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та навчальні завдання
з розвитку англомовного професійного спілкування до практичних занять і самостійної роботи для здобувачів вищої освіти першого (бакалаврського) рівня за освітньо-професійною програмою «Автомобільний транспорт» спеціальності 274 «Автомобільний транспорт» галузі знань 27 «Транспорт» усіх форм навчання

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Методичні рекомендації та навчальні завдання з розвитку англомовного професійного спілкування до практичних занять і самостійної роботи для здобувачів вищої освіти першого (бакалаврського) рівня за освітньо-професійною програмою «Автомобільний транспорт» спеціальності 274 «Автомобільний транспорт» галузі знань 27 «Транспорт» усіх форм навчання. [Електронне видання] / Осецька Н. Ф. – Рівне : НУВГП, 2024. – 53 с.

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ПЕРЕДМОВА

Методичні вказівки та навчальні завдання призначені для розвитку англомовної професійної лексичної компетентності та комунікативних навичок здобувачів освітнього рівня «Бакалавр», необхідних для здійснення ефективної професійної комунікації в галузі автомобілебудування.

Дана методична розробка містить огляд деяких типів сучасних транспортних засобів, їх конструкцій, компонентів та функціональних особливостей. Методичні вказівки та навчальні задання мають на меті допомогти оволодіти базовою професійною лексикою, дати можливість використовувати різні мовленнєві зразки, які можуть зустрічатися в цій галузі.

Методичні вказівки та навчальні завдання призначені для студентів, які обізнані зі структурними закономірностями англійської мови і продовжуватимуть опановувати основи професійного дискурсу. Текстовий матеріал може бути використаний для вирішення декількох завдань у процесі навчання: для ознайомлювального та пошукового видів читання, розвитку навичок перекладу, реферування і анотування, роботи зі словником, а також комунікативних навичок у сфері професійної діяльності.

Тексти для читання дають можливість практичного застосування термінів. Післятекстові запитання дозволяють активізувати використання в комунікативній ситуації ці словникові одиниці, а також мовленнєві зразки, які студенти розглядали під час читання. Кожен урок містить вправи для повторення, які перевіряють рівень засвоєння словникового запасу, що дає можливість обговорювати інформацію, пов’язану з галуззю автомобілебудування.

Пропонуючи цю розробку, ми сподіваємося, що інтерес студентів до представленої інформації про галузь автомобілебудування підвищить їх здатність спілкуватися англійською мовою.

UNIT ONE. DEVICES AND THEIR FUNCTIONS. THE ENGINE.

Language Practice

I. What measuring instruments do you know? List as many as you can. Compare your list with that of your groupmates.

II. Match each word with the proper definition.

a) a tyre	1) a device for indicating current
b) a micrometer	2) a tool for cutting materials
c) a speedometer	3) a device for performing mathematical operations
d) a thermometer	4) a tool for driving in screws
e) an ammeter	5) a thing for protecting wheels
f) a screwdriver	6) an instrument for measuring temperatures
g) a calculator	7) an instrument for indicating the speed of a car
h) a chisel	8) a tool for measuring microdimensions

III. Choose the proper definitions for the words.

a gauge		a device for studying materials' structure
a microscope	is known	a device for measuring low pressures
a computer	as	a device for producing a powerful beam of light
a laser		a device for calculating at high speeds

IV. Rephrase the following.

EXAMPLE: *A: We measure pressure with the help of a manometer.*

B: It <u>is used for</u> measuring pressure.

1. We measure high temperature with the help of a pyrometer.
2. We transport people and goods with the help of a car.
3. We make holes with the help of an electric drill.
4. We measure distances with the help of a laser.

V. Answer your friend's questions about the functions of these devices.

EXAMPLE: a) – *What device is it?*

– This device is known as a laser.

– What is it used for?

– It is used for producing a powerful beam of light.

a) a laser / to produce a powerful beam of light

b) a manometer / to measure pressure

c) an electric drill / to make holes

d) a chisel / to cut different engineering materials

e) a computer / to calculate at high speeds

VI. Fill in the table using information from the text following it.

Device or thing	***Main components***			***Usage***		
	a power source, lenses	...	a manipulator, a drive, a control unit	...	for communi-cating	for producing a beam of light
a laser a car …	✓					✓

A laser. This device is used for p**roducing** a very powerful beam of light. It has its own **power source** and several **lenses.**

A telephone. This is an **apparatus** for **communicating.** It has a receiver.

A car. This vehicle is used for transporting passengers and goods. Every car has four wheels and an engine.

A robot. It is used for performing different jobs **instead** of human beings. It has a manipulator, a control unit and a drive.

VII. Translate the text into Ukrainian.

Any instrument for measuring electricity is known as a meter. An ammeter is used for measuring current in amperes. The abbreviation for the ampere is amp. There are very delicate ammeters that are used for measuring very small current. They are known as a

milliammeter and a microammeter. The device for reading a thousandth of an ampere is called a milliammeter while a microammeter is a device for reading a millionth of an ampere.

Reading Comprehension

I. Learn the following words and word-combinations to comprehend the text.

energy-conversion	pollution
include	alternate
steam	source
rotary	refinement
reciprocating	competitive
diesel engine	emission
gasoline engine	device
reliability	capacity
operate	pressure
efficiency	rate

II. Read and translate the text.

The Engine

A wide range of energy-conversion systems has been used experimentally and in automotive production. These include electric, steam, solar, turbine, rotary, and a variety of piston-type internal combustion engines. The most successful for automobiles has been the reciprocating piston internal-combustion engine, operating on four-stroke cycle, while diesel engines are widely used for lorries and buses. The gasoline engine was originally selected for automobiles because it could operate more flexibly over a wide range of speeds, and power developed for a given weight engine was reasonable; it could be available, moderately priced fuel-gasoline model. Reliability, compact size, and range of operations later became important factors.

There has been an ongoing reassessment of these priorities with new emphasis on the pollution-producing characteristics of automotive power system. This has created new interest in alternate power sources and internal-combustion engine refinements that were not economically feasible in prior years. Although a few limited-

production batteries powered electric vehicles have appeared from time to time, they have not proved to be competitive owing costs and operating characteristics. The gasoline engine, with new emission-control devices to improve emission performance, has not yet been challenged significantly.

In the late 1940^{s} a trend began to increase engine horse-power, particularly in American models. Design changes incorporated all known methods of raising engine capacity, including increasing the pressure in the cylinders to improve efficiency, increasing the size of the engine and increasing the speed at brought a return to smaller engines, four- and six-cylinder designs rated as low as 80 horsepower.

European automobile engines were of a much wider variety, ranging from 1 to 12 cylinders, with corresponding differences in overall size, weight, piston displacement, and horsepower ratings from 19 to 120.

III. Fill in spaces with the appropriate word or phrase.

1. A wide range of energy-conversion systems have been used in automotive production including a variety of piston-type … .
2. The reciprocating-piston internal-combustion engine proved to be …
3. … , and range of operations later became important factors.
4. In the late 1940^{s} a trend began to increase … .

IV. Are the following statements true or false?

1. European engines were of usual variety.
2. As s gasoline engine could operate more flexibly over a wide range of speeds, it was selected for automobiles.
3. The return to smaller engines brought the advent of smaller cars.
4. All known methods of raising engine capacity were incorporated in these design changes.

V. Answer the following questions.

1. What are the energy conversion systems used in automotive production?

2. What engines proved to be the most successful for automobiles? Why?

3. What factors have created new interest in alternate power sources and internal-combustion engine refinements?

4. What are the characteristics of European automobile engines?

VI. Retell the text.

UNIT TWO. MOTOR VEHICLES. INTERNAL COMBUSTION ENGINES.

Language Practice

I. Are you good at driving? Name as many differences as you know between a car and a motorcycle. Compare your list with that of your groupmates.

II. Match the words from two columns to make up word-combinations.

spark	wheel
air-cooled	injector
spare	engine
oil	plug
steering	parts
fuel	sump

III. Ask you friend where the following things are. Make questions with Is there …? and Are there … ? and your partner will answer using different expressions of certainty and uncertainty.

EXAMPLE: *radiator / in the car*

– Is there a radiator in the car?

– Yes, certainly. There is a radiator in the car.

fan / at the front of the car engine

an engine / at the back of the car

a spare wheel / in the garage

a jack / under the car

IV. Find mistakes in the following sentences and correct them.

1. The nuts is on the workbench.
2. – Where are the nails? Are they on the table?
   – Yes, it is.
3. Switch off the drill and then drill the hole.
4. Is there many differences between the types of engines?
5. Water-cooled engines always has a radiator.
6. There are water-cool and air-cool engines.
7. You should work in a workshop tomorrow.
8. Why don't you bring me a tyre yesterday.

V. There is no motor vehicle without an engine.

All **motor vehicles** have an engine. There are two types of engines. There are **petrol** engines and there are **diesel** engines. There are two engines in the diagram.

There is a **two-stroke** petrol engine on the left. There is a **four-stroke** diesel engine on the right. There are **spark plugs** in all petrol engines. Diesel engines do not have spark plugs. They have **fuel injectors.**

There are always **valves** in 4-stroke diesel engines. There are no valves in 2-stroke petrol engines. A 2-stroke petrol engine never has valves.

There is no **oil sump** in a 2-stroke engine. There is oil in the **fuel.** The 4-stroke engines have an oil sump. There is no oil in the fuel.

VI. Answer the questions.

1. Is there an engine in all motor vehicles?
2. What are the types of engines?
3. Which engines are there in the diagram?
4. Are there any spark plugs or fuel injectors in diesel engines?
5. There are always valves in 4-stroke engines, aren't there?
6. Which engines have oil sumps?

VII. Complete this table according to the information in the text.

Type of engine	*Oil sump*	*Valves*	*Fuel injector*	*Spark plug*
2-stroke petrol engine				
4-stroke diesel engine				

VIII. Define whether the sentences are true or false. Correct the false ones.

1. Modern vehicles have no engine.
2. All petrol engines have spark plugs.
3. A 2-stroke petrol engine has valves.
4. A motorcycle has a steering wheel.
5. A car usually has side lights.
6. There are handlebars in all vehicles.

IX. Discuss with your friend the differences between a motorcycle and a car.

X. Fill in the gaps with the words: *side lights, handlebars, mirror, windscreen, wipers, steering wheel.*

In the diagram there is a motorcycle on the … and there is a … on the right. … … a headlight on the front of the motorcycle. The car … two headlights at each side. There … two wipers on the windscreen. … … no windscreen on the … and it has … wipers. … … two side lights on the front of the … … no side lights on the front of the … . … … a steering wheel in the car. A motorcycle … no steering wheel. … … handlebars. … is a mirror on the car and there … a mirror on the motorcycle.

XI. a) Match the English compound nouns with their Ukrainian equivalents.

vehicle engine	двигун з боковим розташуванням клапанів
side valve engine	двигун з верхнім розташуванням клапанів
overhead valve engine	ступінь стиснення
compression ratio	двигун транспортного засобу

b) Translate the following passage paying attention to the translation of the compounds nouns.

Almost all modern vehicle engines have valves. There are side valve engines. In this design the valves are at the side of the cylinder. It is a comparatively simple design. The side valve engines are not very powerful but quite reliable.

There are also overhead valve engines for vehicles. In this design the valves are overhead the engine and have a complex design. The overhead valve engines are powerful and have high compression ratio.

Reading Comprehension

I. Learn the following words and word-combinations to comprehend the text:

basic	form
between	fuel
burn (burnt, burnt)	head
burning	internal combustion engine
camshaft	motion
chamber	move
change	oil
close	open
combustion chamber	part
compression	piston
crankcase	power
crankshaft	provide
engine	reciprocating part
flywheel	support
force	valve

II. Read and translate the text.

Internal Combustion Engines

Internal combustion is the process of the burning of fuel within the engine. The fuel burns within the engine and provides forces. These forces provide the engine power.

Internal combustion engines have stationary, rotary and reciprocating parts.

Stationary Engine Parts. The stationary engine parts are the cylinder block, the crankcase and the cylinder head.

The cylinder block is one of the basic parts of the engine. The process of combustion takes place within the cylinders. All modern vehicles engines have some cylinders.

The crankcase is a part of the cylinder. It supports the crankshaft

and the camshaft and keeps the lubricating oil near the engine parts.

The cylinder heads close the cylinders. The cylinders and the cylinder heads form the combustion chambers. The burning of fuel takes place within the combustion chambers.

Rotary Engine Parts. Rotary engine parts are the crankshaft, the flywheel and the camshaft.

The crankshaft changes reciprocating motion of pistons to rotary motion. The camshaft opens the valves of the engine.

keeps the lubricating oil *утримує мастило*

III. Read the following international words and give their Ukrainian equivalents.

block, cylinder, component, carburettor, diesel, filter, tractor, process, system, gas, battery, vibration, magneto, function, transmission.

IV. Match the words from the line A with the words from the line B to have word-combinations.

A. Engine, cylinder, combustion, piston, fuel, exhaust.

B. Chamber, valve, system, head, parts, rings.

V. Fill in the gaps with the words given below.

1. The ... changes reciprocating motion of pistons to rotary motion.
2. The ... opens the valves of the engine.
3. The ... is one of the basic parts of the engine.
4. The cylinder and the ... form the combustion chamber.
5. The ... of fuel provides forces.
6. The ... keeps the lubricating oil near the engine parts.

(cylinder head, camshaft, burning, crankcase, crankshaft, cylinder block).

VI. Answer the questions.

1. What process takes place in internal combustion engines?
2. What does the burning of fuel provide?
3. What are the basic parts of the internal combustion engine?
4. What are the stationary engine parts?
5. What does the crankcase support?

6. What is the function of the cylinder heads?
7. What do cylinders and cylinder heads form?
8. Where does the burning of fuel take place?
9. What are the rotary engine parts?
10. What is the function of the crankshaft?
11. What does the camshaft open?

VII. Retell the text.

UNIT THREE. TYPES OF ENGINES. PRINCIPLES OF ENGINE OPERATION.

Language Practice

I. Discuss the following questions:

a) How do various types of vehicles differ from each other?
b) Are there different types of engines in different vehicles?

II. a) A 4-stroke engine has four working cycles. Do you know all of them?

b) Match the English word-combinations with their Ukrainian equivalents.

1) power stroke	a) такт випуску
2) exhaust stroke	b) такт стиснення
3) compression stroke	c) такт впуску
4) induction stroke	d) робочий хід

III. You want to know what objects your friend has in his garage. Ask him about their location using some, any and not any.

EXAMPLE: *spare wheels / in the garage*

A: – Are there **any** spare wheels in the garage?
B: – There are **some** spare wheels there.
C: – There aren't **any** spare wheels there.

wipers / on the windscreen	tyres / in the garage
spark plugs / in the engine	cylinders / in the engine
tools / in the toolbox	nuts / on the worktable

IV. Correct mistakes in the following sentences.

1. There are not much vehicles with two-stroke engines.
2. This plant produces motorcycles. Only little motorcycles have four-stroke petrol engines.
3. – Are there some tools in that toolbox?
   – No, there are not any tools in it.
4. I'd like to know how many spark plugs are there in the engine.
5. There is not many cars with two-stroke engines, is there?
6. There are a lot of student in the workshop at the moment.
7. Are there some lorries with two-stroke engines?
8. I don't think there are some lorries with two-stroke engines.
9. I have few tools. Let's repair the car.
10. There are a few nails left. We need to buy some more.

V. Try to answer these questions before you read the text.

1. Are there any basic types of fuel for motor vehicles? What are they?
2. How many motorcycles have four-stroke petrol engines/two-stroke petrol engines?
3. Are there any motorcycles with diesel engines?
4. What motor vehicles have diesel engines?
5. How many lorries have diesel engines?
6. How many cars have four-stroke petrol engines?
7. Are there many lorries with petrol engines?

VI. Read the text about different types of fuel and engines and check your answers.

There are some basic types of fuel for motor vehicles. There is diesel fuel, there is petrol and there is **fuel mixture.**

Most motorcycles have two-stroke petrol engines. But there are **a few** motorcycles with four-stroke petrol engines. There are no motorcycles with diesel engines.

A **lot of** buses have diesel engines but only a few cars have such engines. There are also a few cars with two-stroke engines but most cars have four-stroke petrol engines.

Most lorries have diesel engines. There are not **many** lorries with four-stroke petrol engines but there are no lorries with two-stroke engines.

A lot of engines are **at the front of** the car. A few engines are **at the back** and very few are **in the middle.**

VII. Complete the sentences.

1. There are a … motorcycles with four-stroke petrol engines.
2. … motorcycles have diesel engines.
3. There are a … cars with diesel engines.
4. … cars have two-stroke engines, … cars have four-stroke petrol engines.
5. Are there … lorries with four-stroke petrol engines? There are not… lorries with such engines.
6. A … of engines are at the front of the car.
7. There are a … engines at the back and there are very … engines in the middle.

VIII. a) Fill in the table using the information from the text. One answer is already given.

	most	a few	none	a lot	few
diesel engines					
two-stroke petrol engines	motorcycles				
four-stroke petrol engines					

b) Use the information from the table above and describe what engines various vehicles have.

EXAMPLE: Most motorcycles have two-stroke petrol engines.

IX. Discuss with your partner how many cars / lorries / motorcycles have diesel engines / two-stroke engines / four-stroke petrol engines.

X. Complete the description of the 4-stroke four-cylinder engine.

Four-stroke engine, four-cylinder engine, timing belt, belt, camshaft, induction, intake, power, compression, exhaust.

A four-stroke four-cylinder engine

The most common multi-cylinder engine is … . The layout is normally in-line and the firing order is generally 1 – 3 – 4 – 2. Each cylinder is always on a different stroke from all the others. When cylinder 1 is on the … stroke, cylinder 2 is on the …, cylinder 3 is on

the …, cylinder 4 is on the …. The main advantage of this engine is that the power … is once every 180° of crankshaft rotation.

XI. Describe the complete cycle of operation for all the cylinders at any position of the crankshaft. Use the information from the table below.

Crankshaft position (degrees)	***Cylinder 1***	***Cylinder 2***	***Cylinder 3***	***Cylinder 4***
	(strokes)			
0-180	power	exhaust	compression	induction
180-360	exhaust	induction	power	compression
360-540	induction	compression	exhaust	power
540-720	compression	power	induction	exhaust

Reading Comprehension

I. Learn the following words and word-combinations to comprehend the text.

air
bottom dead centre
call
common
cycle
draw (drew, drawn)
draw in (into)
exhaust
heat
heavy
high
ignite
intake
inward
mixture
movement
new
operate
outward
spark
stroke
power stroke
top dead centre
because of
during
from
than
toward

II. Read and translate the text.

Principles of Engine Operation

Engines operate on cycles. There are four strokes of the piston in one cycle of engine operation. There are two outward strokes toward the crankshaft and two inward strokes away from the crankshaft.

When the piston is at the end of the stroke away from the crankshaft (inward stroke) this is top dead centre (TDC). When the piston is at the end of the outward stroke (toward the crankshaft) this is bottom dead centre (BDC). The piston movement from TDC to BDC is an engine stroke.

The four strokes in a cycle of the internal combustion engine are: intake, compression, power and exhaust.

Intake (induction). During the intake stroke the piston moves to BDC and the intake valve opens. This movement of the piston draws a mixture of air and fuel into the cylinder (in a diesel this movement of the piston draws in air only).

Compression. When the piston reaches BDC it moves toward the cylinder head (inward motion). The valves do not open and the piston compresses the fuel mixture between the piston and the cylinder head (in a diesel the piston compresses air only).

Power. When the piston reaches TDC, an electric spark ignites the fuel mixture in the combustion chamber of the gasoline engine (in a diesel engine the heat of the highly compressed air ignites the fuel).

When the air-fuel mixture burns it moves the piston with great force.

There are higher **pressures** in the diesel engines and because of these pressures the diesel engines have heavier piston pins, connecting rods and crankshafts than the gasoline engines.

Exhaust. The exhaust stroke takes place when the piston moves up. The exhaust valve opens and the piston forces out the gases. The new cycle will begin in the cylinder.

Because of the four strokes we call this engine a four-stroke-cycle engine. The four-stroke-cycle engine with spark ignition is the most common type of the internal combustion engine.

away from	*у бік від*
only	*лише, тільки*
reach	*досягати*
pressure	*тиск*
force out	*виштовхувати*

III. Fill in the gaps with the appropriate word-combinations. Translate the sentences into Ukrainian.

1. During the intake stroke the piston moves to the ... and the intake valve opens (top dead centre, bottom dead centre).
2. The piston compresses the fuel mixture during the ... (exhaust stroke, compression stroke).
3. During the ... an electric spark ignites the fuel (power stroke, compression stroke).

IV. Match the antonyms.

top, great, intake, close, bottom, outward, draw in, inward, exhaust, force out, small, open.

V. Answer the questions.

1. What do engines operate on?
2. How many strokes of the piston are there in one cycle of engine operation?
3. How many outward and inward strokes are there in one cycle?
4. What is an engine stroke?
5. What are the four strokes in one cycle of the internal combustion engine?
6. When does the intake valve open?
7. What draws a mixture of fuel and air into the cylinder?
8. Where does the piston compress the fuel mixture?
9. What ignites the fuel mixture in the combustion chamber of the gasoline engine?
10. What does the ignited mixture move?
11. When does the exhaust stroke take place?
12. Why do we call this engine a four-stroke-cycle engine?
13. What is the most common type of the internal combustion engine?

VI. Retell the text.

UNIT FOUR. SOME CAR SYSTEMS. THE SYSTEMS OF THE INTERNAL COMBUSTION ENGINE.

Language Practice

I. a) List as many car systems as possible. Compare your list with the rest of the group. Who's got the longest list?

II. Match a line in A with a line in B.

A	B
1. Where were you yesterday?	a. It's a special tube in the carburettor.
2. What were you studying in the lab?	b. It's used for mixing fuel with air.
3. Where is the fuel mixed with the air?	c. The fuel system of a car.
4. What is a venturi?	d. The fuel mixture is ignited.
5. What happens in the combustion chamber?	e. In the lab.
6. What is a carburettor used for?	f. In the carburettor.

III. Match the English words with their Ukrainian equivalents.

1) steering	a) привід
2) accelerator	b) двигун внутрішнього згорання
3) advantage	c) незалежна підвіска
4) independent suspension	d) бак
5) internal combustion engine	e) паливна система
6) drive	f) прискорювач
7) fuel system	g) рульове керування
8) tank	h) перевага

IV. Fill in the table with the missing forms of the following words. Use your dictionary if necessary.

Verb	*Noun*	*Adjective*
1. …	Safety	…
2. …	…	separate
3. cool	….	
4. …	Power	
5. compress		…

6. detect	…	
7. …	…	adaptive
8. …	improvement	

V. Analyse the word-combinations in the table and translate the following combinations into Ukrainian

Артикль	*Іменник в ролі означення*	*Визначальний іменник*	*Переклад*
the	steam	engine	паровий двигун
the	steam engine	cylinder	циліндр парового двигуна
the	steam engine cylinder	improvement	удосконалення циліндра парового двигуна

the land transport
the land transport problem
the internal combustion engine
the internal combustion engine improvement
the vehicle motion
the vehicle motion control
the control device
the control device application

VI. Give the opposite to the following sentences.

1. This mechanism is used in the engine.
2. Power is not produced by the engine.
3. Fuel is burnt in the engine to produce power.
4. Fuel and air are not mixed in the carburettor.

VII. Your partner wants to check your knowledge of automotive engineering. Answer his questions. Use such adverbs as always, never, sometimes, often, seldom, usually.

EXAMPLE: *a) Oil is used in diesel engines.*

A: Is oil always used in diesel engines?
B: Yes, it is.
b) Sulphur is used in petrol fuel.
A: Is sulphur always used in petrol fuel?
B: No, it isn't. It's never used in petrol fuel.

1. Diesel fuel is used in different engines.
2. Gas is kept in a special tank.
3. Petroleum is needed in all branches of industry.
4. Fuel is carried by the fuel pipe.
5. Fuel is mixed with air in the carburettor.

VIII. Correct mistakes.

1. This car be powered by the energy of the Sun.
2. Machines are not maked of wood.
3. This car are equipped with the experimental fuel system.
4. To this theory is often referred in scientific literature.
5. Is our engineer invite to the scientific conference in Denmark?
6. How different fuels to be produced?

IX. List all possible components of the fuel system in the car.

X. How many word-combinations can you form with the noun "fuel"? Scan the text to check which of them are mentioned there.

XI. Now read the text attentively and learn about different mechanisms in a car.

A motor vehicle is a complex engineering construction. It is **composed** of several thousand parts. The smaller parts are joined together and form larger components, or units. One of the main components of any vehicle is, of course, the engine.

In addition to the engine itself, there are four **separate** mechanisms, which are used to feed the engine. These mechanisms are the **fuel system,** the **lubrication** system, the electrical system and the **cooling system**.

The fuel system is a separate mechanism that is used for feeding the engine. The fuel system consists of a **tank,** a fuel line or a pipe, a pump **carburettor**. The engine produces power when air and fuel are **mixed** and **burnt**.

So let's have a look at the fuel system operation. The fuel is stored in a fuel tank. The fuel tank is connected to a fuel pipe. The fuel pipe carries the fuel to the fuel pump. This pump can be either electric or mechanic in operation. Electric pumps are generally

situated near the fuel tank whereas a mechanical pump is generally **located** beside the engine. It is **driven** by the camshaft. The fuel pump is connected to the carburettor. In the carburettor the fuel is mixed with air. It is important to have the right ratio of air to fuel. For example, the optimum ratio of air to petrol in the fuel mixture is 15 parts of air to 1 part of petrol. The fuel and the air are **compressed** by the piston in the carburettor and they are drawn into the engine. In the engine the fuel and air are burnt and they produce power.

XII. Answer the following questions.

1. How many mechanisms are there in addition to the engine itself? What are they?
2. When does an engine produce power?
3. Where is fuel stored?
4. The fuel pump is connected to the carburettor, isn't it?
5. Does the fuel pump carry the fuel into the carburettor or into the fuel tank?
6. Where is the fuel mixed with air?

XIII. Complete the sentences.

1. There are … mechanisms which … for feeding the engine.
2. The … is a separate mechanism which is … to feed the … .
3. Air and fuel … mixed and … .
4. The fuel… in a fuel tank.
5. The fuel pump … to the carburettor.
6. In the carburettor the fuel is … with … .
7. The … and air are … into the engine.

XIV. At the Motor Show last week you saw a totally new design of a car. It was equipped with "an intelligent vehicle motion control". You told your father about this innovation but he doesn't believe in all these improvements. Describe him how this system works and speak about its advantages and disadvantages. Work in pairs.

XV. The first cars appeared at the end of the 19th century. Nowadays we can't imagine our life without a car. At the same

time cars cause a lot of Problems. So, is a car our friend or enemy?
a) Read the following statements. Think of some more.

Reasons to have a car	*Reasons not to have a car*
1. It saves our time. 2. It carries heavy materials. 3. It's very comfortable. 4. It gives a chance to travel whenever and wherever. 5. It brings quick help (police, ambulance, …). 6. …	1. It is very noisy. 2. It pollutes air. 3. Many people are killed or injured in car accidents. 4. It does harm to your health, because you don't walk. 5. It causes traffic jams. 6. …

b) Discuss the problem in pairs and try to reach an agreement.

Reading Comprehension

I. Learn the following words and word-combinations to comprehend the text.

bearing
main bearing
cause *v*
cool
force
friction
gear
governor
injector
inlet
locate
lubricate
manifold
oil pan
passage
pressure
coolant
deliver
equip
expand
fan
film
float
ratio
reduce
surface
vary
water jacket
wear (wore, worn)
in order to
proper

II. Read and translate the text.

The Systems of the Internal Combustion Engine

Four systems are necessary for proper operation of the internal combustion engine. These are fuel, lubricating, cooling and ignition systems.

The Fuel System. The gasoline engine fuel system must supply the engine with a mixture of air and fuel that burns within the cylinders. Gasoline engines use a carburettor mixing the fuel and air and delivering the mixture to the engine through the intake manifold. Air-fuel rations vary for idling, light-load and heavy-load operations. Diesel engines have a high-pressure pump forcing the fuel through injectors into the combustion chamber.

The Lubricating System. A film of oil is produced between the working surfaces of the metal parts. In this way friction and wear are being reduced because the film of oil keeps the surfaces apart. A lubricating system is necessary in order to deliver the oil to the moving parts of the engine. All modern tractor engines are lubricated by the force-feed method. Engine lubrication is provided by an oil pump located in the oil pan. Gear-type pumps are commonly used in most engines because of their long life and trouble-free operation. Pump inlets are located in a float that takes oil from the cleanest place in the oil pan. Oil filters are located between the oil pump and engine parts to reduce engine wear. Oil is delivered through passages to the camshaft bearings, the crankshaft main bearings and the connecting rod bearings. Oil is delivered to the valve mechanism and other parts requiring lubrication.

The Cooling System. There are two types of the cooling system: the thermosiphon system and the pump system. In the thermosiphon system the water expands as it is being heated and rises to the top of the radiator. Gravity causes the downward movement of the water in the radiator where cooling takes place. Then the water is delivered back to the engine water jackets: the engine parts are being cooled.

The Ignition System. In gasoline engines the fuel charge is ignited by an electric spark. These are spark ignition engines. In diesel engines the compressed air ignites the fuel charge. Diesels are compression ignition engines.

Spark ignition engines use an electric ignition system providing

the ignition of the fuel charge.

Two types of electric ignition systems are commonly used: the battery system and the magneto system. These systems function on the same basic principles. Battery systems are used on practically all newer vehicles.

idling	*холостий хід*
in this way	*таким чином*
keeps the surfaces apart	*не дає поверхням стикатися*
force-feed	*примусове подання*
trouble-free operation	*безперебійна робота*

III. Answer the following questions.

1. How many systems are necessary for proper operation of the internal combustion engine?
2. What are those systems?
3. What system must supply the engine with a mixture of air and fuel?
4. Where does the mixture of air and fuel burn?
5. What pumps do the diesel engines have?
6. Where is a film of oil produced?
7. What system is necessary in order to deliver the oil to the moving parts of the engine?
8. By what method are all modern tractor engines lubricated?
9. What pumps are commonly used in most engines?
10. Where are pump inlets located?
11. Where is oil delivered to?
12. How many types of cooling system are there?
13. What causes the downward movement of the water in the radiator?
14. What system is providing pressure for circulation?
15. In what engines is the fuel charge ignited by an electric spark?
16. What ignites the fuel charge in diesel engines?
17. What ignition system do spark ignition engines use?
18. What types of electric ignition systems are commonly used?

IV. Retell the text.

UNIT FIVE. DESIGNING CARS. DIESEL ENGINE.

Language Practice

I. Discuss the following questions.

a) Why are there so many models of cars today?

b) How does the car design influence your choice of cars?

c) A car designer is a very prestigious profession nowadays. Can you explain why?

II. Match a line in A with a line in B.

A	B
1) Who was the Volkswagen Beetle designed by?	a) It was designed by Rudolf Diesel.
2) Where was the first steam engine produced?	b) I think, because of its attractive design.
3) Why is this car so popular?	c) Let's hope for the best.
4) When will new cars be designed?	d) I think in a couple of years.
5) I hope your Mercedes will be repaired soon.	e) By Ferdinand Porsche.
6) Who invented a new internal combustion engine?	f) In France.

III. Match the words with their definitions.

1) to adjust	a) smth. which is used to carry people or goods from one place to another
2) to arise	b) to regulate for proper use
3) to reduce	c) to start or originate
4) to detect	d) a public road that is wide, well-paved and direct
5) to respond	e) to react, to answer
6) highway	f) to make or become smaller or less
7) vehicle	g) to discover the presence

IV. Match the words with the similar meaning.

1) feature	a) provide
2) respond	b) help
3) monitor	c) device
4) detect	d) characteristic
5) improve	e) answer
6) feed	f) find
7) appliance	g) make better
8) assist	h) control

V. Ask an engineer about the advances in car design.

EXAMPLE 1: *the gearbox / to improve*

– Was the gearbox improved?

– Yes, it was.

the size of the car / to reduce
the car design / to improve
wheels / to modify
mini motor cars / to design
new types of fuel / to use

VI. Insert necessary prepositions.

1. Michal is preparing … his examination now.
2. I've heard a lot… the advantages … electric cars.
3. People need petroleum … all branches of industry.
4. The fuel is stored … a fuel tank.
5. Vehicles are driven … a combustion engine.
6. Automotive chassis differ a lot… conventional chassis.
7. The cars of the future will run … solar energy.
8. The lecturer paid attention … the design of a new minicar.

VII. Translate into Ukrainian.

1. Internal combustion engines are known to generate power employing the energy contained in the fuel mixture.
2. Water jackets surround the cylinders to cool them.
3. These are valves to be tested during our experiment.
4. Gasoline, diesel and some other engines are considered to be based on the same operating principles.

5. Specialists find the four-stroke cycle engine to be the most common type.

6. The mixture to be ignited is delivered to the combustion chamber.

7. Properly maintained engines are assumed to give the greatest efficiency.

8. To seal the combustion chamber piston rings are used.

9. The new method to be used for fuel ignition is more effective.

10. We know the diesel engine to be very much the same as the petrol engine.

11. We watched the combine harvester cut and thresh the crop.

12. Mechanical engineers consider the cutter-bar to be one of the main parts of the combine harvester cutting mechanism.

13. The instruction requires the cooling water temperature to be 80-85°.

14. The operator saw the grain be directed to the grain pan under the concave.

VIII. There exist different types of cars and a mini motor car is one of them.

1. What do you know about this vehicle?
2. Have you ever seen or driven it?
3. Why is it called "mini"?
4. Are they widely used nowadays?

IX. Scan the text and say what it is about.

Mini motor cars are sold all over Europe. The first Mini was produced in Britain in 1959 and it has become Britain's most popular and successful car since that time.

In the late 1950s, BMC, the British Motor Corporation, wanted to build a car that was different from other cars. They wanted a small, cheap and economical car – a family car that was big enough to carry four **passengers**. In the 1950s it was a difficult problem. At that time a typical family car was quite long, about three and a half meters. It had large wheels and large **space** for the engine. So there wasn't much **room** for the passengers. Besides that, it was very expensive to make.

The Mini was **designed** by Alec Issigonis. His **design** was revolutionary. First, the car was made half a meter shorter. Next, the wheels were made much smaller and they were put right at the four corners of the car. To provide enough room for 4 passengers the engine was turned sideways and the gearbox was put underneath.

Today nearly every small car is based on the design of the Mini. So why is the Mini so popular? The answer is simple: it is well designed, very economical, it is easy to drive around the city and easy to park.

X. Complete the sentences.

1. Mini motor cars are … all over Europe.
2. The Mini has become Britain's most … and … car.
3. In the 1950s BMC wanted to build a … and … car.
4. The Mini… by Alec Issigonis.
5. The car … half a meter … .
6. The wheels were known to be made … .
7. The engine … sideways and the … was put underneath.
8. Today almost every car is … on the … of the … .

XI. Answer these questions.

1. When was the first Mini produced?
2. Who was this car designed by?
3. How did a typical family car look like in the 1950s?
4. What changes did Alec Issigonis make in a new car, called the Mini?
5. What are the advantages of the Mini?
6. Do you think that the Mini is a good car? Why? / Why not?
7. Would you like to drive such a car yourself?

XII. Our University will hold a students' conference tomorrow called "Small cars – a myth or reality?" Make a short report on mini cars.

XIII. Your brother started working in a prosperous engineering company last year and he has saved enough money for a small, cheap car. Discuss advantages and disadvantages of buying a small car and give your brother a piece of advice.

Reading Comprehension

I. Learn the following words and word-combinations to comprehend the text:

act	low
apply	outside
believe	point
charge n	petrol
contain	raise
consider	reach
convert	report v
efficiency	result (in)
employ	suppose
enough	throttle
expect	instead of
find (found, found)	inside

II. Read and translate the text.

Diesel Engine

Heat engines are machines in which the potential energy contained in fuel may be employed to do useful work. We know them to be divided into two main classes: 1) engines in which the working substance gets its heat outside the working cylinder (e. g. steam engines); 2) those in which combustion of fuel takes place inside the working cylinder (internal combustion engines).

In internal combustion engines the working substance is a mixture of air with petrol, oil or other fuel. The process of combustion takes place within the cylinder. We consider the cylinder to be the heart of the engine. The combustion of the fuel provides a pressure which acts on the engine piston. The piston is forced down the cylinder and by a number of mechanisms part of the heat energy contained in the fuel may be converted into work: two main types of internal combustion engines are found to be commonly used: 1) petrol; 2) diesel. The term "diesel" is applied to various types of engines which run without electric spark to cause ignition of the fuel. In 1890 the cycle was reported to have been invented in which air only was compressed and the fuel was injected after compression. These engines were of the low-pressure type requiring some other method

to ignite the fuel charge.

Dr. Diesel is known to have patented a cycle in which the fuel was ignited on its injection into the cylinder owing to the high temperature provided by the air compression. The type to which the term “diesel” is usually applied is the compression-ignition (CI) engine.

The cycle of a typical modern four-stroke diesel engine is as follows:

1. On the intake stroke only air is drawn into the cylinder.

2. On the compression stroke the air is compressed so that the temperature is raised greatly.

3. Towards the end of the compression stroke the fuel is injected into the combustion chamber. The temperature of the air in the combustion chamber is high enough to ignite the fuel as it is injected, and combustion of the mixture of fuel and air produces the power stroke.

4. The piston moving up on the exhaust stroke, the burnt gases leave the cylinder.

The compression of air instead of a mixture of fuel and air makes it possible to employ high pressures without any danger of detonation.

The usual compression ratios employed in petrol engines are not more than $10:1$, the compression ratios employed in diesels may be $16:1$ and result in compression pressures of up to 5000 kN/m^2. The temperature of the compressed air at the moment of fuel injection is usually about 750°C.

The injection of the fuel is supposed to take place over a period equivalent from 15° to 30° of rotation of the crankshaft. Injection usually takes place before the piston reaches top dead centre, but both the point of injection and its period are variable. The fuel is injected at pressures from 5500 to 20 000 kN/m^2. The combustion of the fuel and expansion of gases give an impulse to the piston which is more powerful than that produced in the petrol engine, the higher compression ratio giving higher efficiencies.

the working substance	*робоча речовина*
e. g. steam engines	*наприклад, парові двигуни*
on its injection	*при впорскуванні*
owing to	*внаслідок*
without any danger of detonation	*не викликаючи небезпеки вибуху*
10:1	*ten to one*
kN/m²	*kilonewton per square meter*
15°	*fifteen degrees*

III. Answer the following questions.

1. What are heat engines?
2. What is the working substance in the internal combustion engine?
3. What types of internal combustion engines are commonly used on farms?
4. To what types of engines is the term "diesel" applied?
5. When was the diesel cycle invented?
6. What are the four strokes of the diesel engine cycle?
7. What are the compression ratios employed in the diesel engines?
8. What gives an impulse to the piston?

IV. Retell the text.

UNIT SIX. TYPES OF FUEL. THE DIESEL ENGINE FUEL SYSTEM.

Language Practice

I. Discuss the following questions.

a) Are you good at Chemistry? How many elements are there in the Periodic Table?

b) What are the basic fuels that vehicles use? What are their elements?

II. Learn symbols in Chemistry.

Al	–	aluminium	алюміній
Ag	–	argentum	срібло
Ar	–	argon	аргон
As	–	arsenic	миш'як
Au	–	aurum	золото
B	–	boron	бор
Ba	–	barium	барій
Be	–	berillium	берилій
Bi	–	bismut	вісмут
Br	–	bromine	бром
C	–	carbon	вуглець
Ca	–	calcium	кальцій
Ce	–	cerium	церій
Cd	–	cadmium	кадмій
Cl	–	chlorine	хлор
Co	–	cobalt	кобальт
Cr	–	chromium	хром
Cs	–	caesium	цезій
Cu	–	copper	мідь
F	–	fluorine	фтор
Fe	–	ferrum	залізо
Ge	–	germanium	германій
H	–	hydrogen	водень
He	–	helium	гелій
Hg	–	mercury	ртуть
I	–	iodine	йод
Ir	–	iridium	ірідій
K	–	kalium	калій
Li	–	litium	літій
Mg	–	magnesium	магній
Mn	–	manganese	марганець
Mo	–	molybdenum	молібден
N	–	nitrogen	азот
Na	–	natrium	натрій
Ne	–	neon	неон
Ni	–	nickel	нікель
O	–	oxygen	кисень
P	–	phosphorus	фосфор
Pb	–	plumbum	свинець
Pt	–	platinum	платина
Ra	–	radium	радій
Rh	–	rubidium	рубідій
S	–	sulfur	сірка
Sb	–	antimoni	сурма
Se	–	selenium	селен
Si	–	silicon	кремній
Sn	–	stannum	олово
Sr	–	strontium	стронцій
Te	–	telurium	телур
Th	–	thorium	торій
Ti	–	titanium	титан
U	–	uranfun	уран
W	–	wolfram	вольфрам
Zn	–	zinc	цинк
Zr	–	zirconium	цирконій

III. Are you good at substances? Choose the right Ukrainian translation for the English word.

1) carbon	a) сірка
2) nickel	b) водень
3) cast iron	c) вуглець
4) rubber	d) залізо
5) copper	e) нікель
6) sulphur	f) каучук

7) iron	g) сталь
8) steel	h) чавун
9) zinc	i) мідь
10) hydrogen	j) цинк

IV. Scan the text and find all chemical constituents of different fuels.

There is a lot of **carbon** (about 85 %) in diesel fuel. There is also a lot of carbon in petrol. There is a little **hydrogen** in both these fuels. But there is little **sulphur** (about 1 %) in diesel fuel and there is no sulphur in petrol. There is a great deal of petrol (about 95 %) and a little **oil** (about 5 %) in the fuel mixture for two-stroke engines. There is no oil in the fuel for four-stroke engines. There is a great deal of air (90 %) and not much fuel (10 %) in the fuel and air mixture.

V. Say if these sentences are true or false. Correct the false ones.

1. There is a lot of carbon in diesel fuel.
2. Petrol has a low percentage of carbon.
3. There is too much sulphur in petrol.
4. There is a lot of hydrogen both in diesel fuel and in petrol.
5. There is no oil in the fuel for four-stroke engines.
6. There is more fuel than air in the fuel and air mixture.

VI. Answer your partner's questions about the chemical composition of various fuels. Choose the right expression of quantity.

EXAMPLE: – How much carbon is there in diesel fuel?

– There's a lot of carbon in diesel fuel.

a) carbon in diesel fuel	little
b) sulphur in diesel fuel	much
c) sulphur in petrol	plenty of
d) carbon in petrol	a little
e) hydrogen in diesel fuel	not much
f) hydrogen in petrol	any
g) petrol in the fuel mixture for two-stroke engines	a lot of
h) oil in the fuel mixture for two-stroke engines	some
i) copper in aluminium alloys	no

VII. You are an expert in fuels. Answer your partner's questions about various types of fuels and their composition. Use different expressions of quantity.

VIII. Study this table and discuss with your partner which type of fuel is suitable for these vehicles: racing cars, passenger cars, motorcycles, lorries, buses.

Fuel	***Composition***	***Price***
methanol	37.5% of carbon 12% of hydrogen 50% of oxygen	$1.14
diesel	85% of carbon 0.5% of sulphur 13.5% of hydrogen	$0.52
petrol	74% of carbon 25% of hydrogen	$0.65
gas	100% of natural gas	$0.74
liquid hydrogen	100% of hydrogen	$2.17

IX. Translate the text into Ukrainian.

As you know there are three types of an *internal combustion engine* which are very important for our industrial life. These are, of course, the petrol engine, the diesel engine and the gas turbine. They have a lot in common. They all use liquid fuel, produce mechanical work and also exhaust gases. However there are many differences in the principles of their construction and operation.

Let's consider the gas turbine now. It has five characteristics. They are:

– a high *power-weight ratio (потужність на одиницю маси),*

– a very small number of moving parts (in comparison with the petrol engine and the diesel engine),

– independent of major water supplies,

– rapid starting (30 seconds to the full power).

Reading Comprehension

I. Learn the following words and word-combinations to comprehend the text.

difference	vehicle
fuel	maintain
supply	arrange
ignite	trap
spark	expensive
air cleaner	precision
fuel pump	quantity
fuel filter	pressure

II. Read and translate the text.

The Diesel Engine Fuel System

1. The main difference between the petrol engine and the diesel engine is in the method in which the fuel is supplied to the cylinders and ignited.

2. We know the diesel engine to have no carburettor and no electrical equipment to provide a spark for the fuel ignition.

3. The diesel engine fuel system includes an air cleaner, a fuel pump, fuel filters, fuel injection pump and fuel injectors.

4. The air cleaner is the same type of air cleaner as fitted to petrol engines.

5. A fuel lift pump is fitted to the fuel line of the diesel fuel system. Such pumps are necessary on vehicles where the fuel tank is not placed high enough to maintain a good gravity flow. This is always the case with cars but not always with tractors because the fuel tank is placed high enough.

6. One or more fuel filters are sure to filter the fuel as it is pumped from the lift pump to the injection pump. These filters are of the same form as a metal container in which there is some filter element and they are arranged so that the fuel should pass through the element. The dirt being trapped on the surface of the element, it is necessary to replace these elements at recommended intervals. The interval varies according to the type of the element used (usually from 200 to 400 working-hours of the engine).

7. The fuel injection pump is a very important and expensive part

of the diesel engine. It is expensive because a lot of skilled work is necessary to make a precision instrument. It is important because it must deliver accurately to the engine very small quantities of fuel. In a muticylinder engine the quantities of fuel delivered to each cylinder must be equal and delivered at high pressure. Two types of fuel injection pumps are usually employed on tractors: a plunger type pump or a distributor type pump. In both cases engine speed is increased by the acceleration control which causes the pump mechanism to deliver an increasing quantity of fuel to the engine.

8. The fuel injector is another very accurately made part of the diesel fuel system and its purpose is to inject into the cylinder the small quantities of the fuel. The fuel is to be delivered in a very fine spray and this is achieved partly because it is forced through little holes in the end of the injector and partly because the pressure which forces it through these holes is very high.

9. From the tank the fuel passes through the top into a filter bowl then it is delivered by gravity down to the lift pump in which there is another filter. The lift pump pumps the fuel up and through the main fuel filter. From this point the fuel passes to the injection pump which meters it and pumps it through the injector into the cylinder in which compression of air has taken place.

10. It being necessary to increase the speed of the diesel engine, the operator has to open the throttle control which moves a mechanism within the injector pump and more fuel is expected to be delivered to each cylinder.

III. Match the antonyms.

outside, irregular, start, after, regular, high, top, reduce, low, slow, bottom, big, stationary, small, finish, moving, inside, draw into, before, increase, rapid, expel.

IV. Fill in the gaps with the words or word-combinations give bellow. Translate the sentences into Ukrainian.

1. … is expensive because a lot of skilled work is necessary to make a precision instrument.

2. In a … engine, the quantities of fuel delivered to each cylinder must be equal and delivered at high pressure.

3. The purpose of the fuel injector is to inject into the cylinder the small … of the fuel.

4. The fuel is delivered in a very fine … .

5. From this point the fuel passes to the injection pump which … it and pumps it through the injector into the cylinder in which compression of air has taken place.

(spray, meters, multicylinder, fuel injection pump, quantities).

V. Answer the questions.

1. What is the main difference between the petrol engine and the diesel engine in the method in which the fuel is supplied to the cylinders and ignited?
2. Does the diesel engine have a carburettor and an electrical equipment?
3. What does the diesel engine fuel system include?
4. What type of the air cleaner is used in the diesel engines?
5. Why is a fuel lift pump used?
6. Why are the fuel filters used?
7. What is the form of fuel filters?
8. Is the fuel injection pump a cheap part of the diesel engine?
9. How is the fuel delivered to another filter?
10. How does the lift pump pumps the fuel?
11. Is it possible to increase the speed of the diesel engine? How?

VI. Retell the text.

UNIT SEVEN. AUTOMOTIVE PROBLEMS. COOLING SYSTEMS.

Language Practice

I. Discuss the following questions.

a) Are you good at repairing cars?
b) What are the most common faults in a car?
c) Do you know how to repair them?

II. Find the English equivalents in B to the Ukrainian words in A.

A	*B*		
1) кількість	a) amount	b) quality	c) count
2) змінювати	a) to change	b) to block	c) to remove
3) вільний	a) difficult	b) easy	c) free
4) збільшувати	a) to reduce	b) to decrease	c) to increase
5) домішки	a) starter	b) particle	c) spark
6) ретельний	a) clockwise	b) thorough	c) backwards
7) ремонт	a) overhaul	b) research	c) maintenance

III. Match a line in A with a line in B.

A	B
1. My car doesn't start.	a) Not yet.
2. I think there is no petrol in the tank.	b) But I have just charged it!
3. What are you busy with?	c) No wonder, the pistons are damaged.
4. The engine is out of order.	d) I'm changing the air filter.
5. Have you checked the spark plugs?	e) What's wrong with it?
6. The battery must be flat.	f) On the contrary! It is full.

IV. Match the words with the similar meaning.

to damage	to get into
downwards	ordinary
to change	free
impurity	to break
common	to overhaul

unobstructed	to replace
to enter	dust and dirt
to repair	down

V. Complete the table with the missing words.

	Verb	***Noun***
заводити (двигун)		
		absorption
	to radiate	
		circulation
охолоджувати		
	to conduct	

VI. Make all possible sentences, matching the actions that take place at the same time.

EXAMPLE: *to repair the car / to follow the mechanic's instructions*

(When) repairing the car I followed the mechanic's instructions.

to park your car	to remember about the speed limit
to maintain the car in order	to start the engine
to press the accelerator	to save yourself a lot of trouble
to push a car forwards and backwards	to consider road signs
to introduce automated vehicles	to keep the distance
to drive a car	to take into account the safety of traffic

VII. If none of the switches are working something must be wrong with the electrical system in the car. Say in what order you will check its components. Work in a chain.

Begin like this: Having noticed a fault in the electrical system of my car I will turn the engine on. Having turned the engine on I will turn it off again. Having …etc.

Your actions: to switch on the lights;
to switch them off;
to press the horn button;
to push the indicator lever to the left;
to push the lever to the right;
to stop the indicator;
to switch on the engine again;
to press the brake pedal;
to release the pedal; to switch off the ignition;
to ask the mechanic for help.

VII. Fill in the gaps with the words given in the box.

clockwise	anticlockwise	to the right
to the left	in front of	upwards
downwards	forwards	backwards

1. To start the car the key should be turned … .
2. Take the first turn …, the second … and you will see the service station … you.
3. If the starter is jammed you should try to push the car … and … .
4. It is necessary to turn the bulb … in order to take it out of the socket.
5. The pistons in this car move … and … .

VIII. Look at the headline and try to guess what the text is going to be about.

IX. Scan the text to find the answers to the following questions.

1. Do modern cars need servicing regularly?
2. What are the three most common faults in the car?
3. What should you do if the battery appears to be dead?
4. What does a fuel warning light show?
5. Why is there no spark sometimes?
6. What is likely to happen to the petrol pump?
7. How can the fuel pipe become blocked?
8. How do you know that the starter motor is likely to be jammed?
9. Is the air filter an important part of the engine?

Finding a Fault in the Car

Servicing your car regularly you prevent it from becoming unreliable. Of course, you can't foresee everything. Having failed to start the car in the morning you had better check three things first: the battery, the fuel level and the spark plugs. It is quite easy to repair these **faults.**

If the battery appears to be **flat** it is necessary to recharge it. If this doesn't work, you should replace it.

An empty tank is another **common** fault in the car. Having noticed a fuel warning light on the instrument panel of your car you should **fill up** the tank with more petrol.

Dirty spark plugs are also certain to cause a problem. To drive the car it is important to clean them regularly and adjust the **gap** in the spark plugs to the proper width. If the gap is not correct the engine will not run well.

If your car still does not start, the petrol pump may be broken, or the fuel pipe may be blocked. Having discovered a broken pump, it is a good idea to repair or replace it. If the fuel pipe is blocked, take it off and unblock it.

Having heard a loud click! When you turn the key, you are sure to realize that the **starter** motor may be **jammed. If** it **is,** you can try to **release** it **pushing** the car **forwards** and **backwards** (in the 2nd gear). If the car still doesn't start, the starter motor should be repaired or even replaced.

And don't forget about the air filter. Its function is to remove particles of dirt, dust and other **impurities** from the air passing to the carburettor. A blocked filter decreases the airflow to the carburettor thus increasing the amount of fuel in the mixture. This causes the engine to operate inefficiently. Cleaning and changing filters regularly you prevent a considerable damage that is certain to be caused inside the cylinders. In this case the engine will need a **thorough overhaul.**

If you are a poor mechanic, stopping at **service stations** periodically you will save at least time and money. As they say, prevention is better than cure.

X. Fill in the table with the data from the text.

A component of the car	The fault	What to do
1. the battery	flat	…
2. …	…	…
…	…	…

XI. You are studying to get a driving license. The topic of the lesson today is "Maintenance of a Car". Your friend is your instructor. Ask him about the most common faults in the car and the ways to repair them.

You can start like this: – What shall I do if the car doesn't start?
– Well, you should …

XII. Complete the instructions with the words: gauge, gap, spanner, socket, spark plug, cover.

How to Check a Spark Plug

First you should remove the cover. Having achieved this, place the … over the spark plug. Then it is necessary to rotate the … anti-clockwise until it seems to be loose. Having removed the plug from the …, examine the gap and check it to be clean. After that, insert a … in the gap. Check that the … is between 0.65 and 1.00 mm wide. Having replaced the plug in the socket you should rotate it clockwise until it is hand-tight. Next, it is necessary to place the spanner over the plug and give only a quarter turn clockwise. Caution should be taken not to overtighten the plug. Finally, replace the ….

Reading Comprehension

I. Learn the following words and word-combinations to comprehend the text.

piston	exhaust pipe
dissipate	emit
wear out	cover
efficient	fin
fan	unobstructed
equip	consequently
hose	significantly

II. Read and translate the text.

Cooling Systems

When you drive a car, the engine becomes very hot. Why?

Burning in the engine the **fuel-air mixture** produces energy. But only *a quarter of* this energy makes the pistons move. *Most of* it turns into heat. *About half of* this heat goes down the **exhaust pipe** and *the other half* stays in the engine making it very hot. In fact, the cooling system on a car driving down the freeway dissipates enough heat to heat two average-sized houses! The primary job of the cooling system is to cool the engine and to keep it from **overheating**. However, the cooling system also has several other important jobs. The engine in your car runs best at a fairly high temperature. When the engine is cold, components wear out faster, and the engine is less efficient and emits more pollution. So, another important job of the cooling system is to allow the engine to heat up as quickly as possible, and then to keep the engine at a constant temperature. There are two types of cooling systems found on cars: air-cooled and liquid-cooled.

Air Cooling. Some older cars, very few modern cars and most motorcycle have air-cooled engines. Constructing the engine block covered in numerous **external** aluminum fins engineers greatly increase its surface area, which can be cooled by the flow of air passing over it. A powerful fan is used to supply an increased amount of air for cooling multi-cylinder engines. The forced airflow conducts heat away from the cylinders radiating it into the air more efficiently.

However, it is difficult to design large engines with an **unobstructed** airflow over all the cylinders. The alternative is a liquid (water)-cooling system.

Liquid Cooling. Most cars are equipped with liquid-cooling systems. Flowing around the *engine* the **fluid** absorbs its heat, which consequently allows the engine to get cooled. Then, having entered through the *top hose* the hot fluid passes through the heat exchanger or *radiator*. The radiator transfers the heat from the fluid to the air **pulled** through the exchanger by a *fan.* Leaving the radiator through the *bottom* hose the cooled fluid is **pumped** around the engine again.

Cars operate in a wide variety of temperatures. So whatever fluid

is used to cool the engine it has to have a very low freezing **point,** a high boiling **point,** and it has to have the capacity to hold a lot of heat. Water holds heat quite effectively, but it freezes at too high a temperature to be used in car engines. The **coolant** used in most cars is a mixture of water and ethylene glycol ($C_2H_5O_2$), also known as antifreeze. Adding ethylene glycol to water, the boiling and freezing points are improved significantly.

III. Answers the questions.

1. Why does the engine become very hot?
2. How much energy pushes the pistons?
3. What are the two functions of the cooling system?
4. How are motorcycles usually cooled?
5. What increases the efficiency of air-cooling?
6. Why is liquid-cooling preferred to air-cooling in large engines?
7. Where is hot fluid cooled in the car engine?
8. What liquids are used in the cooling system?
9. What requirements must the coolant meet?

IV. When burning the fuel-air mixture produces a lot of energy. Where does 25 % / 75 % / 37.5 % / 38.5 % of the initial amount of this energy go?

V. Name the objects in the picture in the text.

VI. Point out the functions of the following objects.

EXAMPLE: The function of the engine is to move the vehicle.

a fuel-air mixture, the cooling system, the coolant, a top hose, a fan, a pump

VII. You are taking a test for a driving license tomorrow. Today you have a consultation. Your friend is your instructor.

Student: Prepare a list of questions concerning cooling systems and ask the instructor for explanations.

Instructor: Look at the picture again and explain the operation of the cooling system to your student.

VIII. Speak about the types of cooling systems.

Mathematics Related to Automotive Industry

The square of the hypotenuse of a right triangle is equal to the sum of the squares of the other two sides.

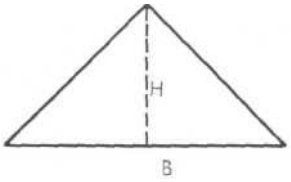
$$C^2 = A^2 + B^2.$$

The square of one side of a right triangle equals the squares of the hypotenuse minus the square of the other side.

$$A^2 = C^2 - B^2$$

The area of a triangle is equal to one-half the product of the base and height.

$$A = \frac{1}{2} \cdot (B \times H) \qquad \text{or} \qquad \frac{B \times H}{2}.$$



$$\pi = 3{,}1416 \qquad \text{or} \qquad \frac{22}{7}.$$

The circumference of a circle is equal to π multiplied by the diameter.

$$C = \pi \times D.$$

The area of a circle is equal to π multiplied by the radius squared.

$$A = \pi \times R^2.$$

The area of a circle is equal to the circumference multiplied by one-half the radius.

$$A = C \times \frac{1}{2} R \qquad \text{or} \qquad \frac{C \times R}{2}.$$

To find the area of a square or rectangle, multiply the length of one side by the length of an adjacent side.

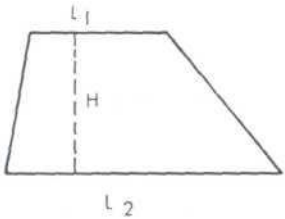
$$A = S_1 \times S_2.$$

To find the perimeter of a polygon, add the length of all sides.

$$P = S_1 + S_2 + S_3 + S_4 + S_5 + \ldots + S_n.$$

To find the area of a trapezoid, multiply its height by one-half the sum of the parallel sides.

$$A = \frac{1}{2} \cdot (L_1 + L_2) \times H \quad \text{or} \quad A = \frac{(L_1 + L_2) \times H}{2}.$$



To find the volume of a square or rectangular solid, multiply the length by the height by the width.

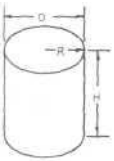
$$V = L \times H \times W.$$

To find the volume of a sphere, multiply the diameter cubed by π by one-sixth.

$$V = \frac{1}{6} \times \pi \times D^3 \text{ or } \quad V = \frac{\pi \times D^3}{6}.$$

To find the volume of a cylinder, multiply the area of its base by its height.

$$V = \pi R^2 \times H$$



To find the volume of a pyramid, multiply the height by one-third its base area.

$$V = \frac{1}{3} H \times W \times D.$$

To find the volume of a cone, multiply one-third of the product of its base area by the height.

$$V = \frac{1}{3} \pi R^2 \times H.$$

The diagonal of a square is equal to the square root of twice the area.

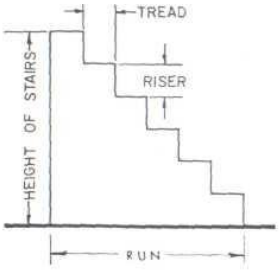
$$D = \sqrt{2A}.$$

To find the tread width, divide the run of the stairs by the number of treads. This is always one less tread than riser.

$$\text{Tread width} = \frac{\text{Run of stairs}}{\text{Number of treads}}.$$

To find the height of a riser, divide the height of the stairs by the number of risers.

$$\text{Riser height} = \frac{\text{Height of stairs}}{\text{Number or stairs}}.$$



To find the number of risers, divide the height of the stairs by the height of each riser.

$$\text{Riser number} = \frac{\text{Height of stairs}}{\text{Height of risers}}.$$

To find the number of board feet in a piece of lumber, multiply the length in feet by the width in inches by the thickness in inches, divided by 12.

$$BF = \frac{L \times W \times T}{12}.$$

To find the electrical resistance in a circuit, divide the voltage (E) by the amperage (I).

$$R = \frac{E}{I}.$$

To find the electric current in amperes (I) in a circuit, divide the voltage (E) by the resistance in ohms (R).

$$I = \frac{E}{R}.$$

To find the voltage in an electric circuit, multiply the current in amperes (I) by the resistance in ohms (R).

$$E = I \times R.$$

Wording Mathematical Formulae

$$\frac{a+b}{a-b} = \frac{c+d}{c-d},$$

a plus b over a minus b is equal to c plus d over c minus d.

$$a^3 = \log_c d,$$

a cubed is equal to the logarithm of d to the base c.

$$\varphi(z) = b\left[\left(+\frac{z}{c_m}\right)^{m/(m-1)} - 1\right],$$

a) φ of z is equal to b, square brackets, parenthesis, z divided by c sub m plus 2, close parenthesis, to the power m over m minus 1, minus 1, close square brackets;

b) φ of z is equal to b multiplied by the whole quantity: the quantity two plus z over c sub m, to the power m over m minus 1, minus 1.

$$\left|\varphi_j(t_1) - \varphi_j(t_2)\right| \le \left|M\left(t_1 - \frac{\beta}{t}\right) - M\left(t_2 - \frac{\beta}{t}\right)\right|,$$

the absolute value of the quantity φ sub j of t one, minus φ sub j of t two, is less than or equal to the absolute value of the quantity M of t_1 minus β over j, minus M of t_2 minus β over j.

$$k = \max_j \sum_{i=}^{n} \left|a_{ji}(t)\right| \quad (t \in [a, b]; \quad j = 1, 2, \ldots, n),$$

k is equal to the maximum over j of the sum from i equals one to i equals n of the modulus of a_{ji} of t, where t lies in the closed interval ab and where j runs from one to n.

$$\lim_{n\to\infty}\int_{\tau}^{t}\{f[s,\varphi_n(s)]+\Delta_n(s)\}ds=\int_{\tau}^{t}f[s,\varphi(s)]ds,$$

the limit as n becomes infinite of the integral of f of s and φ_n of s plus delta n of s, with respect to s, from τ to t, is equal to the integral of f of s and φ of s with respect to s, from τ to t.

$$\Psi_{n-r_s+1}(t)=e^{t\lambda_{q+s}}p_{n-r_s+1}$$

Ψ sub n minus r sub s plus 1 of t is equal to p sub n minus r sub s plus 1, times e to the power t times λ sub q plus s.

$$L_n^+g=(-1)^n\left(\overline{a_0}g\right)^{(n)}+(-1)^{n-1}\left(\overline{a_1}g\right)^{(n-1)}+\ldots+\overline{a_n}g,$$

L sub n adjoint of g is equal to minus 1 to the n, times the nth derivative of a sub zero conjugate times g, plus, minus one to the n minus 1, times the n minus first derivative of a sub one conjugate times g, plus … plus a sub n conjugate times g.

$$\frac{\partial F[\lambda_i(t),t]}{\partial\lambda}\lambda_i'(t)+\frac{\partial F[\lambda_i(t),t]}{\partial t}=0,$$

the partial derivative of F of lambda sub i of t and t, with respect to lambda, multiplied by lambda sub i prime of t, plus the partial derivative of F with arguments lambda sub i of t and t, with respect to t, is equal to 0.

$$\frac{d^2y}{ds^2}+[1+b(s)]y=0,$$

the second derivative of y with respect to s, plus y, times the quantity 1 plus b of s, is equal to zero.

$$f(z)=\hat{\varphi}_{mk}+O\left(|z|^{-1}\right)\ \left(|z|\to\infty;\quad \arg z=\gamma\right),$$

f of z is equal to φ sub mk hut, plus big O of one over the absolute value of z, as absolute z becomes infinite, with the argument of z equal to gamma.

$$D_{n-1}'(x)=\prod_{s=0}^{n}\left(1-x_s^2\right)^{\varepsilon-1},$$

D sub n minus 1 prime of x is equal to the product from s equal to zero to n of, parenthesis, 1 minus x sub s squared, close parenthesis, to the power … epsilon minus 1.

$$K(t, x) = \frac{1}{2\pi i} \int\limits_{\left|\omega - \frac{1}{2}\right| = \rho} \frac{K(t, z)}{\omega - \omega(x)} d\omega,$$

K of t and x is equal to one over two πi, times the integral of K of t and z, over ω minus ω of x, with respect to ω along curve of the modulus of ω minus one half, is equal to rho.

$$\frac{d^2 u}{dt^2} + a^4 \Delta \Delta u = 0 \quad (a > 0),$$

the second partial (derivative) of u with respect to t, plus a to the fourth power, times the Laplacian of the Laplacian of u, is equal to zero, where a is positive.

$$D_k(x) = \frac{1}{2\pi i} \int\limits_{c-i\infty}^{c+i\infty} \xi^k(\omega) \frac{x^\omega}{\omega} d\omega \quad (c > 1),$$

D sub k of x is equal to one over two πi, times integral from c minus i infinity to c plus πi infinity of dzeta to the k of ω, x to the ω divided by ω, with respect to ω, where c is greater than 1.

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