UNIT 5
SYSTEMS OF THE ENGINE

STEP 1. Text A: The Fuel System
Grammar Revision: **The Present Continuous Tense**
Text B: The Fuel Pump

STEP 2. Text A: The Ignition System
Grammar Revision: **The Past Continuous Tense**
Text B: Spark Plugs

STEP 3. Text A: The Lubrication System
Grammar Revision: **The Future Continuous Tense**
Text B: The Cooling System

Revision

STEP 1

TEXT A. THE FUEL SYSTEM

PRE-TEXT EXERCISES

I. Translate international words:
automobile, construction, form, component, system, gasoline, cylinder, proportion, acceleration, carburettor, diesel, gasoline, filter, gas, atmosphere.

II. Give the meanings of the following words:
form, to meet, to operate, to run, a tank, fine.

III. Read and memorize:
1. **join** – зв'язувати, з'єднувати
2. **liquid** – рідина
3. **lean** – збіднений
4. **coarse** – грубий
5. **boost** – підкачувати
6. **bypass** – перепускний
7. **depression** – розрідження
8. **jet** – жиклер
9. **headpipes** – приймальні труби глушника
10. **cap** – ковпачок, голівка

IV. Read and remember the following word combinations:
a fine (secondary) filter – фільтр тонкого очищення, *a primary (coarse) filter* – фільтр грубого очищення, *an air cleaner* – очищувач повітря, *a fuel tank* – паливний бак, *a fuel boost pump* – паливно-підкачувальна помпа, *a bypass valve* – перепускний клапан, *a sediment bowl* – помпа відстійник, *an inlet manifold* – впускний трубопровід, *a fuel filler cap* – кришка заливної горловини, *a fuel level sensor* – покажчик рівня палива.

V. Read and translate the text:

THE FUEL SYSTEM

An automobile is a complex construction composed of many small parts. Smaller parts are joined to form larger units or components. One of the main components of the automobile is an engine. One of the basic systems to feed an engine is the fuel system **(Fig. 21)**.

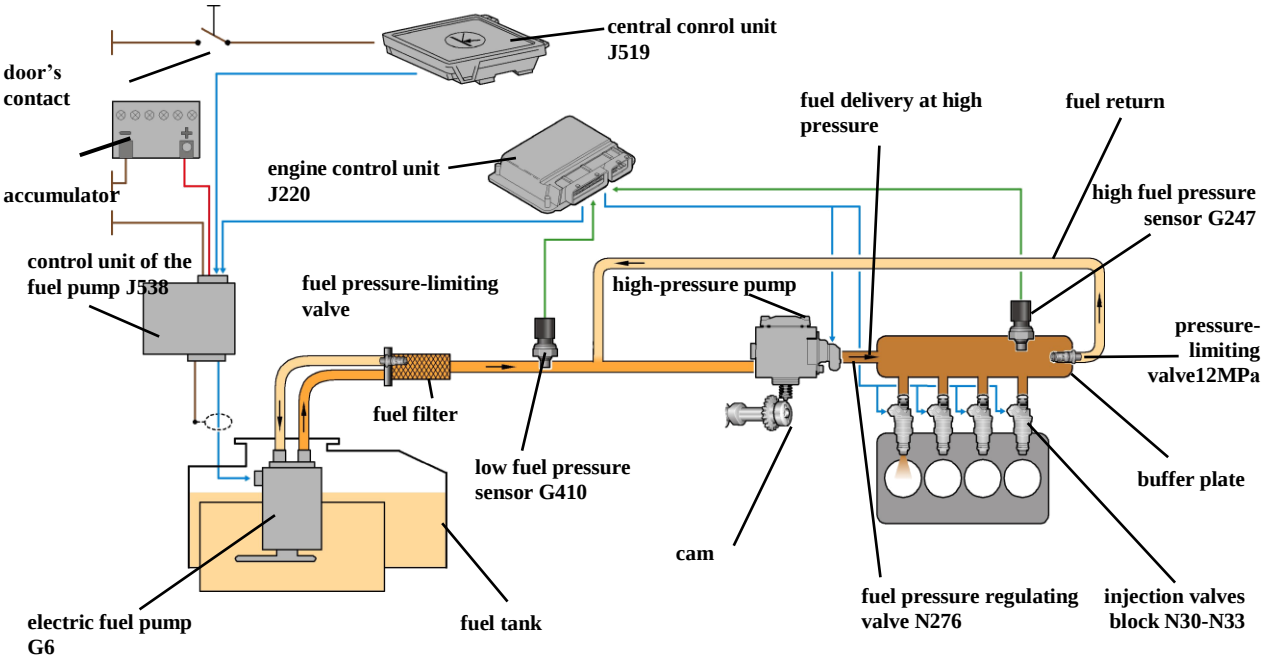


Fig. 21. Skoda Oktavia's fuel system

The fuel system is designed to store liquid gasoline and to deliver it to the engine cylinders on the intake strokes in the form of vapour mixed with air. The fuel system must vary the proportions of air and gasoline vapour to meet the requirements of the various operating conditions. Thus for initial starting with a cold engine a very rich mixture of about 9 pounds of air to 1 pound of gasoline is needed. After the engine has warmed up, it will run satisfactorily on a leaner mixture of about 15 pounds of air for each pound of gasoline. For acceleration and full-load or high speed operation, the mixture must again be enriched.

Diesel engines. The purpose of the fuel system is to deliver air and fuel to engine cylinders. The fuel is supplied under high pressure at definite time and in proper proportions depending on the engine load. Main components of the fuel system of a four-stroke diesel engine are: a fine (secondary) filter, fuel lines, an air cleaner, a fuel injection pump, a nozzle, a primary (coarse) filter, a fuel tank, a fuel boost pump, a bypass valve.

Gasoline engines. The fuel system is designed for preparing a combustible fuel-air mixture in definite proportions, its delivering to engine cylinders and letting exhaust gases out.

While the engine is running fuel after its pre-cleaning in a sediment bowl is delivered to a carburettor **(Fig. 22)** from a tank by a fuel pump. During the inlet stroke the depression created in the engine cylinder is transmitted to a carburettor and air filter installed on it. Cleaned air flows to a mixing chamber; fuel is delivered from jets. Vapourized fuel is mixed with air forming a combustible mixture supplied to engine cylinders from a carburettor through an inlet manifold. Gases formed after quick combustion of air-fuel mixture in a cylinder expand and force the piston downwards making a power stroke. After a power stroke is completed burnt gases are expelled by a piston through an open exhaust valve to an exhaust manifold. They flow to headpipes, an exhaust pipe and afterwards to the atmosphere. The fuel is delivered to a tank through a filler closed by a fuel filler cap. Quantity of fuel in the tank is registered by a fuel level sensor.

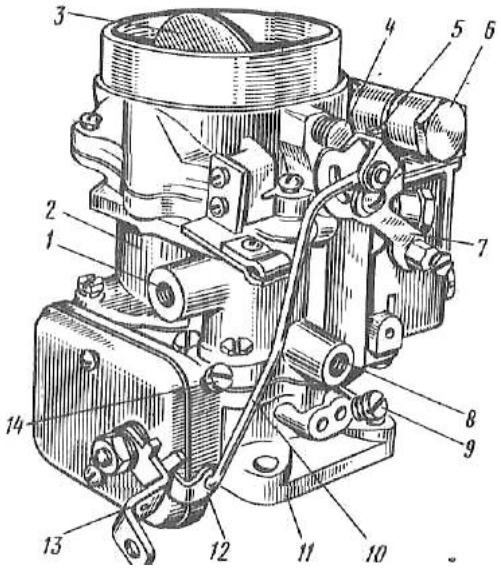


Fig. 22. Carburettor

1 – outlet	8 – outlet
2 – body	9 – regulating screw
3 – carburettor choke	10 – accelerator rod
4 – carburettor choke axle	11 – mixing chambers housing
5 – slow running jet	12 – low rotation speed lever
6 – filter cap	13 – main mixing chamber throttle arm
7 – air choke actuator arm	14 – idling adjustment screw

TEXT-BASED ASSIGNMENTS

LEXICAL EXERCISES

I. Give contextual synonyms:
to consist of, components, a vehicle, to keep, inlet, to change, the aim, to supply, to operate.

II. Choose antonyms:

A	B
1. intake	a) solid
2. liquid	b) down
3. rich	c) to open
4. up	d) outlet
5. inlet	e) bottom
6. to close	f) lean
7. top	g) exhaust

III. Give a word with a general meaning:
– fuel, oil, gasoline, petrol
– a tank, a pump, a component

IV. Give English equivalents:
паливо, збагачувати, розігрівати, постачати, впускний, вихідний, встановити, змішувати, передавати, працювати.

V. Match the columns:

1. задовільно працювати	a) to store liquid gasoline
2. помпа високого тиску	b) an open exhaust valve
3. паливопроводи	c) to meet requirements
4. попереднє очищування	d) various operating conditions
5. змішувальна камера	e) to run satisfactorily
6. відповідати вимогам	f) pre-cleaning
7. помпа-відстійник	g) a mixing chamber
8. відкритий випускний клапан	h) diesel fuel injection pump
9. зберігати рідкий бензин	i) a sediment bowl
10. різноманітні умови роботи	j) fuel lines

VI. Translate the following word combinations with the key word
– "fuel": fuel system, to deliver air and fuel to engine cylinders, the purpose of the fuel system, main components of the fuel system, fuel lines, fuel injection pump, a fuel tank, a fuel boost pump, a combustible fuel-air mixture, vapourized fuel, quantity of fuel in the tank, a fuel level sensor.

VII. Translate the words and word combinations to describe Skoda Oktavia's fuel system (Fig. 21).

VIII. Translate the words and word combinations to describe the main parts of the carburettor (Fig. 22).

IX. Choose the correct continuation of the sentence:

1. Camshaft is …….. a) the length of the up-and-down motion of the piston
2. Evaporation is … b) supports the engine and the body
3. Valve is ……. c) a change of state during which liquid turns to vapour or gas
4. Stroke means … d) a device that can be opened or closed to allow to stop the flow of liquid, gas or vapour from one to another place
5. Frame……. e) the shaft running through the engine which has the cams placed upon it at certain fixed positions and used for operating engine valves

X. Find in the text the word combinations to describe:
a) the fuel system of a diesel engine
b) the fuel system of a gasoline engine

XI. Complete the following table:

Item		**Its Function**	
English	Ukrainian	English	Ukrainian
The fuel system			

XII. Answer the questions:

1. What is one of the basic systems to feed an engine?
2. How is the fuel system designed?
3. What is the fuel system designed for?
4. What are the main components of the fuel system of a four-stroke diesel engine?

5. What are the main components of the fuel system of a gasoline engine?

XIII. Correct the statements if necessary using the following phrases: *You are wrong, I disagree with you, Your statement is not correct, I do not share your point of view:*

1. Any vehicle has a fuel system. 2. The fuel system is designed to ignite fuel. 3. For initial starting a leaner mixture is needed. 4. A fuel pump and a fuel tank are main parts of the fuel system. 5. The fuel tank is located at the front of the vehicle.

XIV. Group the following word combinations making a scheme of fuel delivery in

a) a diesel engine: ***1 → 2 → 3 → 4 → 5 → 6 → 7 → 8 → 9***

a fuel intake, a high-pressure pump, a fuel line, a fuel tank, main combustion chamber of the cylinder, a fuel injector, a micronic filter, a preliminary filter, a fuel booster pump;

b) a gasoline engine: ***1 → 2 → 3 → 4 → 5 → 6***

injection, a fuel tank, the main combustion chamber of the cylinder, a fuel intake, a fuel booster pump, a fuel line.

XV. Translate the following sentences into English:

1. Паливна система передбачена для зберігання палива та його постачання до циліндрів двигунів. 2. Співвідношення пароутворення повітря та бензину повинно варіюватися, щоб відповідати робочим потребам в любих умовах. 3. Для початкового пуску двигуна потрібно дуже збагачена суміш, що складається з 9 футів повітря та 1 футу бензину. 4. Головними складовими паливної системи становлять бак, трубопровід постачання палива, насос та карбюратор. 5. Паливний бак зазвичай розташовується у задній частині автомобіля на рамі. 6. Трубопровід постачання палива – це трубопровід, за допомогою якого паливо потрапляє з бака до двигуна.

GRAMMAR EXERCISES
(Grammar Revision: The Present Continuous Tense)

XVI. Copy out sentences in the Present Continuous Tense:

1. The fuel system must vary the proportions of air and gasoline. 2. The fuel system is storing liquid gasoline. 3. After the engine has warmed up, it will run satisfactorily on a leaner mixture. 4. The rocker arm is resting against a cam on the camshaft. 5. The fuel pump consists of a rocker arm, a flexible diaphragm and two valves.

XVII. Make the following sentences negative:

1. The fuel system is delivering gasoline to the engine cylinders. 2. The fuel system is storing liquid gasoline. 3. Carburettors are mixing gasoline with air under various operating conditions. 4. The fuel tank is containing a number of baffles or metal plates. 5. Having joints with the housing these parts are sliding.

XVIII. Put questions to the italicized words:

1. Leakage of gasoline is involving *hazards.* 2. *The rocking motion* is causing the diaphragm to fluctuate up and down. 3. Electro-magnetic fuel pumps are keeping the fuel *in the line to the carburettor* under pressure. 4. The car *is rounding* a corner. 5. These diaphragms are *alternately* creating pressure and vacuum in the pump chamber.

XIX. Replace the infinitive in brackets by the verb in the Present Continuous Tense.

1. On the return stroke the diaphragm (to create) pressure in the pump chamber. 2. Metal plates (to have) openings through which the gasoline can pass. 3. Metal plates (to prevent) sudden surging of

the gasoline. 4. The diaphragm (to fluctuate) up and down. 5. The gasoline (to pass) through openings in the metal plates.

XX. Put sentences in the Present Continuous Tense:

1. Leakage of gasoline always involves hazards. 2. The plunger contained two double poppet valves. 3. Pumps pull the gasoline through the fuel line. 4. A carburettor mixes the gasoline with air. 5. Engines will run satisfactorily on a leaner mixture.

CONVERSATIONAL PRACTICE

XXI. Read and dramatize the following dialogue:

Student: Good morning.
Automotive engineer: Good morning.
Student: Let me introduce myself. My name's Oleksandr Volkov.
Automotive engineer: Glad to meet you. How can I help you?
Student: You, my future specialty will be connected with automobiles. I would like you to ask you…
Automotive engineer: About what?
Student: About the fuel system.
Automotive engineer: Why the fuel system.
Student: Oh, I've missed some lectures and now I can't catch what it is designed for.
Automotive engineer: Well, the fuel system is designed to store liquid gasoline and to deliver it to the engine cylinders in the form of vapour mixed with air. But I'd like to mention that the fuel system must vary the proportions of air and gasoline vapour to meet the requirements of the various operating conditions.
Student: I've heard about it. And can you describe me the main components of the fuel system of a four-stroke diesel engine?
Automotive engineer: Of course, I can. A fine (secondary) filter? Fuel lines, air cleaner, fuel injection pump, a nozzle, a primary (coarse) filter, a bypass valve.
Student: Oh, thank you for your help.
Automotive engineer: It was nice to meet you. Good bye.
Student: Good bye.

XXII. Motivate the following statements:

Statement from the text	Arguments
1. The fuel system must vary the proportions of air and gasoline.	
2. For initial starting with a cold engine a rich mixture is needed.	

XXIII. Discuss the text in pairs. Follow the plan:

1. The purpose of the fuel system.
2. Proportions of air and gasoline vapour to be used.

XXIV. Compare the fuel systems of a diesel engine and a gasoline engine.

WRITTEN PRACTICE

XXV. Write down a summary of the text using the following expressions:

Data are given about …
It is known that …
… is dealt with …
… is formulated …
Attention is drawn to …
… is described in short …
It is known …
Attempts are made to analyze …

TEXT B. THE FUEL PUMP

Fuel to the carburettor is usually fed by a diaphragm pump. The pump is combined with a fuel strainer and sediment bowl. As the fuel has to pass through the strainer in the upward direction, any dirt separated out tends to settle to the bottom of the bowl, which is quickly detachable for cleaning.

Except the mechanical type of pump there are electro-magnetic fuel pumps. These can be located at the main fuel tank and then keep the fuel in the line to the carburettor under pressure, which makes it practically impossible for vapour lock to occur in the fuel line. Parts with sliding or rotary parts having joints with the housing that must be packed are unsuitable for gasoline, as it is impossible to keep the packing permanently tight, and leakage of gasoline always involves hazards.

The electro-magnetic fuel pump is double-acting and its plunger, which is hollow and has ports in its side walls which register with suction and delivery ports in the pump body, contains two double poppet valves. The plunger is attached to the core of a solenoid. A pair of electric contacts that are actuated by the same solenoid as the plunger are located in a pressed-steel housing below the pump proper. The pumping action is continuous, but when the carburettor bowl is filled to the proper level, the float holds the float valve shut and the gasoline moved is then circulated within the pump through a by-pass valve provided for the purpose. There is a spring only on the suction valves, and that is needed only to prime the pump, not in regular operation.

EXERCISES

I. Divide the text into logical parts and entitle them.

II. Look through the text again and find key words and word-combinations of every passage.

III. Consult the dictionary and give the meanings of the following words:

a tank, a line, housing, a body, an operation.

IV. Define the word building models of the following words:

1) electro-magnetic, double-acting, by-pass, pressed-steel
2) impossible, unsuitable
3) direction, pressure, delivery
4) practically, permanently

V. Ask 5-6 questions of your own on the text and ask your group mates to answer them.

VI. Speak about

– the necessity of a fuel pump
– types of pumps

VII. Read the text, entitle it and answer the following question: *"Why must a pump be replaced periodically?"*

Pump design considerations aim to ensure reliable operation and maximize the length of the intervals between services. Seal design remains a vital ingredient in maintaining pump integrity. No matter how sophisticated design may be, a seal is still considered to be a wear item and must be replaced periodically. Seals on pistons usually rely on the pumped fluid to provide natural lubrication and cooling. Inevitably a small amount of fluid will pass across the seal from the high pressure side to the lower pressure side.

VIII. Read the text and render it in Ukrainian:

Pump Selection Software From Iwaki America

Iwaki America Inc has introduced Iwaki Pump Selector, software which the company claims can streamline the pump selection process. It provides users with the opportunity to evaluate selections for optimization of system efficiencies. The options for multiple speed curves, dynamic adjustment of impeller diameters and operating speeds allow the review of pump selections under changing load conditions. The software allows users to control the operating speed and impeller diameter and see the changes in pump performance in real time.

STEP 2

TEXT A. THE IGNITION SYSTEM

PRE-TEXT EXERCISES

I. Translate international words:
system, diesel, type, limit, energy, electric, battery, period, principal.

II. Give the meanings of the following words:
point, composition, light, close, accurately.

III. Read and memorize:

1. **provide** – забезпечити
2. **magneto** – магнето
3. **current** – 1. струм (електричний) 2. течія, потік, струмінь
4. **by means of** – за допомогою
5. **occasionally** – іноді
6. **remain** – залишатися
7. **shut off** – 1. відключати (струм, воду) 2. закривати (кран) 3. перекрити шлях (тощо)
8. **prefer** – надавати перевагу
9. **remote** – далекий; віддалений; що, діє на відстані; дистанційний
10. **conventional** – 1. загальноприйнятий, звичайний, традиційний 2. серійний

IV. Read and translate the text:

THE IGNITION SYSTEM

In automotive engines, other than those of the diesel type, the combustible mixture is ignited by an electric spark produced between the points of a spark plug. Provided the composition of the charge is well within the limits of ignitability, the amount of spark energy required to effect ignition is very small, but for the best engine performance it is essential that the spark be accurately timed.

There are two general systems of electric ignition: battery ignition **(Fig. 23)** and magneto ignition. Battery ignition being used in practically all cases where a storage battery is required for other purposes, as for starting the engine, for lighting etc.

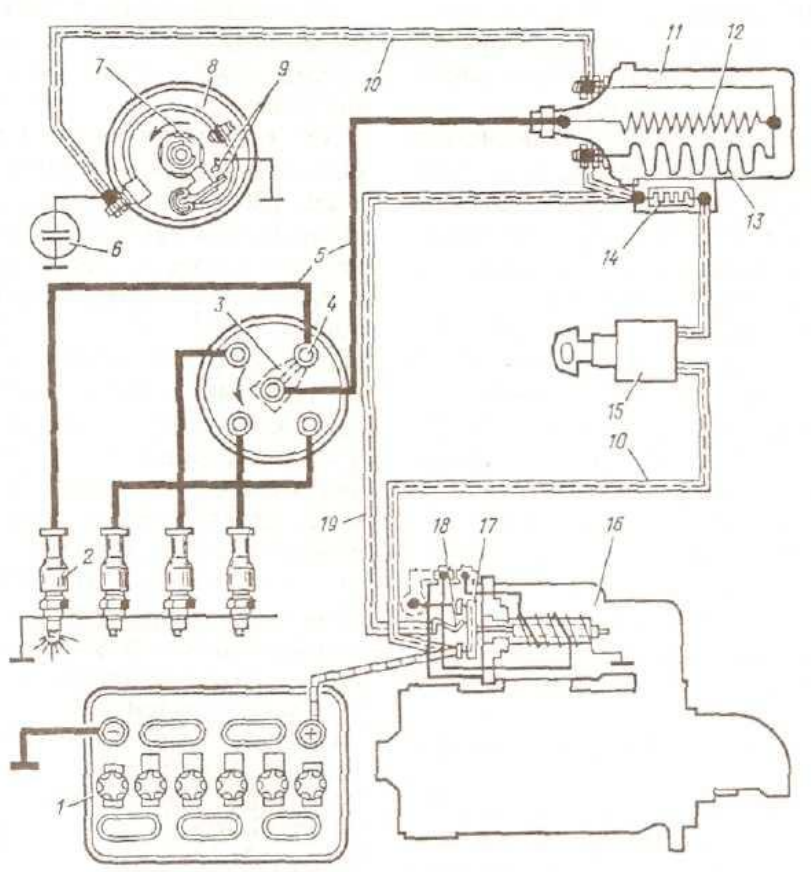


Fig.23. Battery Ignition

1 – battery	11 – ignition coil
2 – spark plug	10 – low voltage cable
3 – current distribution rotor plate	12, 13 secondary and primary windings
4 – ignition distributor side terminal	14 – additional resistance
5 – coil wire	15 – battery disconnect switch
6 – condenser	16 – starting relay
7 – breaker distributor cam	17 – contact plate
8 – timer-distributor	18 – spring contact
9 – interrupter contact points	19 – low voltage resistor cable

In such cases there is a convenient source of ignition current at hand, and there is then little reason why current for ignition should be generated separately by means of a magneto.

Of course the storage battery occasionally loses its charge as when it is allowed to remain idle for a long period, or if the operator, upon reaching his destination accidentally stalls his engine and forgets to shut off the ignition current.

This is not a serious matter in districts where charging equipment is always close at hand, but it may cause great trouble in out-of-the-way districts, which is the principal reason why magneto ignition

is generally preferred in remote districts. The magneto is the conventional source of ignition for farm engines.

TEXT-BASED ASSIGNMENTS

LEXICAL EXERCISES

I. Find Ukrainian equivalents:

A	B
1. an engine	a) іскра
2. combustible	b) струм
3. to ignite	c) зберігання
4. a spark	d) точно
5. a plug	e) горюча речовина
6. current	f) запальна свічка
7. storage	g) заряджувати
8. to charge	h) обладнання, устаткування
9. accurately	i) запалювати
10. equipment	j) двигун

II. Say which of the following words are terms:
an engine, diesel, a table, a spark, a plug, mixture, freedom, problem, combustible, current, ignition, a magneto, to pass, to charge, to prefer, to require.

III. Translate the following word-combinations with the key words:
– **"to ignite", "ignition":** to be ignited by an electric spark, to effect ignition, two general systems of electric ignition, battery and magneto ignition, a convenient source of ignition current, current for ignition, to shut off the ignition current.

IV. Find in the text the English equivalents for the following Ukrainian word combinations: горюча суміш; система запалювання; іскровий розряд; запальна свічка; склад заряду; найкраща робота двигуна; за допомогою магнето; відключити струм; місця, що знаходяться далеко.

V. Explain the meaning of the following correlated terms and use them in sentences of your own:
a) to do – to make – to produce – to manufacture
b) amount – quantity
c) to require – need

VI. Translate the words and word combinations to describe the main components of the battery ignition (Fig. 23).

VII. Complete the following sentences:

1. The purpose of lubrication is … . 2. Friction is a force that … . 3. A great amount of friction is necessary in … . 4. The principal parts of the engine needing lubrication are … . 5. For the engine lubrication ... . 6. The oil may be placed in … . 7. A pump may be used … . 8. In automotive engines the combustible mixture is ignited by … . 9. There are two general systems of electric ignition … . 10. Battery ignition is used in … . 11. The storage battery occasionally … . 12. The magneto is the conventional source of ignition for… .

VIII. Answer the questions:

1. How is the combustible mixture ignited in diesel engines?
2. What is necessary for the best engine performance?
3. How many systems of electric ignition are there?
4. Where is battery ignition used?
5. Where is the magneto conventionally used?

IX. Translate the following sentences into English:

1. Будь-який двигун, що працює на бензині, має систему запалювання. 2. В багатьох типах двигунів горюча суміш запалюється за допомогою електричної іскри. 3. Для найкращої роботи двигуна важливо точно розрахувати іскру. 4. Існують 2 загальні системи електрозапалювання: запалювання за допомогою акумуляторної батареї та магнето. 5. У віддалених районах використовується система запалювання від магнето. 6. Система запалювання від акумуляторної батареї передбачена для запуску двигуна або для освітлення. 7. Традиційним джерелом запалювання для тракторів та фермерського обладнання становить магнето.

X. Fill in the table using the information from the text:

The Ignition System		
Type of Ignition	**Battery Ignition**	**Magneto Ignition**
Where it is used		

GRAMMAR EXERCISES

(Grammar Revision: The Past Continuous Tense)

XI. Copy out sentences in the Past Continuous Tense:

1. In jumping, this current makes a spark. 2. The car was able to move while the engine was running. 3. A spark sets fire to the mixture of air and petrol vapour. 4. The operators were installing the engine all the morning yesterday. 5. Various metal alloys are used for the central electrode.

XII. Put the following sentences in a negative form:

1. A spark plug was providing a gap across which the current generated. 2. The storage batteries occasionally were losing their charge. 3. Spark plugs were providing a gap across which the current could jump. 4. This current was making a spark. 5. A steel body was screwing into a cylinder.

XIII. Put questions to the italicized words:

1. A spark was setting fire *to the mixture of air and petrol vapour*. 2. *An insulated centre piece* was carrying an electrode. 3. Some plugs were having *three* earthed electrodes. 4. Others plugs were having only one *electrode*. 5. The sparks *were jumping* the annular gap.

XIV Replace the infinitive in brackets by the Past Continuous Tense:

1. The operators (to test) a new device from 11 till 12 yesterday. 2. Alex (to measure) the current at 5.45 yesterday. 3. The engineers (to carry out) an important experiment on metal alloys at 10 o'clock yesterday. 4. The students (to determine) why the storage batteries lost their charge from 3 till 5 o'clock yesterday. 5. I (to write) a report on the nature of the electrode material at 7 o'clock yesterday.

XV. Put the following sentences in the Past Continuous Tense:

1. Platinum has come into great favour despite its high cost. 2. An electric spark ignites the combustible mixture. 3. We use battery ignition in practically all cases. 4. Of course the storage battery occasionally loses its charge. 5. It causes great trouble in out-of-the way districts.

CONVERSATIONAL PRACTICE

XVI. Speak about:

- the ignition system in general
- battery ignition
- magneto ignition

WRITTEN PRACTICE

XVII. Prove that diesel engines differ from gasoline as to the ignition system. Write down your arguments.

TEXT B. SPARK PLUGS

Spark plugs work in engines under changing loads and temperatures. The purpose of the plug is to ensure reliable ignition of the engine even at extreme temperatures and protect the engine against self-ignition under extreme thermal loads.

The thermal balance of the spark plug under normal operation conditions must ensure self-leaning coal and oil deposits off plug cone. To meet these requirements the spark plug has a heat factor precisely defined by the manufacturer.

The use of spark plugs colder than recommended ones causes cleaning of cone to get worse and ignition of engine to be more difficult. The use of spark plugs hotter than recommended ones is very dangerous for the engine as could cause its overheating and self-ignition.

Combustion products which collect on the insulator cone of spark plugs during the operation, cause starting of cold engine to be more difficult and plugs to "lose" sparks, and consequently drop of engine power while running. Such a state gets worse due to the electrical erosion which occurs while a plug sparking and chemical erosion as well which a gap between a central point and earth electrodes to increase.

To limit these disadvantages it is recommended to check a gap periodically and to adjust it, if necessary, to values specified in the engine operation manual and if ethyl petrol is used, to clean insulator cone by sanding. To ensure the correct sparking of the plug and economic running of the engine have the spark plugs replaced after following mileage:

– 20 000 kms in case of four-stroke engines

– 10 000 kms in case of two-stroke engines.

Life of multi-pointed spark plugs, i. e. with three earth electrodes, is at least two times longer than that of single-point plugs do not require any periodical check. Multi-pointed spark plugs cannot be used for engines fired with ethyl petrol because existence of several earth electrodes makes self-cleaning of the insulator cone more difficult.

EXERCISES

I. Read the text and group its terms into 2 categories: a) nouns, b) verbs.

II. Write down word combinations concerning:

– the purpose of a spark plug

– disadvantages during the operation

– multi-pointed spark plugs

III. Comprehension questions:

1. What must thermal balance of the spark plug under normal operation conditions ensure?
2. What do combustion products cause?
3. Where cannot multi-pointed spark plugs be used?

IV. Give subtitles for each paragraph of the text.

V. Write down a summary of the text using the following expressions:

Data are given about …

It is known that …

… is dealt with …

… is formulated …

Attention is drawn to …

… is described in short …
It is known …
Attempts are made to analyze …

VI. Read the text and answer the following question: "What standard does a spark plug "Bosch" follow?"

Spark plugs "Bosch" are the most popular and best-selling – more than 5 billion all over the world. They have been producing for 90 years. Automobile manufacturers of Volkswagen Group (Volkswagen, Audi, Skoda, Rolls-Royce), General Motors Corporation, Ford Corporation (Ford, Volvo), Nissan Corporation (Nissan, KIA) and many other prefer this mark of the spark plug.

Spark plugs "Bosch" are produced according to manufacturer's own design and technology which keep pace with up-to-date and keener requirements of engines manufacturers and cope with competition of leading manufacturers of spark plugs. Engineering materials of highest quality parameters are used for the production process. High quality of spark plugs is ensured by quality control according to requirements of ISO 9001 (Ukrainian Standard – ДСТУ ISO 9000-2000).

STEP 3

TEXT A. THE LUBRICATION SYSTEM

PRE-TEXT EXERCISES

I. Translate international words:
system, material, minimum, cylinder, vacuum, principle, automobile, pump, adequate.

II. Give the meanings of the following words:
a film, power, to run.

III. Translate words with the same root:
to lubricate – lubrication – lubricant – lubricated – lubricating (system)

IV. Words to remember:
1. **friction** – тертя
2. **rub** – терти
3. **eliminate** – усунути
4. **bearing** – підшипник
5. **pin** – штифт, палець, вісь
6. **scorings** – рубці
7. **feed** – постачати
8. **throttle** – дросель, дросельна заслінка
9. **crank case** – картер
10. **splash** – розбризкувати

V. Read and translate the text:

THE LUBRICATION SYSTEM

The purpose of lubrication is to reduce the friction between moving surfaces. If parts rubbing on each other are not separated by a film of lubricant, the surface will rub and rapidly wear away. Friction is a force that tends to retard or to stop motion of one surface over another. The frictional force depends on the nature of the surface, and also on the kind of material. The rougher the surface and the softer the material, the greater the friction; while the harder the material and the smoother the surface the less the friction. The more friction there is, the greater the loss of power, as it requires power to overcome friction.

A great amount of friction is necessary in certain parts of the car such as in the brakes, the clutch, and the outer surface of the tyres in order that they be efficient. On the other hand, it is essential that all friction possible be eliminated from the bearings and pistons in order to have as little of the engine power lost as possible. It is impossible to eliminate the friction entirely, but with the proper use of suitable lubricants, the loss due to friction can be reduced to a minimum. The principal parts of the engine needing lubrication in order to prevent friction are the main crankshaft bearings, connecting-rod bearings pins, camshaft bearings, piston, and cylinder walls.

Lubrication requirements. Bearing surfaces of high speed machinery must always be kept well lubricated, in order that the friction motion at these surfaces may be low, and that there may be no scoring of the surface when the bearing loads are high. In combustion engines, oil must be fed to all of the bearing surface continuously while the engine is running, in adequate quantity, yet it must not be supplied in excess to the cylinder walls, as the suction due to the partial vacuum in the cylinders during the inlet stroke tends to draw it up into the combustion chambers, especially when running on low throttle, and if too much is fed the exhaust will be smoky with oil vapour, and carbon deposits will form on the combustion chamber walls. For engine lubrication, mineral or petroleum oil is used almost exclusively.

There are three principles used in providing suitable lubrication for the various parts of the automobile engine. The oil may be placed in the crank case and be splashed by the revolving cranks to the parts to be lubricated, or a pump may be provided to pump the oil from the bottom part of the crank case to a point above the part to be lubricated to which the oil flows by gravity. A pump may be used to pump the oil under pressure to the parts to be lubricated. All the modern lubricating systems **(Fig.24)** are based upon one or a combination of the above principles.

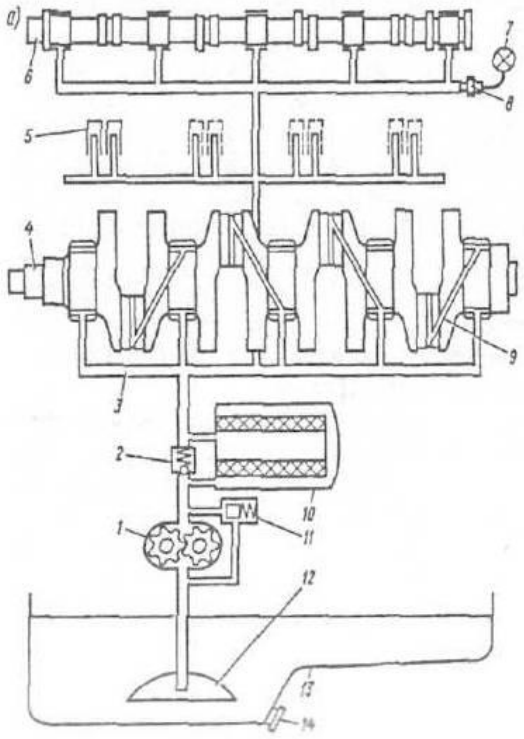


Fig.24. The Lubrication System

1 – oil pump
2 – bypass valve
3 – main oil passage
4 – crankshaft
5 – hydraulic tappet
6 – camshaft
7 – pressure sensor
8 – oil pressure sensor
9 – oil channels in the crankshaft
10 – oil full-flow filter
11 – emergency valve
12 – oil pick-up with a primary filter
13 – oil pan
14 – fuel tank filler cap

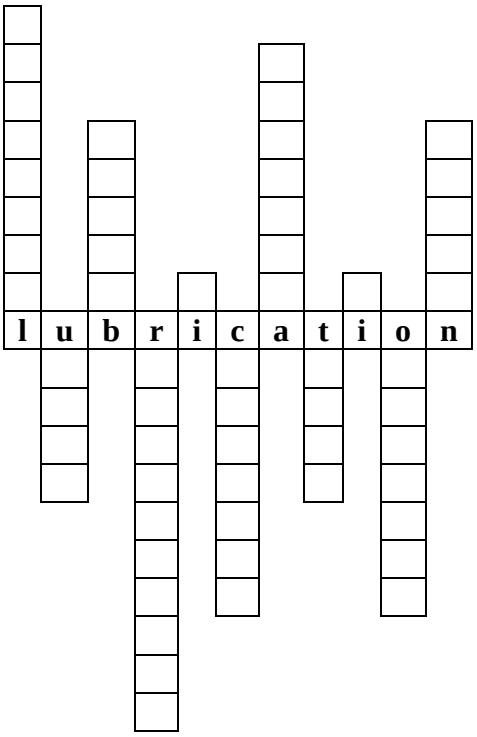
TEXT-BASED ASSIGNMENTS

LEXICAL EXERCISES

I. Find synonyms:

1. to reduce	a) to show	b) to press	c) to low
2. kind	a) type	b) way	c) splash
3. parts	a) throttle	b) inlet	c) components
4. principal	a) various	b) scoring	c) main
5. to use	a) to base	b) to apply	c) to run
6. purpose	a) oil	b) crank	c) aim
7. to stop	a) to run	b) to retard	c) to supply
8. to require	a) to pump	b) need	c) to lubricate
9. essential	a) important	b) bearing	c) smoky
10. motion	a) friction	b) throttle	c) movement

II. Solve the crossword:



l – змащувати
u – під
b – гальма
r – вимога
i – якщо
c – кулачковий вал
a – адекватний
t – шини
i – в
o – подолати
n – природа, сутність

III. Find autonyms:

A	B
1. to move	a) to stop
2. rough	b) rapidly
3. to move	c) exhaust
4. slowly	d) to reduce
5. high	e) to stop
6. inlet	f) low
7. to increase	g) smooth

IV. Give English equivalents:

зменшувати, терти, спрацьовувати, зупиняти, відставати, змащувати, працювати, постачати, накачувати, розбризкувати.

V. Translate the following word-combinations with the key-words:

– "**lubrication":** engine lubrication system, the purpose of lubrication, lubrication requirements, to provide suitable lubrication;

– “**lubricant”:** a film of lubricant, suitable lubricants;
– “**friction”:** to reduce friction between moving surfaces, frictional force, the greater friction, the more friction, to overcome friction, a great amount of friction, to eliminate friction entirely, the loss due to friction, to prevent friction, the friction motion.

VI. Fill in the table using the text:

The Lubrication System			
Nouns	Verbs	Adjectives	Adverbs

VII. Complete the following sentences:

1. The purpose of lubrication is … . 2. Friction is a force that … . 3. A great amount of friction is necessary in … . 4. The principal parts of the engine needing lubrication are … . 5. For the engine lubrication ... . 6. The oil may be placed in … . 7. A pump may be used … .

VIII. Write true (T) or false (F) for each of the sentences below, according to the information given. Correct statements if it is necessary using the following phrases: *You are wrong, I disagree with you, Your statement is not correct, I do not share your point of view:*

1. If parts rubbing on each are separated by a film of lubricant, the surface will rub and rapidly wear away. 2. Friction is a force that tends to retard or to stop motion of one surface over another. 3. The more friction is the greater the loss of power. 4. The rougher the surface and the softer the material the smaller friction. 5. A great amount of friction is not necessary in the brakes, the clutch and the outer surface of the tires. 6. Mineral oil is used for the engine lubrication. 7. All modern lubricating systems are based upon only one principle.

IX. Answer the questions:

1. What is the purpose of lubrication?
2. What is friction?
3. What does the frictional force depend on?
4. What parts need a great amount of friction?
5. Why must bearing surfaces of high speed machinery always be kept well lubricated?
6. What oil is used for engine lubrication?
7. What is a pump for?

X. Find out in the text sentences proving the necessity of lubrication.

GRAMMAR EXERCISES
(Grammar Revision: The Future Continuous Tense)

XI. Copy out sentences in the Future Continuous Tense:

1. Selection of cooling system, frontal area, fan diameter and relative fan location are critical to efficient operation. 2. Systems with large frontal areas and fans will be reducing fan horsepower, noise and vehicle system resistance. 3. The fan should be spaced 2-3 times its projected from the radiator core. 4. Air flow testing is desirable prior to decision making. 5. 20 percent more frontal area will be providing 10 percent more cooling with the same fan.

XII. Put questions to the italicized words:

1. *The surface* will be wearing away. 2. In this case we *shall be losing* the power. 3. In this case the principal parts of the engine will be lacking *lubrication*. 4. Suitable lubrication will be providing for the various parts of the *automobile* engine. 5. A pump will be pumping the oil *under pressure* to the parts to be lubricated.

XIII. Replace the infinitive in brackets by the Future Continuous Tense:

1. The students (measure) voltage in the electrical chain at the class tomorrow. 2. All the companies investigating diesels (to try) to reduce noise and smoke.3. The vehicle designers (to face) many problems in the future. 4. We (to study) properties of conductors in half an hour. 5. Your group mates (to experiment) with new devices at 5 o'clock.

XIV. Put sentences in the Future Continuous Tense:

1. The surface will rub. 2. Helen studies the properties of copper. 3. It overcomes friction. 4. The professor reported the results of the tests. 5. We were studying the friction force.

CONVERSATIONAL PRACTICE

XV. Speak about:

– the purpose of lubrication
– the mechanism of friction
– parts needing friction

WRITTEN PRACTICE

XVI. Write down principles used in providing suitable lubrication

TEXT B. THE COOLING SYSTEM

Engines become very hot while they are running, due to the intense heat created by combustion. Immediately after the gas in the cylinder has burnt the temperature in the cylinder is almost 4,500F. This is higher than the melting point of steel. Unless the engine is cooled, the moving parts such as valves and pistons will expand enough to stick.

The cooling system is designed to transmit the excessive heat from engine parts to the atmosphere resulted in creating the necessary temperature regime – the engine is nether overheated nor overcooled thus ensuring the normal operating conditions. Heat can be abstracted in two ways: by liquid (liquid-cooled system) or air (air-cooled system). The cooling system may be of one-stage and two-stage type **(Fig. 25)**.

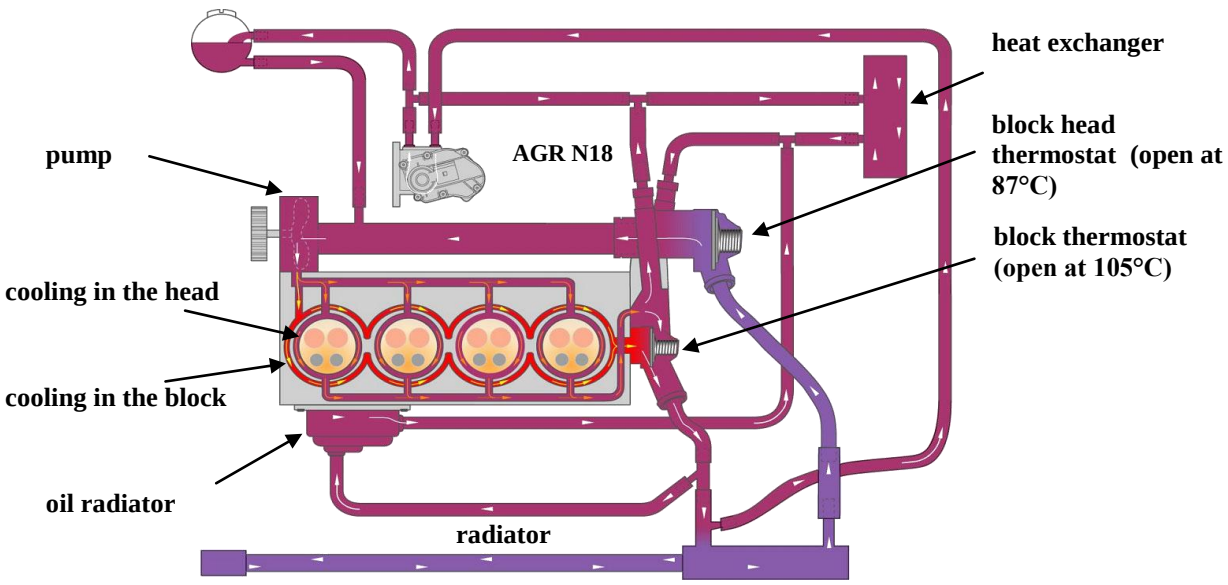


Fig.25. Skoda Oktavia's two-stage cooling system

The engine should be cooled otherwise gases having high temperature heat engine parts expanding them. Oil on cylinders and pistons is burnt out; their friction and wear are increasing. Because of parts' overheating pistons are seized in the engine cylinder and can be damaged. This will stop the engine and may even ruin it. To avoid negative consequences resulted in engine overheating it is necessary to cool the engine. Overcooling is as bad as overheating and has a negative impact on engine operation. Overcooling results in fuel (gasoline) vapour condensation. Vapour washes away lubricants diluting oil in a crankcase. Piston rings, pistons and cylinders are rapidly worn away, efficiency and power of the piston are reduced. It is obvious that normal operation of cooling system leads to maximum efficiency, lower fuel consumption and longer service life.

EXERCISES

I. Find in the text English equivalents:
охолодження, переохолодження, охолоджувати, система охолодження, охолоджений за допомогою повітря, охолоджений за допомогою рідини.

II. Translate the following noun-terms:
a cylinder, an engine, a valve, a piston, vapour, heat.

III. Find in the text verb-terms and translate them.

IV. Give word combinations for the description of the cooling system.

IV. Comprehension questions:

1. What is the temperature when the gas in the cylinder has burnt?
2. What moving parts do you know?
3. What can cause the destruction of the engine?
4. Why is overcooling is as bad as overheating?
5. What does overcooling result in?

V. Render the text in Ukrainian.

REVISION

I. Give the meanings of the following words you know:
tank, cap, charge, arm, film, button, spring, light, nut.

II. Match the two columns:

A	B
1. friction	a) свічка запалювання
2. surging	b) охолоджувати
3. throttle	c) струм
4. a tank	d) шатун
5. a spark plug	e) пружина
6. bearing	f) запалювання
7. to cool	g) рубці
8. a charge	h) поршень
9. current	i) дросель
10. lubricant	j) картер

11. a camshaft	k) розбризкувати
12. to rub	l) дросель
13. to splash	m) кулачковий вал
14. a connecting rod	n) підшипник
15. a spring	o) підтікання
16. a piston	p) тертя
17. ignition	q) мастило
18. scorings	r) терти
19. a crankcase	s) заряд
20. a baffle	t) бак

III. Choose antonyms:

A	B
1. liquid	a) bottom
2. rich	b) exhaust
3. inlet	c) lean
4. top	d) to reduce
5. impossible	e) smooth
6. to increase	f) rapidly
7. to move	g) down
8. rough	h) solid
9. up	i) to stop
10. slowly	j) possible

IV. Translate words with the same root:

a) to ignite – ignition – igniting – ignited
b) to lubricate – lubricant – lubrication – lubricating – lubricated
c) to mix – mixture – mixer – mixing – mixed
d) to pump – a pump – pumping

V. Fill in the table with missing words:

Ukrainian Word	Nouns	Verbs
1.	1. compression	1.
2.	2.	2. to ignite
3. усунення	3.	3.
4.	4.	4. to deliver
5.	5. rotation	5.
6. тепло	6.	6.
7. працювати	7.	7.
8.	8.	8. to move
9.	9. mixture	9.
10. тиск	10.	10.
11.	11. lubrication	11.
12	12.	12. to rub
13. підтікання	13.	13.
14.	14. insulation	14.
15.	15.	15. to evaporate

V. Explain the meaning of the following correlated terms and use them in sentences of your own:

a) to design – to build – to construct
b) a vehicle – an automobile – a car – a truck – a lorry
c) demands – requirements – desires

VI. Divide the following words and word combinations into groups: a) the ignition system b) the lubrication system c) the fuel system d) words which belong to neither system:
a rocker arm, a shaft, gear, a fuel tank, a spark plug, current, a lever, a baffle, a lubricant, a cam, a film, a seat, a cap, friction, to ignite, a magneto, to charge.

VII. Fill in the table:

System	Nouns	Verbs	Adjectives
Fuel			
Ignition			
Lubrication			

VIII. Use the words of Ex. I-IV to make up word combinations of your own.

IX. Give English equivalents:
усунути тертя, запалювати за допомогою запальної свічки, рухомі поверхні, постачати паливо, необхідні мастила, швидко спрацьовувати, запалити горючу суміш, відповідати сучасним вимогам, запобігти підтіканню палива, створити тиск.

X. Complete the following sentences:
1. There are two general systems of electric ignition … . 2. The fuel system is designed … . 3. The purpose of lubrication is … . 4. Battery ignition is used in … . 5. The fuel system consists of … . 6. The magneto is a conventional source of ignition for … . 7. The principal parts of the engine needing lubrication are … .

XI. Answer the questions:
1. What is a pump for?
2. What is the fuel system designed for?
3. What are the main components of the fuel system?
4. What is the aim of lubrication?
5. What is friction?
6. How many general systems of ignition are there?

XII. Correct statements if it is necessary using the following phrases: *You are wrong, I disagree with you, Your statement is not correct, I do not share your point of view:*
1. The magneto is used for charging equipment being close at hand. 2. There are two general systems of electric ignition: battery ignition and magneto ignition. 3. The fuel system is designed to store liquid fuel and to deliver it to the engine cylinders. 4. The purpose of lubrication is to increase the friction between moving surfaces. 5. A fuel tank, a fuel pump, a fuel line and carburettor are main components of the fuel system. 6. Battery ignition is used for starting the engine and lighting. 7. In diesel engines the combustible mixture is ignited with a spark plug.

XIII. Look through "The Ignition System", "The Lubrication System", "The Fuel System" and fill in the table:

System	Main Components	Function
Fuel		
Ignition		
Lubrication		