дієслово to have.
Зразок: It is necessary for me to go there. – I have to go there. I am obliged to tell you the truth. - I have to tell you the truth.
A. 1. It is necessary for him to get up at half past six.
2. It was necessary for them to build a bridge across the river.
3. It was necessary for her to read many books in order to prepare a good report.
4. It will be necessary for me to stay at home on Saturday.
5. It will be necessary for him to see a doctor.
B. 1. The driver was obliged to stop the car.
2. The teacher was obliged to give him a “two”.
3. I shall be obliged to expel you from the circle.
4. The woman was obliged to lock the door.
5. I was obliged to repeat my question.

8. Перефразуйте речення використовуючи дієслово to be.

A. 1. We agreed to meet near the theatre.
2. They agreed to discuss the film after classes.
3. The pupils agreed to go to the forest on Sunday.
4. We agreed to spend the summer in the country.
5. We agreed to come to school at five.

B. 1. It was arranged that I should meet them at the bus stop.
2. It was arranged that I should go there by plane.
3. It was planned that you should be given this task.
4. It was arranged that you should join us in Poltava.

Resistors

1. Read and translate the following text.

A resistor is one of the most common elements of any circuit. Resistors are used: to reduce the value of current in the circuit; to produce IR voltage, drop and in this way to change the value of the voltage.

When current is passing through a resistor its temperature rises high. The higher the value of current the higher is the temperature of a resistor. Each resistor has a maximum temperature to which it may be heated without a trouble. If the temperature rises higher the resistor gets open and opens the circuit.

Resistors are rated in watts. The watt is the rate at which electric energy is supplied when a current of one ampere is passing at a potential difference of one volt. A resistor is rated as a 1-W resistor if its resistance equals 1,000,000 ohms and its current-carrying capacity equals 1/1,000,000 amp, since $P = E \times I = IR \times I = I^2R$ where P - power is given in watts, R - resistance is given in ohms and I - current is given in amperes.

If a resistor has a resistance of only 2 ohms but its current-carrying capacity equals 2,000 amp, it is rated as a 8,000,000-W resistor. Some resistors have a constant value - these are fixed resistors, the value of other resistors may be varied - these are variable resistors.

2. Study the following vocabulary and do the tasks that follow.

Rectifier - випрямляч
h.f.a.c. carrier - високочастотна несуча хвиля змінного струму
audio portion - низькочастотна частина
r.f. portion - високочастотна частина
amplifier - підсилювач
semiconductor - r напівпровідник
crystal substance - кристалічна речовина
silicon - кремній
crystal lattice - кристалічна решітка
и-type germanium - t-германий
p-type germanium - p-германий
valence electron - валентний электрон
hole - дірка
hole current - дірковий струм

junction transistor - площинний транзистор
point-contact transistor - точковий напівпровідниковий транзистор
n-p-n transistor - n-p-n транзистор
emitter - емітер
base - база напівпровідникового транзистора
collector - колектор
biased positive - з позитивним зміщенням
base-to-collector junction - перехід база-колектор
emitter-to-base junction - переход эмітер-база
rugged construction - міцна конструкція

3. Translate into Ukrainian.

A resistor is one of the most common elements of any circuit. Resistors are used: to reduce the value of current in the circuit; to produce IR voltage drop and in this way to change the value of the voltage.

When current is passing through a resistor its temperature rises high. The higher the value of current the higher is the temperature of a resistor. Each resistor has a maximum temperature to which it may be heated without a trouble. If the temperature rises higher the resistor gets open and opens the circuit.

4. Complete the following sentences.

to produce IR voltage drop and in this _____ the value of the voltage.
When current is passing through a resistor its _____ high. The higher the value of current the _____ of a resistor. Each resistor has a maximum temperature to which it may be heated without a trouble.

5. Define the terms:

biased positive
collector
hole
amplifier
valence electron

6. Translate into English.

Коли струм проходить через резистор його температура піднімається висока. Чим вище значення струму, тим вище температура резистора. Кожен резистор має максимальну температуру, до якої може бути нагріта без проблем. Якщо температура піднімається вище резистора отримує відкритий і розмикає ланцюг.

7. Combine the two sentences as in the models.

Models: I teach English here. I am glad of it. - I am glad to teach English here.
We helped him. We are happy about it. - We are happy to have helped him.
I was examined yesterday. I am glad of it. - I am glad to have been examined yesterday.

A. 1. I work at the factory. I am happy about it. 2. I see you. I am glad of it. 3. I study French. I am glad of it. 4. I live in this town. I am happy about it. 5. I know this man. I am happy about it.

B. 1. I am going to Paris. I am happy about it. 2. I am spending my holidays in the Crimea. I am happy about it. 3. I am listening to the symphony. I am glad of it. 4. I am reading his letter. I am glad of it. 5. I am playing chess with you. I am glad of it.

C. 1. I spent my holidays in the Caucasus. I am happy about it. 2. He played chess with the world champion. He is happy about it. 3. I bathed in the river. I am glad of it. 4. I learned English at school. I am glad of it. 5. I passed my examination yesterday. I am glad of it.

D. 1. I don't understand this rule. I am sorry about it. 2. I am not working there now. I am sorry about it. 3. I have not seen this film. I am sorry about it. 4. She has not been working all these years. She is sorry about it. 5. Peter didn't see her. He is sorry about it.

E. 1. She was not invited to the evening party. She is sorry about it. 2. We are taught English. We are glad of it. 3. I was waked early this morning. I am glad of it. 4. I was not informed of it. I am sorry about it. 5. I am not allowed to go there. I am sorry about it.

8. Complete the following sentences.
1. A resistor is one of the most common _____.
2. Resistors are used:
a. to reduce the value of current in the circuit;
b. to produce IR voltage drop and in this way to change the value _____.
3. When current is passing through a _____ rises high.
4. The higher the value of current the higher is the temperature of a_____.
5. Each resistor has a _____ to which it may be heated without a trouble.
6. If the temperature rises higher the resistor gets open and opens the _____.

9. Define the terms:
to change the value of the voltage.
the watt is the rate
which electric energy
supplied when a current
one ampere is passing
a potential difference of one volt

10. Translate into Ukrainian.
When current is passing through a resistor its temperature rises high. The higher the value of current the higher is the temperature of a resistor. Each resistor has a maximum temperature to which it may be heated without a trouble. If the temperature rises higher the resistor gets open and opens the circuit.

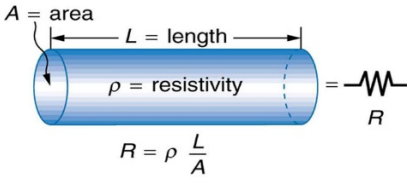
11. State the function of the infinitive in the sentences. Translate them.
1. Everyone had a wish to say something. (Gaskell) 2. He decided to go alone. (Gordon) 3. We must work hard to live. (Abrahams) 4. The question must be answered. (Heym) 5. It was difficult to believe (Dinckens) 6. She was going to my rooms to see my aunt. (Dickens) She had no desire to open her heart to her aunt. (Gaskell) 8. The

great thing is to make a good breakfast. (Jerome) 9. I am ready to go with Annie. (Dickens) 10. Nothing could be done before morning. (Gaskell) 11. It wasn't safe to cross the bridge at night. (Greene) 12. To earn a living he became a salesman. (Carter) 13. The man was the first to speak. (Gaskell) 14. I am too old to be given a hiding. (Shaw) 15. This is my bench, and you have no right to take it away from me. (Albee)

Resistance and Resistivity

1. Read and translate the following text.

Resistance is the electric property that impedes a current. A current flowing through a wire (or resistor) is like water flowing through a pipe, and the voltage drop across the wire is like the pressure drop which pushes water through the pipe. Resistance is proportional to how much pressure is required to achieve a given flow, while conductance is proportional to how much flow occurs for a given pressure. Conductance and resistance are reciprocals. The resistance of an object depends on its shape and the material of which it is composed. The cylindrical resistor is easy to analyze, and by so doing we can gain insight into the resistance of more complicated shapes. As you might expect, the cylinder's electric resistance R is directly proportional to its length L, similar to the resistance of a pipe to fluid flow. The longer the cylinder, the more collisions charges will make with its atoms. The greater the diameter of the cylinder, the more current it can carry (again, similar to the flow of fluid through a pipe). In fact, R is inversely proportional to the cylinder's cross-sectional area A.



2. Read and translate the following text again and discuss in groups.

3. Answer the following text.
1. What is a typical axial-lead resistor?
2. What are Resistance and Resistivity?
3. What is a conductance?
4. What is a resistance is reciprocals?
5. What is a Typical Resistor?

4. Learn by heart words and phrases.
Typical Resistor - типовий резистор
resistance - опір
a typical axial-lead resistor- типовий осьової провід резистора.
a more sophisticated circuit analysis - складніший аналіз ланцюга
practical application of these relationships - практичне застосування цих відносин
a number of standard values in series or parallel - ряд стандартних значень в послідовно або паралельно

5. How you translate into Ukrainian the following part of text and understood. The work for groups.

A: A typical axial-lead resistor.
What determines resistivity? The resistivity of different materials varies by an enormous amount. For example, the conductivity of teflon is about 1030 times lower than the conductivity of copper. Why is there such a difference? Loosely speaking, a metal has large numbers of "delocalized" electrons that are not stuck in any one place, but free to move across large distances, whereas in an insulator (like teflon), each electron is tightly bound to a single atom, and a great force is required to pull it away. Likewise, resistors range over many orders of magnitude.
B: Cylindrical Resistor
A uniform cylinder of length L and cross-sectional area A. Its resistance to the flow of current is similar to the resistance posed by a pipe to fluid flow. The longer the cylinder, the greater its resistance. The larger its cross-sectional area A, the smaller its resistance.

6. Complete the following sentences.

resistance depends, different resistance, resistivity, intrinsic property, extrinsic property.

As mentioned, for a given shape, the _____(1) on the material of which the object is composed. Different materials offer _____(2) to the flow of charge. We define the _____(3) ρ of a substance so that the resistance R of an object is directly proportional to ρ. Resistivity ρ is an _____(4) of a material, independent of its shape or size. In contrast, the resistance R is an _____(5) that does depend on the size a shape of the resistor.

7. Translate into English using the infinitive.
А. 1. Я радий, що працюю разом з ним. 2. Я радий, що працював разом з ним. 3. Вона щаслива, що вчиться в цьому інституті. 4. Вона щаслива, що вчилась у цьому інституті. 5. Мені незручно, що я турбую вас. 6. Мені незручно що я потурбував вас. 7. Він буде радий поїхати туди. 8. Він буде радий, що поїхав туди.
Б. 1. Я радий, запросити вас на вечір. 2. Я радий, що мене запрошують на вечір. 3. Я радий, що запросив їх на вечір. 4. Я радий, що мене запросили на вечір. 5. Я радий послати вам цю книжку. 6. Я радий, що послав їй цю книжку. 7. Я радий, що мене посилають на цю конференцію. 8. Я радий, що мене послали на цю конференцію.
В. 1. Я хочу послати їй телеграму. Я хочу, щоб мене послали на конференцію. 3. Моя сестра хоче побачити їх там. 4. Вона не хоче, щоб її там побачили. 5. Дівчинка любить, щоб їй розповідали казки. 6. Дівчинка любить розповідати казки.

Conductor

1. Read and translate the following text.

Conductors are materials having a low resistance so that current easily passes through them. The lower the resistance of the material, the more current can pass through it.

The most common conductors are metals. Silver and copper are the best of them. The advantage of copper is that it is much cheaper than silver. Thus copper is widely

used to produce wire conductors. One of the common functions of wire conductors is to connect a voltage source to a load resistance. Since copper wire conductors have a very low resistance a minimum voltage drop is produced in them. Thus, all of the applied voltage can produce current in the load resistance.

It should be taken into consideration that most materials change the value of resistance when their temperature changes.

Metals increase their resistance when the temperature increases while carbon decreases its resistance when the temperature increases. Thus metals have a positive temperature coefficient of resistance while carbon has a negative temperature coefficient. The smaller is the temperature coefficient or the less the change of resistance with the change of temperature, the more perfect is the resistance material.

2. Find answers to these questions in the text above:

1. What materials are called conductors?
2. What is the advantage of copper compared with silver?
3. What is the most common function of wire conductors?
4. Why is a minimum voltage drop produced in copper conductors?
5. What is the relation between the value of resistance and the temperature in carbon?
6. What materials are called insulators?
7. What are the most common insulators?
8. What are the two main functions of insulators?

3. Complete the sentences using the correct variant:

1. Insulators are materials having
a) low resistance.
b) high resistance.
2. Current passes through conductors
a) easily.
b) with great difficulty.
3. Copper and silver are
a) common conductors.
b) common insulators.
4. Air, paper and plastics are
a) common insulators.
b) common conductors.
5. In case a high voltage is applied to.
a) it does not conduct current an insulator
b) it conducts current.
6. Insulators are used
a) to store electric charge.
b) to reduce voltage.
c) to prevent a short between conducting wires
8. Carbon decreases its resistance
a) when the temperature increases.
b) when the temperature decreases.
9. Metals have
a) a positive temperature coefficient of resistance
b) a negative temperature coefficient of resistance

4. Learn by heart words and phrases.
Conductors - провідники
low resistance - низький опір
silver and copper - срібло і мідь
advantage - перевага
cheaper - дешевше
temperature changes - зміни температури
carbon has a negative temperature coefficient - вуглець має негативний температурний коефіцієнт
store electric charge - зберігати електричний заряд
a positive temperature coefficient - позитивний температурний коефіцієнт
smaller is the temperature coefficient - менше температурний коефіцієнт

5. Complete the following sentences.
1. Metals increase their resistance when the temperature increases while carbon decreases its resistance when the _____.
2. Thus metals have a _____of resistance while carbon has a negative temperature coefficient.
3. The smaller is _____ or the less the change of resistance with the change of temperature, the more perfect is the resistance material.

6. Translate into Ukrainian:
1. The most common insulators are air, paper, rubber, plastics.
2. Any insulator can conduct current when a high enough voltage is applied to it.
3. Currents of great value must be applied to insulators in order to make them conduct.
4. The higher the resistance of an insulator, the greater the applied voltage must be.

7. Translate into English using the infinitive.
Г. 1. Забути цей день було неможливо. 2. Переправлятися через річку вночі було небезпечно. 3. Вчитися наполегливо- завдання кожного учня. 4. Допомогти йому тепер- значить врятувати його. 5. Її мета- стати лікарем. 6. Ваше завдання - написати твір про свої літні канікули. 7. Наше завдання полягало в тому, щоб закінчити роботу до 5 грудня.
Д. 1. Він перший допоміг нам. 2. Вона написала твір першою. 3. Вона першою розповіла мені про це. 4. Директор говорив на зборах останнім. 5. Він перший поздоровив нас. 6. Я пішов додому останнім.
Е. 1. Ми взяли таксі, щоб щоб прибути на станцію вчасно. 2. Вона пішла на пошту, щоб одержати посилку. 3. Я ввімкнув телевізор, щоб подивитися футбольний матч. 4. Вони приїхали в Київ для участі в спортивних змаганнях. 5. Завтра ми підемо в ліс збирати гриби. 6. Щоб вивчати мову, ви повинні якомога більше читати.
Є. 1. Погода була надто хороша, щоб залишитися вдома. 2. Завдання було надто складним, щоб зробити його за годину. 3. Він досить досвідчений, щоб виконати це завдання. 4. Сьогодні надто холодно, щоб іти на річку. 5. В цьому тексті надто багато нових слів, щоб зрозуміти його без словника.

Conductors and insulators

1. Read and translate the following text.

All substances have some ability of conducting the electric current, however, they differ greatly in the ease with which the current can pass through them. Metals, for example, conduct electricity with ease while rubber does not allow it to flow freely. Thus, we have conductors and insulators.

What do the terms "conductors" and "insulators" mean? Substances through which electricity is easily transmitted are called conductors. Any material that strongly resists the electric current flow is known as an insulator.

Let us first turn our attention to conductance, that is the conductor's ability of passing electric charges. The four factors conductance depends on are: the size of the wire used, its length and temperature as well as the kind of material to be employed.

2. Give the Ukrainian equivalents for the words and word combinations below:
1) conductors; 2) insulators; 3) transmit; 4) resistance; 5) passage of current; 6) socket; 7) to connect to; 8) cord; 9) high voltage transmission line; 10) leak off.

3. Find in the text the sentences with the following related words and translate them: conducting – conductor – conductivity – conductance

4. Guess what it is?
1.used to cover desk lamp cords
2. one of the most important insulators of all
3. the most widely used conductor
4. a better conductor than copper 5. not so good conductor as copper
6. the insulator usually used on the city street poles and high voltage transmission lines

5. State questions to the underlined words:
1) Solid metals conduct electricity with ease.
2) Conductance depends on the four factors.
3) There are many kinds of insulation used to cover the wires.
4) Insulators keep electricity from leaking off the conductor.
5) Conductors play an important role in electrical engineering.

6. Say whether these sentences are true or false:
1) Electrical conductivity of a body depends upon its atomic constitution.
2) There is no difference in the conducting ability of various substances.
3) The longer the wire is the weaker its opposition is.
4) The kind of the insulating material depends upon the purpose it is meant for.
5) Conductors are substances through which electricity is easily transmitted.
6) Insulators do not allow the electric current to flow freely.

7. Talk on the conducting ability of various substances and their appliance in electrical engineering. Use the table in Task IV.
Test: Conductors and insulators.

8. Fill in the blanks with the words and phrases:

A bare wire, poles, electrical engineering, insulation, opposition, to resist, similar, turned off, air, cord, covers, glasses, leak off, rubber, socket, is transmitted.

1. A …… is a small insulated cable.
2. We need …… for a chemical experiment.
3. When the temperature rises …… to the passing current increases.
4. …… is a perfect insulator.
5. If the switch is …… the current does not flow.
6. …… is a poor conductor electricity.
7. …… is a wire not covered with insulated material.
8. We study … .
9. If a wire is covered with … it is called an insulated wire.
10. Any magnet has two … .
11. Some liquids have … properties.
12. Electricity … by wires.
13. The train … a great distance from Lviv to Sevastopol.
14. If there is no insulation the current can … the conductor.
15. We shall consider the ability of insulators … the current flow.
16. Copper wires connect electrical devices to the … .

9. Arrange the following words in pairs of
a) Synonyms: b) Antonyms:
substance different ease dissimilar
to allow of course conductor to close
easily to use difficult to turn off
to resist instrument large long
to employ readily short thick
certainly to permit thin small
various to oppose to turn on insulator
device matter like difficulty
to break easy

10. Find the correct variant:
1. Insulators are materials having
a) low resistance. b) high resistance.
2. Current passes through conductors
a) easily. b) with great difficulty.
3. Copper and silver are
a) common conductors. b) common insulators.
4. Air, paper and plastics are
a) common conductors. b) common insulators.
5. Insulators are used
a) to store electric current. b) to prevent a short between conducting wires.
6. Metals increase their resistance
a) when the temperature decreases. b) when the temperature increases.
7. In case a high voltage is applied to an insulator
a) it does not conduct current. b) it conducts current.

11. Make up five sentences from each table.

I He/ She You We They	saw heard watched noticed	him her them you the girl		enter the house. leave the room. play the piano. sing. approach the river.
I He/ She You We They	made let caused forced	him them you me	(to)	learn the poem by heart. do the exercise again. go home. buy it. read it aloud.

I He/ She You We They	want(s) wanted like(s) should like would like	her them you me they boys	to become an agronomist. to work here. to speak English. to sing this song. to stay here.

Conductor

1.Read and translate the following text.

In physics and electrical engineering, a **conductor** is an object or type of material that allows the flow of an electrical current in one or more directions. Materials made of metal are common electrical conductors. Electrical current is generated by the flow of negatively charged electrons, positively charged holes, and positive or negative ions in some cases.

In order for current to flow, it is not necessary for one charged particle to travel from the machine producing the current to that consuming it. Instead, the charged particle simply needs to nudge its neighbor a finite amount who will nudge its neighbor and on and on until a particle is nudged into the consumer, thus powering the machine. Essentially what is occurring here is a long chain of momentum transfer between mobile charge carriers; the Drude model of conduction describes this process more rigorously. This momentum transfer model makes metal an ideal choice for a conductor as metals, characteristically, possess a delocalized sea of electrons which gives the electrons enough mobility to collide and thus effect a momentum transfer.

2. Study the following vocabulary and do the tasks that follow.

a conductor - провідник
charged particle - зарядженачастка
charge carriers - носії заряду
a long chain - з довгим ланцюгом
electrons - електрони

3. Define the terms:

between mobile charge carriers
momentum transfer
Insulators are non-conducting materials

insignificant electric currents

4. Translate the second part of text.

The resistance of a given conductor depends on the material it is made of, and on its dimensions. For a given material, the resistance is inversely proportional to the cross-sectional area. For example, a thick copper wire has lower resistance than an otherwise-identical thin copper wire. Also, for a given material, the resistance is proportional to the length; for example, a long copper wire has higher resistance than an otherwise-identical short copper wire. The resistance R and conductance G of a conductor of uniform cross section, therefore, can be computed as where is the length of the conductor, measured in metres [m], A is the cross-section area of the conductor measured in square metres [m²], σ (sigma) is the electrical conductivity measured in siemens per meter ($S \cdot m^{-1}$), and ρ (rho) is the electrical resistivity (also called specific electrical resistance) of the material, measured in ohm-metres (Ω·m). The resistivity and conductivity are proportionality constants, and therefore depend only on the material the wire is made of, not the geometry of the wire. Resistivity and conductivity are reciprocals. Resistivity is a measure of the material's ability to oppose electric current.

This formula is not exact: It assumes the current density is totally uniform in the conductor, which is not always true in practical situations. However, this formula still provides a good approximation for long thin conductors such as wires.

5. Study the following vocabulary and do the tasks that follow.

The resistance - опір
a long copper - довгий мідний
the conductor measured in square metres - провідника вимірюється в квадратних метрах
commercial power frequency - промислової частоти потужність
increase in temperature - підвищення температури
electron scattering - розсіювання електронів

6. Translate the following sentences.

1. The resistivity and conductivity are proportionality constants, and therefore depend only on the material the wire is made of, not the geometry of the wire.
2. Resistivity and conductivity are reciprocals.
3. Resistivity is a measure of the material's ability to oppose electric current.
4. This formula is not exact: It assumes the current density is totally uniform in the conductor, which is not always true in practical situations.
5. However, this formula still provides a good approximation for long thin conductors such as wires.

7. Read and translate the following part of text.

Conduction materials

Copper has a high conductivity. Annealed copper is the international standard to which all other electrical conductors are compared. The main grade of copper used for electrical applications, such as building wire, motor windings, cables and busbars, is electrolytic-tough pitch (ETP) copper (CW004A or ASTM designation C100140). This copper has an electrical conductivity of at least 100% IACS (International

Annealed Copper Standard). If high conductivity copper must be welded or brazed or used in a reducing atmosphere, then oxygen-free high conductivity copper (CW008A or ASTM designation C10100) may be used. Because of its ease of connection by soldering or clamping, copper is still the most common choice for most light-gauge wires.

Silver is more 'conductive' than copper, but due to cost it is not practical in most cases. However, it is used in specialized equipment, such as satellites, and as a thin plating to mitigate skin effect losses at high frequencies.

8. Study the following vocabulary and do the tasks that follow.

Conduction materials - провідності матеріалів
main grade of copper - основний клас міді
conductivity of copper - провідність міді
buried cables - підземних кабелів
Organic compounds - органічних сполук
Oils are hydrocarbons - масла, вуглеводні
Covalent bonds are simply the sharing of electrons - ковалентні зв'язки-це просто обмін електронами

9. Complete the following sentences.

Aluminum, compatible connectors, common metal, Anodized aluminum, _____ (1) wires used for low voltage distribution, such as buried cables and service drops, require use of _____(2) and installation methods to prevent heating at joints. Aluminum is also the most _____(3) used in high-voltage transmission lines, in combination with steel as structural reinforcement. _____ (4) surfaces are not conductive. This affects the design of electrical enclosures that require the enclosure to be electrically connected.

10. Make up five sentences from each table.

I	expect(s)	him	to come back at five.
He/ She	expected	them	to help them.
You		me	to arrive on Monday.
We		you	to win the match.
They		us	to answer the letter at once.

I	considered	him	to be brave.
He/ She	believed	you	to be an honest man.
You	thought	us	to be lazy.
We	knew	them	to be about twenty- five.
They	supposed	me	to be a good pupil.

I	find(s)	it	difficult.
He/ She	found	the film	to be easy.
You		the subject	to be funny.
We		the story	to be dull.
They		the flat	to be comfortable.

Diodes

1. Read and translate the following text.

In electronics, a diode is a two-terminal electronic component that conducts primarily in one direction (asymmetric conductance); it has low (ideally zero) resistance to the current in one direction, and high (ideally infinite) resistance in the other. A semiconductor diode, the most common type today, is a crystalline piece of semiconductor material with a p–n junction connected to two electrical terminals. A vacuum tube diode has two electrodes, a plate (anode) and a heated cathode. Semiconductor diodes were the first semiconductor electronic devices. The discovery of crystals' rectifying abilities was made by German physicist Ferdinand Braun in 1874. The first semiconductor diodes, called cat's whisker diodes, developed around 1906, were made of mineral crystals such as galena. Today, most diodes are made of silicon, but other semiconductors such as selenium and germanium are sometimes used.

2. Study the following vocabulary and do the tasks that follow.

a two-terminal electronic component - два термінали електронних компонентів
conducts primarily - проводить в першу чергу
direction (asymmetric conductance) - напрямок (асиметрична провідність)
low (ideally zero) - низькою (в ідеалі нульовий)
the current in one direction - струму в одному напрямку
semiconductor diode - напівпровідниковий діод
vacuum tube - вакуумна трубка
a plate (anode) - пластина (анод)
electronic version of a check valve - електронна версія зворотний клапан
rectification - випрямлення
convert alternating current - перетворити змінний струм
direct current - постійного струму
threshold voltage - порогове напруга
regulate voltage - регулювати напругу
Gunn diodes - діоди Ганна
tunnel diodes - тунельні діоди
shot-noise generators - постріл-шум генераторів

3. Complete the following sentences.

Semiconductor, tailored by selecting, special-purpose, regulate voltage, electronically tune, Gunn diodes, negative resistance, switching circuits.

A … diode's current–voltage characteristic can be… the semiconductor materials and the doping impurities introduced into the materials during manufacture. These techniques are used to create … diodes that perform many different functions. For example, diodes are used to … (Zener diodes), to protect circuits from high voltage surges (avalanche diodes), … to radio and TV receivers (varactor diodes), to generate radio-frequency oscillations (tunnel diodes, …, IMPATT diodes), and to produce light (light-emitting diodes). Tunnel, Gunn and IMPATT diodes exhibit, …which is useful in microwave and ….

4. Fill in the blanks with appropriate words:

In electronics, a diode is a two-terminal electronic component that conducts primarily in one direction	Ferdinand Braun

(asymmetric conductance); it has low (ideally zero) resistance to the current in …, and high (ideally infinite) resistance in the other.	
… diodes were the first semiconductor electronic devices.	electronic devices
A …–voltage characteristic can be tailored by selecting the semiconductor materials and the doping impurities introduced into the materials during manufacture.	vacuum tube
… begin conducting electricity only if a certain threshold voltage or cut-in voltage is present in the forward direction (a state in which the diode is said to be forward-biased).	semiconductor material
A semiconductor diode, the most common type today, is a crystalline piece of … with a p–n junction connected to two electrical terminals.	Semiconductor diodes
A … diode has two electrodes, a plate (anode) and a heated cathode.	semiconductor diode's current
Semiconductor diodes were the first semiconductor ….	Semiconductor
The discovery of crystals' rectifying abilities was made by German physicist … in 1874.	one direction

5. Define the terms:
semiconductor diode
rectification
Gunn diodes
semiconductor diode
conducts primarily
electronic devices

6. Translate the following sentences.
1. A semiconductor diode's current–voltage characteristic can be tailored by selecting the semiconductor materials and the doping impurities introduced into the materials during manufacture.
2. Semiconductor diodes begin conducting electricity only if a certain threshold voltage or cut-in voltage is present in the forward direction (a state in which the diode is said to be forward-biased).
3. A semiconductor diode, the most common type today, is a crystalline piece of semiconductor material with a p–n junction connected to two electrical terminals.
4. Diodes, both vacuum and semiconductor, can be used as shot-noise generators.
5. The voltage drop across a forward-biased diode varies only a little with the current, and is a function of temperature; this effect can be used as a temperature sensor or as a voltage reference.

7. B. Find the answers in the text to the following questions:
1. What is a diode?
2. What's the main function of a diode?
3. How can one create a diode?
4. What are the uses of a diode?
5. What types of diodes can be distinguished according to the direction of the voltage?

6. Why is it important to choose the diodes?

8. Read the following text and answer question.

Diodes

A diode is a semiconductor device which allows current to flow through it in only one direction. So, what does a diode consist of that lets it operate by this general principle that the current is allowed to flow in one direction but not the other? Let's consider the process of creating a typical P-N junction diode. When you put N-type and P-type silicon together as shown in this diagram, you get a very interesting phenomenon that gives a diode its unique properties.

Even though N-type silicon by itself is a conductor, and P-type silicon by itself is also a conductor, the combination shown in the diagram doesn't conduct any electricity. The negative electrons in the N-type silicon are attracts to the positive terminal of the battery. The positive holes in the P-type silicon are attracted to the negative terminal of the battery. No current flows across the junction because the holes and the electrons one each moving in the wrong direction.

9. Combine the given two sentences into one using the Objective Infinitive Complex.

Model: Mary opened the window. I saw it. - I saw Mary open the window.

1. Peter took my pen. I saw it. 2. He ran to the river. I saw it. 3. The girl smiled. I noticed it. 4. The children shouted in the next room. I heard it. 5. She played the violin. My brother heard it. 6. The man tried to open the door. We saw it. 7. They got into a taxi. He saw it. 8. Somebody knocked at the door. We heard it.

10. Transform the sentences using the Subjective Infinitive Complex instead of the Objective Infinitive Complex.

Model: I saw her read the letter. - She was seen to read the letter.

1. We heard her sing a folk song. 2. I saw him put his coat on. 3. They heard the clock strike nine. 4. We saw the rider disappear in the distance. 5. We saw the plane take off. 6. They expected him to return in a fortnight. 7. We know her to be a talented actress. 8. Everybody supposed him to be a foreigner. 9. Everybody considered him to be a great man. 10. I expect the telegram to be sent tomorrow.

PARAMETRIC AND TUNNEL DIODES

1. Read and translate the following text.

The history of the semiconductor diode is held to have begun in the early days of radio when "crystals" were used as signal detectors. However, the operating mechanism of the semiconductor diode remained obscure until the introduction of modern transistor physics. Furthermore, semicon¬ductor diodes were not used as active devices until a p-n junction diode was discovered to be an attractive element for parametric amplifiers. Such a diode, characterized by a variable capacitance, is known to be called a parametric diode. It has a voltage-dependent junction capacitance. In some commercial forms it is also known as a „varactor" diode.

Immediately after the introduction of parametric diodes, another semiconductor diode known as the tunnel diode was developed. The tunnel diode is a semiconductor p-

n junction somewhat similar to the parametric diode, although its physical principles of operation are entirely different. The operation of the tunnel diode is based on quantum-mechanical tunneling. Parametric diodes and tunnel diodes may be compared as follows:

2. Study the following vocabulary and do the tasks that follow.
semiconductor diode - напівпровідниковий діод
modern transistor physics - сучасна фізика транзистора
operation is entirely different – операція - це зовсім інше
negative-resistance devices - від'ємного опору пристрої
both two-terminal - обидва два-термінали
while in tunnel-diode amplifiers - у той час як в тунелі-діода підсилювачі
associated idler circuit - пов'язані з ланцюгом холостого ходу

3. Define the terms:
a reactive nature
parametric diode
a parametric amplifier originates essentially
the tunnel diode

4. Translate into Ukrainian.

The history of the semiconductor diode is held to have begun in the early days of radio when "crystals" were used as signal detectors. However, the operating mechanism of the semiconductor diode remained obscure until the introduction of modern transistor physics. Furthermore, semi-conductor diodes were not used as active devices until a p-n junction diode was discovered to be an attractive element for parametric amplifiers.

5. Complete the following sentences.
1. The tunnel diode is a _____ p-n junction somewhat similar to the parametric diode, although its physical principles of operation are entirely different.
2. The operation of the tunnel _____ is based on quantum-mechanical tunneling.
3. Parametric diodes and tunnel diodes may be compared as follows:
a) They are both _____. Physically, they can be manufactured in much the same manner.
4) The operation of parametric diode depends on its _____, controlled by the applied voltage, while the operation of a tunnel diode depends on its negative resistance, made possible by the tunneling current.

6. Transform the sentences according to the models.
Models: It is (im) probable that he will come tomorrow. - He is (un) likely to come tomorrow.
He will certainly come. - He is sure to come.
He will probably come. - He is likely to come.
A. 1. It is probably that it will rain before evening. 2. It is improbably that she will forget her promise. 3 It is probable that the winter will be very cold this year. 4. It is probable that they will be late. 5. It is improbable that this medicine will help him.

B. 1. They will certainly like this film. 2. The doctor will certainly do his best. 3. He will probably forget the address. 4. She will probably catch cold. 5. He will certainly do his duty. 6. The weather will probably change.

7. Transform the following complex sentences into simple ones using the Prepositional Infinitive Complex.

1. It is necessary that we should start early in the morning. 2. It is necessary that she should come here in time. 3. It is important that he should work systematically. 4. It is necessary that you should air the room twice a day. 5. It is necessary that you should go in for sports.

The varieties of waves

1. Read and translate the following text.

In physics, electromagnetic radiation (EM radiation or EMR) refers to the waves (or their quanta, photons) of the electromagnetic field, propagating (radiating) through space carrying electromagnetic radiant energy. It includes radio waves, microwaves, infrared, (visible) light, ultraviolet, X-, and gamma radiation.

Classically, electromagnetic radiation consists of electromagnetic waves, which are synchronized oscillations of electric and magnetic fields that propagate at the speed of light through a vacuum. The oscillations of the two fields are perpendicular to each other and perpendicular to the direction of energy and wave propagation, forming a transverse wave. The wavefront of electromagnetic waves emitted from a point source (such as a lightbulb) is a sphere. The position of an electromagnetic wave within the electromagnetic spectrum can be characterized by either its frequency of oscillation or its wavelength. The electromagnetic spectrum includes, in order of increasing frequency and decreasing wavelength: radio waves, microwaves, infrared radiation, visible light, ultraviolet radiation, X-rays and gamma rays.

2. Study the following vocabulary and do the tasks that follow.

electromagnetic radiation електромагнітне випромінювання

to the waves (or their quanta, photons) of the electromagnetic field - хвилі (або кванти, фотони) електромагнітного поля

electromagnetic radiation consists - електромагнітне випромінювання складається

electromagnetic waves - електромагнітні хвилі

oscillations - коливання

magnetic fields - магнітні поля

electromagnetic spectrum - електромагнітного спектра

decreasing wavelength - зменшенням довжини хвилі

whose energy - чия енергія

equivalent total (relativistic) mass - еквівалент повної (релятивістської) маси

quantum theory of electromagnetism - квантова теорія електромагнетизму

Quantum effects provide additional sources of EMR - квантові ефекти забезпечують додатковими джерелами ЭМР

biological organisms depend both upon the radiation's power and its frequency - біологічних організмів залежать як від потужність випромінювання і його частота
chemical reactions - хімічні реакції

3. Define the terms:
magnetic fields
quantum theory of electromagnetism
to the waves (or their quanta, photons) of the electromagnetic field
whose energy
electromagnetic waves

4. Translate into Ukrainian.

Electromagnetic radiation is associated with those EM waves that are free to propagate themselves ("radiate") without the continuing influence of the moving charges that produced them, because they have achieved sufficient distance from those charges. Thus, EMR is sometimes referred to as the far field. In this language, the near field refers to EM fields near the charges and current that directly produced them, specifically, electromagnetic induction and electrostatic induction phenomena.

5. Complete the following sentences.

1. _____ are produced whenever charged particles are accelerated, and these waves can subsequently interact with other charged particles.
2. EM waves carry energy, momentum and angular momentum away from their source particle and can impart those_____ to matter with which they interact.
3. Quanta of EM waves are called photons, whose rest mass is zero, but whose energy, or equivalent total (relativistic) mass, is not zero so they are still _____.

The varieties of waves. Properties

1. Read and translate, discuss how you understood the following text.

Electromagnetic waves can be imagined as a self-propagating transverse oscillating wave of electric and magnetic fields. This 3D animation shows a plane linearly polarized wave propagating from left to right. Note that the electric and magnetic fields in such a wave are in-phase with each other, reaching minima and maxima together An alternate view of the wave shown above.

Electrodynamics is the physics of electromagnetic radiation, and electromagnetism is the physical phenomenon associated with the theory of electrodynamics. Electric and magnetic fields obey the properties of superposition. Thus, a field due to any particular particle or time-varying electric or magnetic field contributes to the fields present in the same space due to other causes. Further, as they are vector fields, all magnetic and electric field vectors add together according to vector addition. For example, in optics two or more coherent lightwaves may interact and by constructive or destructive interference yield a resultant irradiance deviating from the sum of the component irradiances of the individual lightwaves.

2. Study the following vocabulary and do the tasks that follow.

Electromagnetic waves - електромагнітні хвилі
oscillating wave - осцилограми
Electromagnetic radiation - електромагнітне випромінювання
alternate view - альтернативний вид
the physical phenomenon associated - фізичні явища, пов'язані
time-varying electric or magnetic field contributes - змінюється в часі електричного або магнітного - поля сприяє
electrodynamics - електродинаміка
Kerr effect - ефект Керра
important aspect - важливим аспектом
wave consists - хвиля складається
types of waves - типи хвиль
time function - функція часу
propagation and its polarization - поширення і поляризація
electromagnetic interference - електромагнітні перешкоди
polarization signals - поляризація сигналів

3. Translate into Ukrainian.

Maxwell's electromagnetic wave equation. Two main classes of solutions are known, namely plane waves and spherical waves. The plane waves may be viewed as the limiting case of spherical waves at a very large (ideally infinite) distance from the source. Both types of waves can have a waveform which is an arbitrary time function (so long as it is sufficiently differentiable to conform to the wave equation).

4. Define the terms:

time-varying electric or magnetic field contributes
important aspect
types of waves
time function
Electromagnetic waves

5. Complete the following sentences.

A: A quantum theory of the interaction between _____ and matter such as electrons is described by the theory of quantum electrodynamics. _____ can be polarized, reflected, refracted, diffracted or interfere with each other.

B: _____ is a transverse wave, meaning that its oscillations are perpendicular to the direction of energy transfer and travel. The _____ and magnetic parts of the field stand in a fixed ratio of strengths in order to satisfy the two _____ that specify how one is produced from the other.

6. Read the following text again. Fill in the blanks with appropriate words:

Maxwell's … wave equation.	Electromagnetic waves
As with any time function, this can be decomposed by means of Fourier analysis into its frequency spectrum, or individual sinusoidal components, each of which contains a single frequency, ….	sinusoidal functions

A … of successive troughs and crests, and the distance between two adjacent crests or troughs is called the wavelength.	monochromatic electromagnetic
Some … both the wave and particle natures of electromagnetic waves, such as the self-interference of a single photon.	Interference
… is the superposition of two or more waves resulting in a new wave pattern.	experiments display
A … wave can be characterized by its frequency or wavelength, its peak amplitude, its phase relative to some reference phase, its direction of propagation and its polarization.	wave consists
A common misconception is that the E and B fields in electromagnetic radiation are out of phase because a change in one produces the other, and this would produce a phase difference between them as … (as indeed happens in electromagnetic induction, and in the near-field close to antennas).	amplitude and phase
… can be imagined as a self-propagating transverse oscillating wave of electric and magnetic fields.	electromagnetic

Radio waves

1.Thermal radiation and electromagnetic radiation as a form of heat

Main articles: Thermal radiation and Planck's law

The basic structure of matter involves charged particles bound together. When electromagnetic radiation impinges on matter, it causes the charged particles to oscillate and gain energy. The ultimate fate of this energy depends on the context. It could be immediately re-radiated and appear as scattered, reflected, or transmitted radiation. It may get dissipated into other microscopic motions within the matter, coming to thermal equilibrium and manifesting itself as thermal energy in the material. With a few exceptions related to high-energy photons (such as fluorescence, harmonic generation, photochemical reactions, the photovoltaic effect for ionizing radiations at far ultraviolet, X-ray and gamma radiation), absorbed electromagnetic radiation simply deposits its energy by heating the material. This happens for infrared, microwave and radio wave radiation. Intense radio waves can thermally burn living tissue and can cook food. In addition to infrared lasers, sufficiently intense visible and ultraviolet lasers can easily set paper afire.

2. Study the following vocabulary and do the tasks that follow.

lowest frequency - низької частоти
impinge upon a conductor - посягають на провідника
electric current - електричний струм
Microwaves - мікрохвильова піч
Natural sources produce - природні джерела дають
basic structure - базова структура
ultimate fate - остаточна доля
microscopic motions - мікроскопічні руху

Infrared radiation - інфрачервоне випромінювання
Thermodynamics - термодинаміка
Radiation - випромінювання
electromagnetic energy - електромагнітної енергії
thermal energy - теплової енергії
radiated away from the matter - випромінювана від матерії
subsequently - згодом

3. Define the terms:
Microwaves
radiation
electric current
electromagnetic radiation
types of waves
polarization signals

4. Choose the correct word to complete each sentence:
1. Electromagnetic _____ are produced whenever charged particles are accelerated, and these waves can subsequently interact with other charged particles.
1. waves 2. energy
2. Electromagnetic _____ is a transverse wave, meaning that its oscillations are perpendicular to the direction of energy transfer and travel.
1. radiation 2. Waves
3. A monochromatic electromagnetic _____ can be characterized by its frequency or wavelength, its peak amplitude, its phase relative to some reference phase, its direction of propagation and its polarization.
1. wave 2. energy

5. Translate the following sentences.
A: The effects of EMR upon chemical compounds and biological organisms depend both upon the radiation's power and its frequency. EMR of visible or lower frequencies (i.e., visible light, infrared, microwaves, and radio waves) is called non-ionizing radiation, because its photons do not individually have enough energy to ionize atoms or molecules. The effects of these radiations on chemical systems and living tissue are caused primarily by heating effects from the combined energy transfer of many photons. In contrast, high ultraviolet, X-rays and gamma rays are called ionizing radiation since individual photons of such high frequency have enough energy to ionize molecules or break chemical bonds.

B: An important aspect of light's nature is its frequency. The frequency of a wave is its rate of oscillation and is measured in hertz, the SI unit of frequency, where one hertz is equal to one oscillation per second. Light usually has multiple frequencies that sum to form the resultant wave. Different frequencies undergo different angles of refraction, a phenomenon known as dispersion.

C: The basic structure of matter involves charged particles bound together. When electromagnetic radiation impinges on matter, it causes the charged particles to oscillate and gain energy. The ultimate fate of this energy depends on the context. It could be

immediately re-radiated and appear as scattered, reflected, or transmitted radiation. It may get dissipated into other microscopic motions within the matter, coming to thermal equilibrium and manifesting itself as thermal energy in the material. With a few exceptions related to high-energy photons (such as fluorescence, harmonic generation, photochemical reactions, the photovoltaic effect for ionizing radiations at far ultraviolet, X-ray and gamma radiation), absorbed electromagnetic radiation simply deposits its energy by heating the material.

Transistors

1. Read and translate the following text.

A transistor is an active component that can be used as an amplifier or a switch. In a Class A amplifier a small signal is applied to the base and an amplified undistorted output is produced on the collector and the emitter. The output can exhibit current and voltage gain, but what is most significant is that a transistor is capable of generating considerable power gain. The transistor circuit does not actually create power, but gets its power from a battery or DC power supply. A transformer can increase voltage at the expense of current, or it can increase current at the expense of voltage. Put the power output of a transformer in watts will always be less than input wattage. A transistor generally has three or more leads. Bipolar transistors have a Base, Emitter, and Collector. The base emitter and the base collector junctions behave like back to back diodes. This actually is a simple way to test a transistor, since transistor failures frequently consist of open or shorted PN-junctions.

2. Learn by heart the following words and phrases.

Transistor - Транзистор
an amplifier or a switch - підсилювача або перемикача
transistor circuit - транзистор схема
Field Effect transistors - польові транзистори
Junction Type Field Effect transistor - з'єднання типу польового транзистора
Insulated Gate Field Effect - ізольований Ефект Полю Гаті
the Insulated Gate Field Effect transistor - з ізольованим затвором польовий транзистор
Operational amplifiers - операційні підсилювачі
Transistor excellent - транзистор відмінно
integrated circuits - інтегральні схеми
small commission that we earn - невелика комісія, що ми заробляємо

3. Translate the text into Ukrainian.

Field Effect transistors are controlled by the Gate voltage; the Gate draws very little gate current. I will only discuss N-type channel Field Effect Transistors. In Junction Type Field Effect transistor, a P type gate is bonded to N-type channel. This results in an actual PN-junction being formed at the Gate to channel bond. Junction Field Effect Transistors are reverse biased, and therefore no current flows through the gate. The gate voltage determines the E field in the junction area.

4. Complete the following sentences.

1. A transistor is an _____ that can be used as an amplifier or a switch.

2. In a Class A amplifier a small _____ to the base and an amplified undistorted output is produced on the collector and the emitter.
3. The output can exhibit current and _____, but what is most significant is that a transistor is capable of generating considerable power gain.
4. The _____ does not actually create power, but gets its power from a battery or DC power supply.
5. A _____ can increase voltage at the expense of current, or it can increase current at the expense of voltage.

5. Translate the text into Ukrainian.
A: Field Effect Transistors are often used in the input stage of operational amplifiers in order to give the input a very high impedance. Operational amplifiers are usually integrated circuits, and they will be discussed in the next lecture.

B: Field Effect transistors are controlled by the Gate voltage; the Gate draws very little gate current. I will only discuss N-type channel Field Effect Transistors. In Junction Type Field Effect transistor, a P type gate is bonded to N-type channel. This results in an actual PN-junction being formed at the Gate to channel bond. Junction Field Effect Transistors are reverse biased, and therefore no current flows through the gate.

C: A transistor must be biased so that both base current and collector current flow in the direction of arrow on the transistor symbol. The arrow on the transistor schematic symbol points in the direction of conventional current flow.

D: A transformer can increase voltage at the expense of current, or it can increase current at the expense of voltage. Put the power output of a transformer in watts will always be less than input wattage. A transistor generally has three or more leads. Bipolar transistors have a Base, Emitter, and Collector. The base emitter and the base collector junctions behave like back to back diodes.

6. Translate into Ukrainian. Underline Objective Infinitive Constructions.

1. I want you to listen to me and I expect you to understand me. 2. If you don't want anyone to know your business, keep your mouth shut. 3. What made you decide to enter that competition? 4. They wanted her to relax and sent the children to her aunt's. 5. Everybody knows him to be a responsible man. 6. Sunglasses always make you look mysterious. 7. The desire for success makes Martin work hard. It doesn't let him rest a minute. 8. Let me take you to the Milky Way on your holiday! 9. It takes two months to make a dream come true. 10. Don't let them fool you! 11. The boss expects you to finish the report by Monday. Would you like me to help you? 12.I don't let my children watch TV shows that are violent. Some of them will make your hair stand on end. 13. I saw you dance, and I'll never be the same again! 14. We saw Megan cross the street and enter the supermarket. 15. I have never heard anyone speak badly of him. 16. Angela felt her heart stop beating. 17. With great interest the detective watched people come in and go out of the house in the middle of the night.

7. Transform the following sentences using Objective Infinitive Constructions.

Model: I expect **that she will send** me a letter.

I expect **her to send** me a letter.

1. I would like to see **how he will say it to my face.** 2. I expect **that you will join our excursion.** 3. We had not expected **that she would reply,** but she did. 4. We knew **that he was a clever man.** 5. I don't like **that you repeat this nonsense.** 6. I hate **when people speak so cynically.** 7. We expect **that everybody will be ready by seven.** 8. They showed themselves even more narrow-minded than we had expected **they would be.** 9. I felt **that somebody touched me lightly on the shoulder.** 10. He heard **that someone called his name. 11.** We did not expect **that he would return so soon.** 12. I saw **that the telegraph boy handed the cable to the man.** 13. They heard **how the woman uttered a little exclamation.** 14. He hated **when people argued about trifles.**

Transistors

1. Read and translate the following text.

Transistors, I was once told, "were the fastest acting fuse known to mankind". This of course was a reference to the fact an early transistor was intolerant of fault conditions whereas in years gone by, vacuum tubes (valves) would cop a lot of abuse. Just remember that fact. [one of "murphy's laws" - The component exists to protect the fuse]

Generally, transistors fall into the category of bipolar transistor, either the more common NPN bipolar transistors or the less common PNP transistor types. There is a further type known as a FET transistor which is an inherently high input impedance transistor with behaviour somewhat comparable to valves. Modern field effect transistors or FET's including JFETS and MOSFETS now have some very rugged transistor devices. I am often asked about the term "bipolar" - see later.

2. Learn by heart the following words anf phrases.
Introduction to transistors - введення в транзисторах
Generally transistors - як правило, транзистори
PNP transistor types - ПНП типів транзистора
Transistors work транзистори працюють
Current flows by means of electrons - струм тече допомогою електронів
battery polarity - полярність акумулятора

3. Answer the following questions.
1. Introduction to transistors?
2. How do transistors work?
3. How do holes and electrons conduct in transistors?

4. Define the terms:
electrons conduct
Current flows
battery polarity
Semiconductor material
junction of the p and n materials

5. Translate into Ukrainian.

Transistors, I was once told, "were the fastest acting fuse known to mankind". This of course was a reference to the fact an early transistor was intolerant of fault conditions whereas in years gone by, vacuum tubes (valves) would cop a lot of abuse. Just remember that fact. [one of "murphy's laws" - The component exists to protect the fuse]

6. Complete the following sentences.

1. Generally transistors fall into the category of _____, either the more common NPN bipolar transistors or the less common PNP transistor types.
2. There is a further type known as a FET transistor which is an inherently high input impedance transistor with behaviour _____ to valves.
3. Modern field effect transistors or FET's including JFETS and MOSFETS now have some very rugged _____.
4. I am often asked about the term "_____" - see later.

7. Translate into Ukrainian. Underline Subjective Infinitive Constructions.

1. She is said to be a very kind woman. 2. He is considered to have finished his scientific research. 3. What are they supposed to be doing? 4. Children were supposed to have stayed in the country-house. 5. She is believed to have been instructed about everything. 6. The new invention is considered to be applied in some days. 7. They aren't supposed to take part in this conference. 8. The young specialist proved to be a good doctor. 9. My mother seems to be cooking a new kind of soup. 10. She appeared to have been ill for two days. 11. They didn't seem to be rich. 12. The front gate didn't happen to be open. 13. The old woman seems to be in a good health. 14. She is likely to get upset if you ask about it. 15. Their work is certain to take a long time. 16. Jane is not sure to obtain information from the article. 17. This question is certain to be discussed. 18. The results of your examination are likely to be known in a day. 19. We were not likely to finish our research before the end of the month.

Thyristors

1. Read and translate the following text.

Thyristors also have switching problems that can be improved by snubbing networks, usually of the simple RC type. In contrast to the switching problems of bipolar transistors and power MOSFETs, it is the extremely rapid turn on of thyristors that tends to cause troubles. For example, the RFI (radio frequency interference) and EMI (electromagnetic interference) generated by thyristors originates primarily from this characteristic. Such interference might not only play havoc with communications equipment, but all too often causes false turn on of other thyristor control circuits. Another source of false turn on in thyristors emanates from the so-called *dv/dt* effect. In so many words, if the voltage across the thyristor rises too rapidly following turn off, the thyristor might be internally retriggered, thereby losing control. This retriggering occurs because of capacitive feedback from the anode to the gate and is one of the factors limiting the frequency at which proper control can be maintained. High frequency is tantamount to high *dv/dt* and there is more internal capacitive feedback to the gate. In actual applications, snubbing is very effective in preventing erratic

performance of this nature. Of course, the proper thyristor must be selected for the frequency involved.

Another way of improving *dv/dt* immunity is to use a low value of gate-cathode resistance to divert much of the internal anode-gate feedback current. This is a very effective approach, but it is at the expense of increased drive power. A negative bias of about 1 V at the gate can also be used to extend immunity from the *dv/ dt* effect. Such reverse bias is more easily applied to SCR than to triac circuits.

2. Learn by heart the following words and phrases.

Thyristors - тиристори
snubbing networks - мереж гнобить
radio frequency interference - радіочастотні перешкоди
electromagnetic interference - електромагнітні перешкоди
such interference таке - втручання
the thyristor tries - тиристор намагається
the phase displacement of voltage and current - зсув фази напруги і струму
the ignition and propagation of a flame - запалювання і розповсюдження полум'я
obviously - очевидно
load circuit - ланцюги навантаження
a delay reactor - затримка реактора

3. Read and discuss the text groups.

Transistors are the tiny electronic components that changed the world: you'll find them in everything from calculators and computers to telephones, radios, and hearing aids. They're amazingly versatile, but that doesn't mean they can do everything. Although we can use them to switch tiny electrical currents on and off (that's the basic principle behind computer memory), and transform small currents into somewhat larger ones (that's how an amplifier works), they're not very useful when it comes to handling much bigger currents. Another drawback is that they turn off altogether as soon as the switching current is removed, which means they're not so useful in devices such as alarms where you want a circuit to trigger and stay on indefinitely. For those sorts of jobs, we can turn to a somewhat similar electronic component called a **thyristor**, which has things in common with diodes, resistors, and transistors. Thryristors are reasonably easy to understand, though most of the explanations you'll find online are unnecessarily complex and often confusing beyond belief. So that's our starting point: let's see if we can take a clear and simple look at what thyristors are, how they work, and what kinds of things we can use them for!

4. Learn by heart the following words and phrases.

electronic components - електронні компоненти
from calculators and computers to telephones - від калькуляторів і комп'ютерів на телефони
the basic principle - основний принцип
the switching current - імпульсний струм
those sorts of jobs - ці види робочих місць
reasonably - розумно
unnecessarily - зайве
silicon-controlled rectifier - кремній-керований випрямляч

General Electric introduced - Дженерал Електрик представила
diacs and triacs - діністори і тріністори
alternating current - змінний струм

5. Define the terms:
electronic components
electronic components
a high current demand
silicon-controlled rectifier
bigger currents

6. Translate into Ukrainian paying attention to the Infinitive Constructions.

1. She felt her hands tremble. 2. Nobody noticed him come in and sit down. 3. Many books are known to be published in our country every year. 4. His invention is considered to be of great importance. 5. She is not likely to change her opinion. 6. The new rocket is reported to go into operation next year. 7. Clyde seemed to have been thinking of no one else but Sondra since their last meeting. 8. I don't want my papers to be looked through. 9. I felt Nick put his hand on my shoulder 10. We saw them jump with parachutes. 11. The sun is known to represent a mass of compressed gases. 12. I heard the door of the entrance hall open and close softly. 13. For a long time the atom was thought to be indivisible. 14. He was said to be one of the most promising nuclear physicists. 15. Clyde was expected to arrive at the weekend. 16. She heard somebody walk up to her door. 17. Money just doesn't happen to interest me. 18. I heard him tell the teacher about it. 19. She appeared to be an excellent actress. 20. You appear to have found in him something that I have missed. 21. This work seems to take much time. 22. His office turned out to be in one of the back streets. 23. He is sure to tell me all about this even if I don't ask him. 24. They are sure to acknowledge your talent. 25. They all gathered on the hill to watch the sun rise. 26. This new course of treatment is sure to help your grandmother. 27. Would you like your luggage to be carried upstairs.

7. Put the infinitives in brackets into the correct form. Translate the sentences.

1. They seemed (to quarrel): I could hear angry voices from behind the door. 2. They are supposed (to work) at the problem for the last two months. 3. The only sound (to hear) was the snoring of grandfather in the bedroom. 4. Her ring was believed (to lose) until she happened (to find) it during the general cleaning. It turned out (to drop) between the sofa and the wall. 5. They seemed (to wait) for ages. 6. I hate (to bother) you, but the students are still waiting (to give) books for their work. 7. He seized every opportunity (to appear) in public: he was so anxious (to talk) about. 8. Is there anything else (to tell) her? I believe she deserves (to know) the state of her sick brother. 9. He began writing books not because he wanted (to earn) a living. He wanted (to read) and not (to forget). 10. I consider myself lucky (to be) to that famous exhibition and (to see) so many wonderful paintings. 11. He seems (to know) French very well: he is said (to spend) his youth in Paris. 12. The enemy army was reported (to overthrow) the defence lines and (to advance) towards the suburbs of the city. 13. The woman pretended (to read) and (not to hear) the bell. 14. You seem (to look) for trouble. 15. It seemed (to snow) heavily since early morning: the ground was covered with a deep layer of snow.

”Thyristors” Three connections

1. Read and translate the following text.

So what is a thyristor? It's an electronic component with three leads called the **anode** (positive terminal), **cathode** (negative terminal), and **gate**. These are somewhat analogous to the three leads on a transistor, which you'll remember are called the emitter, collector, and base (for a conventional transistor) or the source, drain, and gate (in a field-effect transistor, or FET). In a conventional transistor, one of the three leads (the base) acts as a control that regulates how much current flows between the other two leads. The same is true of a thyristor: the gate controls the current that flows between the anode and the cathode. (It's worth noting that you can get thryistors with two or four leads, as well as three-lead ones. But we're keeping things simple here, so we'll just talk about the most common variety.)

2. Learn by heart the following words and phrases.

Anode - анод
cathode - катод
gate - ворота
emitter - випромінювач
collector - колектор
base - база
conventional transistor - звичайний транзистор
small voltage - невелика напруга
smaller current stops - менший струм перестає
gate current - струм
handle real (electric) power currents - обробки реальних (електричний) потужність струмів
electric motors - електричні двигуни
solid-state electronics - твердотільна електроніка

3. Translate the following part of text into Ukrainian.

Now often that's not what we want to happen. In something like an intruder alarm circuit (where maybe an intruder steps on a pressure pad and the bells start ringing), we want the small current (activated by the pressure pad) to trip the larger current (the ringing bells) and for the larger current to keep on flowing even when the smaller current stops (so the bells still ring even if our hapless intruder realizes his mistake and steps back off the pad). In a thyristor, that's exactly what happens.

4. Read and translate the following text.

A thyristor is like two diodes

Recall that a diode is two layers of semiconductor (p-type and n-type) sandwiched together to produce a **junction** where interesting things happen. According to how you wire up a diode, current will either flow through it or not, making it the electronic equivalent of a one-way street. With a positive connection to the p-type (blue) and a negative connection to the n-type (red), a diode is **forward biased**, so electrons (black dots) and holes (white dots) move happily across the junction and a normal current flows:

In the opposite configuration, with a positive connection to the n-type and a negative to the p-type, a diode is **reverse biased**: the junction becomes a huge chasm that electrons and holes can't cross and no current flows:

In a transistor, we have three layers of semiconductor arranged alternately (either p-n-p or n-p-n), giving two junctions where interesting things can happen. (A FET is slightly different, with extra layers of metal and oxide, but still essentially an n-p-n or p-n-p sandwich.). A thyristor is simply the next step in the sequence: four layers of semiconductor, again arranged alternately to give us p-n-p-n (or n-p-n-p if you swap it around) with three junctions in between them. The anode connects to the outer p layer, the cathode to the outer n layer, and the gate to the internal p layer, like this:

5. Learn by heart the following words and phrases.

two layers of semiconductor - двох шарів напівпровідника
forward biased - вперед упередженим
reverse biased - обратнонаправленный
two junction diodes connected in series - два площинних діодів, З'єднаних послідовно
forward blocking - вперед блокування
extra gate connection - додатковий з'єднувальний воріт
the two-transistor model - два транзистора модель

6. Complete the following text:

1. Recall that a diode is two layers of _____(p-type and n-type) sandwiched together to produce a **junction** where interesting things happen.
2. According to how you wire up a diode, current will either flow through it or not, making it the _____ of a one-way street.
3. With a positive connection to the p-type (blue) and a negative connection to the n-type (red), a diode is _____, so electrons (black dots) and holes (white dots) move happily across the junction and a normal current flows.

7. Read and translate the following text.

Reverse blocking

Suppose we reverse the anode/cathode connections. Now you can probably see that both the upper and lower diodes are reverse biased, so still no current flows through the thyristor. This is called **reverse blocking** (and it's analogous to reverse bias in a simple diode).

Forward conducting

The third state is the really interesting one. We need the anode to be positive and the cathode negative. Then, when a current flows into the gate, it switches on the lower transistor, which switches on the upper one, which switches on the lower one, and so on. Each transistor activates the other. We can think of this as a kind of internal, **positive feedback** in which the two transistors keep feeding current to each other until both of them are fully activated, at which point current can flow through them both from the anode to the cathode. This state is called **forward conducting** and it's how a thyristor "latches" (stays permanently) on.

8. Learn by heart the following words and phrases.

Reverse blocking - зворотного блокування

forward conducting - вперед проведення
positive feedback - позитивні відгуки
conducting - проведення
types of thyristors - типи тиристорів
to be positive and the cathode negative - щоб бути позитивним і негативним катодом
stays permanently - залишається назавжди
latches - шпінгалети
simplified - спрощений
internal n-type layer - внутрішній N-типу шару
anode gate thyristor - анод тиристора ворота

9. Answer the following questions.
1. What are thyristors?
2. What types of thyristors do you know?
3. How do thyristors work?
4. What parts does the thyristor consist of?
5. What do thyristors similar to the transistor?

10. Transform the following complex sentences into simple ones using the Subjective Infinitive Complex:
1. It is supposed that he understands German.
2. It is reported that the cosmonauts feel well.
3. It is said that Kate is preparing for her examinations.
4. It is reported that the spaceship has reached the moon.
5. It is said that she has been teaching mathematics for thirty years.
6. It was expected that the film would be shown in May.
7. It seems that he is composing a new symphony.
8. It proved that you were right.
9. It turned out that the text was very difficult.
10. It is probable that the winter will be very cold this year.
11. It is improbable that she will forget her promise.
12. The doctor will certainly do his best.
13. He will certainly do his duty.

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