

UNIT 3

BASIC COMPONENTS OF THE AUTOMOBILE

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STEP 1

TEXT A. ENGINE

PRE-TEXT EXERCISES

I. Translate the following international words:

gasoline, cylinder, automobile, cycle, limit, centre, compression, gas.

II. Translate the following words. Pay attention to their structure:

four-stroke, intake, two-cycle, inlet, crankshaft.

III. Read and memorize:

1. **operating** – робочий
2. **burn** – горіти
3. **within** – всередині
4. **complete** – завершувати, закінчувати
5. **direction** – напрям
6. **motion** – рух, переміщення
7. **revolutions** – оберти
8. **exhaust** – вихлоп, випуск
9. **valve** – клапан
10. **residual** – залишковий

IV. Read and translate the text:

ENGINE

The word “engine” meant any *ingenious device*, and came from the Greek word “ingenious”, “clever”. Any kind of vehicle must be able to move. The ability to move demands power. A machine that produces mechanical power or energy is called an engine or a power plant.

The engine is the source of power that makes the car move. It is usually called an internal combustion engine because gasoline is burned within its cylinders or combustion chambers. Most automobile engines have six or eight cylinders.

The operating cycle of the four-stroke engine that takes place in the engine cylinder can be divided into four strokes. The upper limit of the piston movement is called the top dead centre. The lower limit of piston movement is called the bottom dead centre. A stroke is the piston movement from the top dead centre to the bottom dead centre, or from the bottom dead centre to the top dead centre. In other words, the piston completes a stroke each time it changes the direction of its motion.

Where the entire cycle of events in the cylinder requires four strokes (two crankshaft revolutions), the engine is called a four-stroke cycle engine. The four strokes are: intake (a), compression (b), power (c) and exhaust (d) (**Fig. 11**).

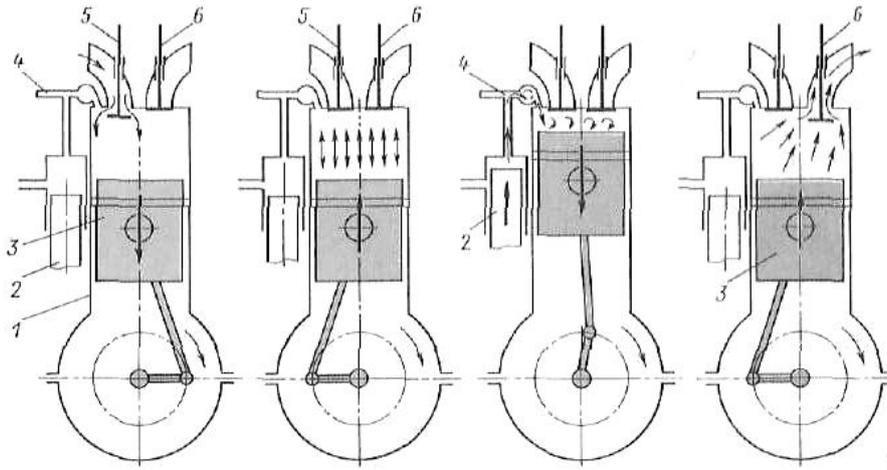


Fig. 11. A four-stroke cycle

Two-cycle engines have also been made, and in such engines the entire cycle of events is completed in two strokes or one revolution of the crankshaft.

On the intake stroke the intake valve is opened. The mixture of air and vaporized gasoline is delivered into the cylinder through the inlet valve. On the compression stroke the inlet valve is closed so that the mixture can be compressed. On the power stroke both valves (inlet and exhaust) are closed in order to rise pressure during the mixture combustion. On the exhaust stroke the exhaust valve is opened to exhaust the residual gas.

There are engines with 2 (**Fig. 12**), 4 (**Fig. 13**) and 8 valves.

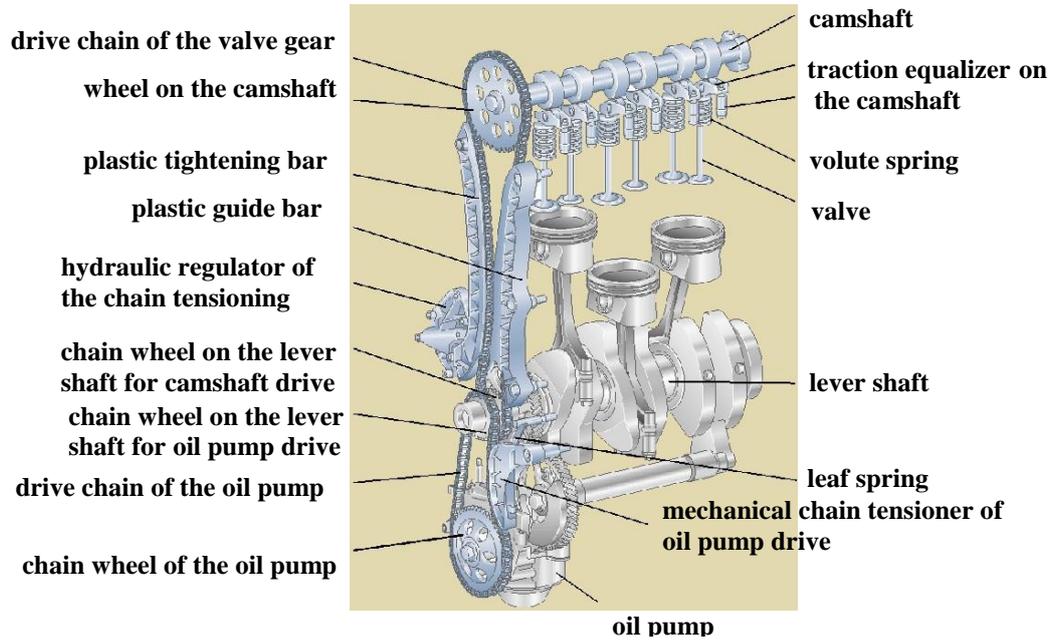


Fig. 12. Skoda's cam drive and oil pump drive of the 2-valve engine

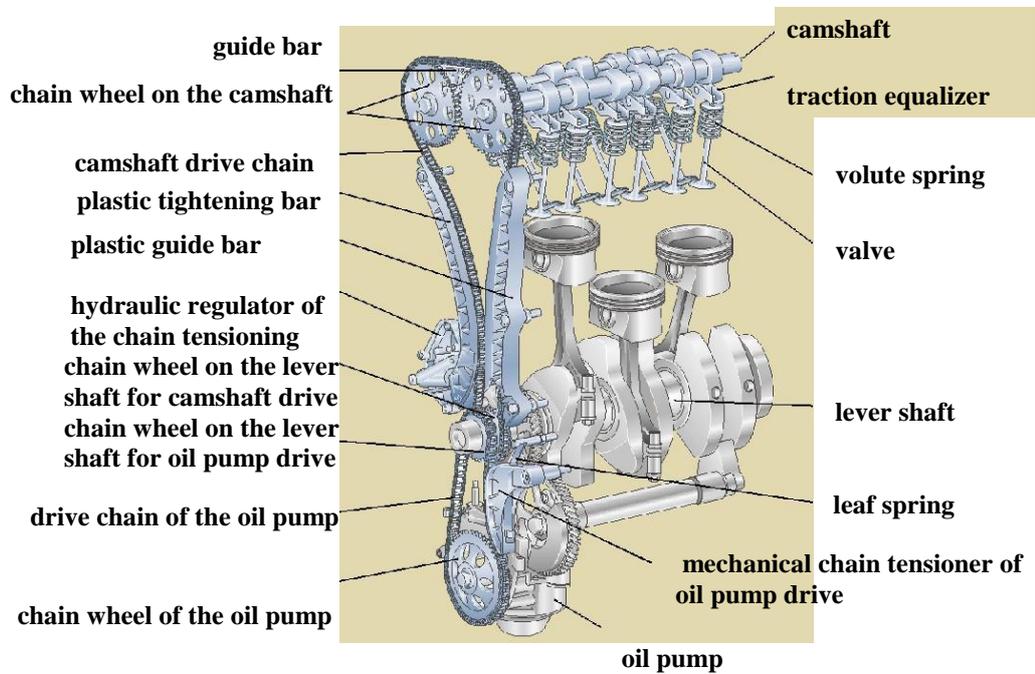


Fig. 13. Skoda's cam drive and oil pump drive of the 4-valve engine

TEXT-BASED ASSIGNMENTS

LEXICAL EXERCISES

I. Read the following words and say which of them are mentioned in the text:

an engine, gasoline, to live, a chamber, a cycle, a piston, expressions, a revolution, a phrase, a stroke, compression, a valve, a question, a statement.

II. Write down and translate the terms describing the operation of the engine.

III. Derive verbs from the following nouns:

movement, compression, direction, mixture, pressure.

IV. Match the words from columns A and B to make word combinations:

A	B
1. source of	a) movement
2. top dead	b) limit
3. piston	c) revolutions
4. combustion	d) valve
5. upper	e) centre
6. direction of	f) gas
7. crankshaft	g) stroke
8. intake	h) motion
9. power	i) power
10. residual	j) chambers

V. Translate the words and word combinations to describe Skoda's cam drive and oil pump drive of the 2-valve (Fig. 12) and 4-valve (Fig. 13) engine.

VI. Choose the correct word in brackets:

1. The engine is the source of power that makes the car (stop/move). 2. Gasoline is burnt (within/out of) the engine's cylinder. 3. The upper limit of the piston movement is called (bottom/top) dead centre. 4. The entire cycle of events in the cylinder requires (four/three) stroke. 5. On the intake stroke the intake valve (is closed/is opened). 6. On the power stroke inlet and exhaust valves (are opened/are closed). 7. Residual gas is exhausted on the (power/exhaust) stroke.

VII. Fill in the table according to the text:

Stroke	Words to Describe
<i>Intake</i>	
<i>Compression</i>	
<i>Power</i>	
<i>Exhaust</i>	

VIII. Put the following words in the suitable form: *to compress, to push downwards, to push, to ignite, the cylinder, to close, to start again, to open, to rotate, to return*

The Intake Stroke. The cycle starts with the piston at TDC. As the inlet valve opens, the piston ... by the rotating crankshaft. The fuel mixture enters When the piston comes to the top of the stroke, the inlet valve closes.

The Compression Stroke. The rotation of the crankshaft ... the piston upwards again. During the compression stroke, the fuel Both valves are now ... and thus the mixture is prevented from escaping. The compression rapidly heats the mixture before ignition occurs.

The Power Stroke. The spark from the plug ... the heated mixture as the piston comes to the top of its stroke. The burning gases expand and force the piston downwards again. This stroke ... the crankshaft through half a revolution (180°).

The Exhaust Stroke. As the piston comes to BDC, the exhaust valve The rotating crankshaft returns the piston to TDC again, expelling the burnt gas through the top of the cylinder. When the piston ... to TDC, the cycle In a vehicle engine this cycle is repeated several thousand times a minute.

IX. Fill in the table:

Stroke		Piston Movement		Valve Position	
English	Ukrainian	English	Ukrainian	English	Ukrainian
1.					
2.					
3.					
4.					

X. Complete the following sentences:

1. The engine is 2. Most automobiles have 3. The operating cycle of the 4-stroke engine 4. A stroke is... . 5. The upper limit of the piston movement 6. The lower limit of the piston movement 7. The entire cycle of events in the cylinder requires

XI. Answer the questions:

1. What makes the car move?
2. Why is an engine called an internal combustion one?
3. How many cylinders have most automobiles?
4. What is the top dead centre?
5. What is the bottom dead centre?

XII. Ask your comrade questions on the text concerning

- a) the intake stroke
- b) the compression stroke
- c) the power stroke
- d) the exhaust stroke

XIII. Translate the following sentences into English:

1. Двигун – це джерело енергії, що примушує автомобіль рухатися. 2. Двигун, в якому паливо згоряє усередині циліндрів або камерах згоряння, має назву двигуна внутрішнього згоряння. 3. Більшість двигунів вантажних автомобілів мають вісім циліндрів, легкових – чотири. 4. робочий цикл 4-х тактового двигуна складається з 4-х тактів: впуск, такт стиснення, робочий хід та випуск відпрацьованих газів. 5. Верхня межа руху поршня – це верхня мертва точка. 6. Нижня межа руху поршня – верхня мертва точка. 7. Такт – це рух поршня від верхньої мертвої точки до нижньої мертвої точки та навпаки.

GRAMMAR EXERCISES
(Grammar Revision: Дієслово “to be”)

XIV. Translate the following sentences. Comment on the functions of the verb “to be”:

1. The word “automobile” is not English. 2. Automobile is a vehicle for ordinary road conditions. 3. Automobiles are playing an important role in the solution of many transport problems. 4. The cars of that time were very small. 5. In 1825 a steam engine was built in Great Britain. 6. This vehicle was suggested by I. Newton. 7. This engine is called an internal combustion engine.

XV. Fill in the blank with the necessary form of the verb “to be”:

1. The main part of the engine ... called the block. 2. Passengers cars ... propelled by an internal combustion engine. 3. In the future engines ... controlled by solid-state electronic components. 4. Fuel pumps ... giving way to electronically controlled injection systems. 5. In the nearest future many family-sized cars ... equipped with diesel engines. 6. Vehicle makers ... to meet at the workshop. 7. The first self-propelled vehicle ... constructed in 1763.

XVI. Correct the mistakes if necessary. Pay attention to the forms of the verb to “be”:

1. The engine are the source of power that makes the car move. 2. On the intake stroke the intake valve is opened. 3. Passenger cars is propelled by an internal combustion engines. 4. This project were suggested by highly qualified engineers. 5. These vehicles was composed of many systems. 6. The automotive industry is improving HFC-134a systems. 7. Equipment are being used in both developed and developing countries.

CONVERSATIONAL PRACTICE

XVII. Speak about the origin of the word “engine”.

WRITTEN PRACTICE

XVIII. Write down a plan for retelling the text.

TEXT B. WHAT ENGINES DIFFER IN

Passenger cars are, as a rule, propelled by internal combustion engines. They are distinguished by the horse-power of the engine, the number of cylinders on the engine and the type of the body, the type of transmission, wheelbase, weight and overall length.

There are engines of various designs. They differ in the number of cylinders, their position, their operating cycle, valve mechanism, ignition and cooling systems.

Most automobile engines have six or eight cylinders, although some four-, twelve-, and sixteen-cylinder engines are also used. The activities that take place in the engine cylinder can be divided into four stages which are called strokes. The four strokes are: intake, compression, power and exhaust. "Stroke" refers to the piston movement. The upper limit of piston movement is called top dead centre, TDC. The lower limit of piston movement is called bottom dead centre, BDC. A stroke constitutes piston movement from TDC to BDC or from BDC to TDC. In other words, the piston completes a stroke each time it changes the direction of motion.

The main part of the engine is called the block. It consists of cylinders and valves. Air and petrol go into the block by means of the carburettor. The petrol reaches the carburettor from the petrol tank through the action of the petrol pump.

There are two main types of petrol engines: 4-stroke and 2-stroke. All cars and larger motor-cycles are known to use 4-stroke engines. But most smaller motorbikes use 2-stroke engines. They are smaller and cheaper than 4-stroke engines.

EXERCISES

I. Give the main idea of the text.

II. Write down all special terms and translate them consulting the dictionary.

III. Find synonyms:

A	B
1. car	a) kind
2. movement	b) automobile
3. type	c) to vary
4. various	d) motion
5. design	e) different
6. to change	f) quantity
7. the number of	g) construction

IV. Give the situations from the text in which the following words are used:

- a) a block, a cylinder, a valve, a carburettor, a pump;
- b) petrol, 4-stroke, 2-stroke, motor-cycles, motorbikes.

V. Comprehension questions:

- 1. How can passenger cars be distinguished?
- 2. What do engines differ in?
- 3. What is a stroke?
- 4. What is TDC?
- 5. What is BDC?

VI. Prepare to speak on the following subjects:

- the term “a stroke”
- the main part of the engine
- types of petrol engines

VII. Do you agree with the statement: “There are engines of various designs”? You’re to give your arguments.

STEP 2

TEXT A. CLUTCH. TRANSMISSION

PRE-TEXT EXERCISES

I. While translating the text pay attention to the semantics of the following words:

ring – 1. кільце 2. обід 3. фланець 4. коронний

plate – 1. пластинка 2. товстий лист (металу); листовая сталь 3. тарілка 4. диск

II. Read and memorize:

- 1. **pinion** – шестірня, зубчастий валик
- 2. **flywheel** – маховик
- 3. **bolt** – болт, затягнути (закріпити) болтом
- 4. **dowel** – шпонка, штир, дюбель
- 5. **rim** – обід, край, кромка
- 6. **thrust** – поштовх, осьове навантаження, натиск

7. **serration** – зубець, гострокуті шліци
8. **spline** – шліц, паз, шпонка
9. **hub** – маточина (колеса), втулка
10. **mount** – розташовувати, закріпити, розміщати

III. Read and remember the following word combinations: *the ring gear of the flywheel* – коронна шестірня маховика, *the driven plate of the clutch* – ведений диск зчеплення, *the pressure plate ring* – компресійне пластинкове поршньове кільце, *the clutch shaft* – вал зчеплення, ведучий вал, *the jack shaft* – проміжний вал, *the sliding gear* – ковзна (пересувна) шестірня, пересувний блок шестірні, *the reverse drive* – реверсивний привід, реверсивна передача.

IV. Read and translate the text:

CLUTCH. TRANSMISSION

Clutch. A clutch (**Fig. 14**) permits easy and quick connection and disconnection of two shafts.

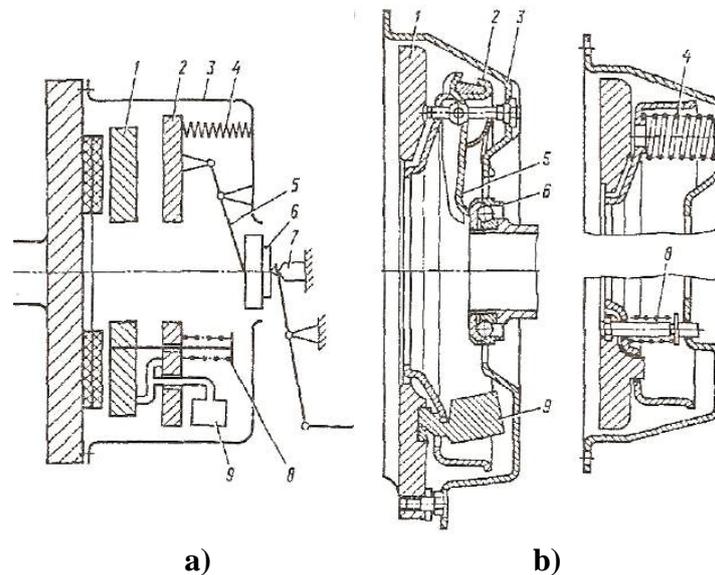


Fig. 14. Centrifugal Clutch: a) scheme b) arrangement

- | | |
|---------------------------|----------------------------|
| 1 – clutch pressure plate | 6 – clutch release bearing |
| 2 – reactive clutch plate | 7 – block stop |
| 3 – housing | 8 – backward spring |
| 4 – spring | 9 – centrifugal weight |
| 5 – release lever | |

A clutch is also used instead of a key to connect the shaft with a revolving part, such as a pulley or a gear. The object of friction clutches is to connect a stationary machine part to a rotating part, to bring it up to speed and to transmit the required power with a minimum of slippage.

The ring gear of the flywheel is utilized for engagement of the pinion of the starting motor when starting the engine. Next to the flywheel is the driven plate of the clutch. The driven plate has fabric linings on each side. It is designed to fit within the flywheel ahead of the pressure plate when the unit is bolted onto the flywheel, in which position it is aligned by the dowels on the rim of the flywheel. The springs within the pressure plate tend to force the pressure plate ring directly against the outer surface of the driven plate while the inner surface and lining of the driven plate are thus thrust against the surface of the flywheel. Under this circumstance the clutch driven plate will turn with the flywheel and the pressure plate which is bolted thereto.

At the centre of the clutch plate there are serrations or splines in a hub. The clutch shaft which is part of the transmission is designed to fit into this hub and to be held and turned thereby.

Transmission. The clutch plate is designed to go onto the spline at the end of the clutch shaft. As the clutch shaft is started turning, it, in turn, causes the jack shaft to turn with it. This jack shaft is in constant motion when the clutch shaft proper is turning. To secure the several speeds which are necessary for the operation of the motor car, the clutch shaft is mounted in direct line with the transmission shaft which carries on it the sliding gears which are utilized for shifting to secure the forward speeds and the reverse drive.

TEXT-BASED ASSIGNMENTS

LEXICAL EXERCISES

I. Compile as many words as you can with the letters of the word “transmission”.

II. Write down noun-terms from the text and translate them the consulting the dictionary.

III. Match the two columns:

A	B
1. to utilize	a) проектувати
2. to start	b) припасувати
3. to design	c) мати тенденцію
4. to bolt	d) використовувати
5. to fit	e) закріпляти
6. to align	f) обертатися, повертати
7. to tend	g) забезпечити
8. to turn	h) вирівнювати, випрямляти
9. to secure	i) закріпити болтом
10. to mount	j) запускати

IV. Translate the words with the same root:

- a) to start – starting – the starting (motor)
- b) to drive – the drive – a driver – driven
- c) to press – pressure

V. Translate the following words and word combinations:

- plate, clutch plate, clutch driven plate
- pressure, pressure plate, pressure plate ring.

VI. Translate the following word combinations with key words:

- **“clutch”**: the clutch driven plate, at the centre of the clutch plate, the clutch shaft, the clutch plate;
- **“plate”**: the driven plate of the clutch, the driven plate, the pressure plate, the pressure plate ring, lining of driven plate;
- **“flywheel”**: the ring gear of the flywheel, next to the flywheel, to fit within the flywheel, to be bolted on the flywheel, on the rim of the flywheel.

VII. Read the following list of words and word combinations. Which of them can be used to describe a) clutch, b) transmission:

the clutch plate, the pressure plate, the driven plate, to start turning, sliding gears, the reverse drive, to be bolted on the flywheel, to fit into the hub, the pressure plate ring.

VIII. Translate the words and word combinations to describe the scheme and arrangement of a centrifugal clutch (Fig. 14).

IX. Find the English contextual equivalents for the word combinations in brackets:

1. (Коронна шестірня) of the flywheel is utilized for the engagement of pinion of the starting motor when starting the engine. 2. The driven plate has fabric lining (з кожного боку). 3. (Враховуючи такі обставини) the clutch driven plate will turn with a flywheel. 4. (Вал зчеплення) is a part of the transmission. 5. As the clutch shaft is started turning it, in turn, causes the jack shaft (обертатися разом з ним).

X. Complete the following sentences:

1. Next to the flywheel is 2. The driven plate has 3. The driven plate is designed 4. The springs within the pressure plate tend to 5. At the center of the clutch plate there are 6. The clutch plate is designed to 7. To secure the several speeds which are necessary for the operation of the motor car

XI. Answer the questions:

1. What does a clutch permit?
2. What is the ring gear of the flywheel utilized for?
3. Where is the driven plate of the clutch located?
4. How is the driven plate designed?
5. What is at the centre of the clutch plate?
6. Is the clutch shaft a part of the transmission?
7. How is the clutch plate designed?
8. What should be done to secure the several speeds which are necessary for the operation of the car?

XII. Arrange the following sentences in the order mentioned in the text:

1. Next to the flywheel is the driven plate of the clutch. 2. At the centre of the clutch plate there are serrations or splines in a hub. 3. The springs within the pressure plate tend to force the pressure plate ring directly against the outer surface of the driven plate while the inner surface and lining of the driven plate are thus thrust against the surface of the flywheel. 4. The ring gear of the flywheel is utilized for engagement of the pinion of the starting motor when starting the engine. 5. Under this circumstance the clutch driven plate will turn with the flywheel and the pressure plate which is bolted thereto.

GRAMMAR EXERCISES

(Grammar Revision: Дієслово “to have”)

XIII. Translate the following sentences. Comment on the functions of the verb “to have”:

1. The driven plate has fabric linings on each side. 2. Most automobile engines have six or eight cylinders. 3. The engine has a two-stroke cycle. 4. Two-cycle engines have also been made. 5. Automotive designers will have to meet at the conference. 6. The piston has already finished its stroke. 7. On the compression stroke the inlet valve has already been closed.

XIV. Choose the necessary form of the verb “to have” in brackets. Comment on its use:

1. On the power stroke both valves (have been closed/has been closed). 2. They (has known/have known) him as a good designer for ten years. 3. We shall (have to discuss/has to discuss) the main part of the engine. 4. This block (have/has) cylinders and valves. 5. The lower limit of piston movement (has been called/have been called) bottom dead centre.

XV. Correct the statements where it is necessary. Pay attention to the functions of the verb “to have”:

1. The electromobles has many disadvantages. 2. The American firm had to manufacture these cars. 3. This electrically driven vehicle have a range of about 60 km/ph. 4. These heavy duty electrical buses has been developed in Paris. 5. The driven plate have fabric linings on each side. 6. The gear box have two shafts. 7. Each shaft has to be fitted with four or five gear wheels of different sizes.

XVI. Translate the following sentences into Ukrainian. Comment on the use of the verb “to have”:

1. Більшість автомобілів мають шість або вісім циліндрів. 2. Американська фірма була змушена розглянути цей проект. 3. На такті стискання впускний клапан був зачинений. 4. Поршень вже завершив свій хід.

CONVERSATIONAL PRACTICE

XVII. Read the text and discuss its contents in pairs:

Types of Clutches

Friction clutches may be divided into two main groups according to the direction of the acting force: axial clutches and radial ones.

Axial clutches are those which have the contact pressure applied in the direction parallel to the axis of rotation. Axial clutches, in turn, can be divided into: a) cone clutches, b) disc clutches and c) combined cone and disc clutches. In radial clutches the contact pressure is applied upon a rim in a radial direction. These clutches may be subdivided into band clutches and block clutches, also into internal and external clutches.

WRITTEN PRACTICE

XVIII. Write down about the difference between the driven plate and the clutch plate.

TEXT B. GEARBOX

The automobile is provided with four or five changes of gears. These gears are contained in a gearbox usually placed at the back of the clutch. The principle, upon which all change-speed gears work, is the fact that when two gear-wheels or spur-gears are meshed together, the larger wheel turns more slowly than the smaller.

In the gearbox there are two shafts – the upper one coming from the engine through the clutch, and the lower one continuing to the back axle. Each shaft is fitted with four or five gear wheels of different size.

Those on the upper shaft are fixed to the shaft itself, but those on the lower shaft are able to slide on a keyway, to right and left along the shaft. The lower shaft is square so the sleeve of the gear wheels can slide backward and forward, but they cannot revolve independently of the lower shaft.

In order to vary the speed of the car, it is only necessary to slide the gear wheels along the lower shaft until the correct two gears come into mesh to form the gearing required.

EXERCISES

I. Read text and give the main idea of it.

II. Suggest some other titles of the text.

III. Divide text into logical parts and entitle them.

IV. Write down the noun-terms and translate them consulting the dictionary.

V. Write down the phrases with the key words “shaft” and “gear” and translate them.

VI. Find out word combinations for the description of the principle upon which all change-speed gears work.

VII. Ask your group mates 5 questions on the text.

VIII. Speak about the function of the gearbox.

IX. Render the text in Ukrainian.

STEP 3

TEXT A. BODY

PRE-TEXT EXERCISES

I. Translate the following international words:

design, components, vibration, passengers, accessories, economy, panel, accidents.

II. Say what meanings of the following words you know:

body, nuts, power.

III. Translate the following words. Pay attention to their structure:

streamlining, pressed-steel, reinforcing, headlining, rubber-insulated.

IV. Read and memorize:

1. **occupant** – пасажир
2. **truck** – вантажний автомобіль
3. **nut** – гайка
4. **insulate** – ізолювати
5. **rubber** – каучук, гума
6. **washer** – шайба, кільцева прокладка
7. **shim** – прокладка
8. **overcome** – приборкати
9. **weld** – зварювати
10. **reinforce** – посилювати

V. Read and translate the text:

BODY

The body is designed to contain and protect not only the engine and other car components but it provides protection to the occupants from wind, dust, cold and rain as well (and to goods in the case of trucks).

The car body is attached to the frame by numerous nuts and bolts, all the bolts insulated with rubber washers or shims to prevent the transfer of vibration and noise from the frame to the body.

The body is designed to contain and protect the engine and accessories, as well as the passengers. In addition it is shaped to reduce the resistance to the air as it moves forward. This shaping of the car to reduce air resistance is called streamlining.

To streamline a car means to shape it in such a manner that it offers less resistance to the passage of the body through air. As car speed increases the resistance of the air also increases. The air resistance increases approximately as the cub of the car speed. Thus, as the car speed increases, a

larger and larger part of the total driving power is being used to overcome the effects of air resistance. Streamlining helps to reduce this air resistance so that greater power economy is achieved at higher speed.

The car body is made up of number of pressed-steel panels, which are welded together to form the complete body. Reinforcing brackets are welded to the body to attach doors, trim, instrument panel, hood, trunk lid, headlining and so on. In case of accidents, panel can be replaced if they are so badly damaged that they cannot be straightened.

The body in most cases is made up of a basic framework of rigid members onto which are fastened metal panels. It is usually supported on the frame by the rubber-insulated bolts that prevent vibration and noise from travelling to the car body and hence to the passengers.

TEXT-BASED ASSIGNMENTS

LEXICAL EXERCISES

I. Match the two columns:

A	B
1 to move	a) чисельні
2 shaping	b) швидкість
3 numerous	c) вирівнювати
4 forward	d) рухатися
5 goods	e) повітря
6 speed	f) запобігати
7 total	g) форма
8 air	h) вперед
9 to straighten	i) загальний
10 to prevent	j) товари

II. Find synonyms:

A	B
1. to design	a) passengers
2. components	b) to low
3. occupants	c) to suggest
4. trucks	d) to construct
5. to reduce	e) main
6. to offer	f) lorries
7. basic	g) parts

III. Give English equivalents:

проекувати, захищати, забезпечити, прикріплювати, ізолювати, вміщати, складатися з, збільшувати, закріплювати, зварювати, замінити, допомагати, зменшити, надавати форму, надати обтічну форму.

IV. Match the words from column A and B to make word-combinations:

A	B
1. to provide	a) body
2. to be attached	b) washers
3. to prevent	c) protection
4. car	d) the resistance
5. rubber	e) speed
6. to reduce	f) framework
7. driving	g) members

- | | |
|-----------|------------------------|
| 8. higher | h) vibration and noise |
| 9. basic | i) power |
| 10. rigid | j) to the frame |

V. Translate the word-combinations with the key word

– “**body**”: a car body, to design a body, to offer less resistance to the passage of the body through air, to form the complete body, to be welded to the body, the body in most cases.

VI. Complete the following sentences:

1. The body is designed to protect... .
2. The car body is attached to... .
3. To streamline a car means... .
4. The air resistance increases... .
5. Streamlining helps... .
6. The car body is made up of... .
7. In case of accident panels... .

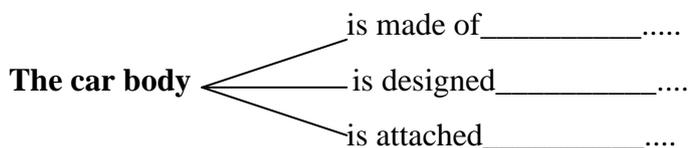
VII. Correct the statements if necessary:

1. The car body is one of the basic car components.
2. The body is aimed to protect the engine.
3. The car body is attached to wheels.
4. Streamlining reduces air resistance.
5. The car body is made of a number pressed-steel panels welded together to form the complete body.
6. In case of accident panels can not be replaced.
7. Reinforcing brackets are welded to the body to attach doors, trim, instrument panels, hood and other elements.

VIII. Answer the questions:

1. What is the function of a car body?
2. How is the car body designed?
3. What is the body attached to?
4. What is streamlining?
5. What streamlining reduces?

IX. Fill in the scheme:



X. Define what sentences do not belong to the text:

1. The automobile is provided with four or five changes of gears. 2. The body is designed to contain and protect not only the engine and other car components but it provides protection to the occupants from wind, dust, cold and rain as well (and to goods in the case of trucks). 3. The body in most cases is made up of a basic framework of rigid members onto which are fastened metal panels. 4. These gears are contained in a gearbox usually placed at the back of the clutch. 5. Streamlining helps to reduce this air resistance so that greater power economy is achieved at higher speed. 6. Most automobile engines have six or eight cylinders, although some four-, twelve-, and sixteen-cylinder engines are used. 7. Car body is made up of number of pressed-steel panels, which are welded together to form the complete body. 8. The body is designed to contain and protect the engine and accessories, as well as the passengers. 9. The engine is the source of power that makes the car move. 10. The clutch shaft which is part of the transmission is designed to fit into this hub and to be held and turned thereby.

XI. Translate the following sentences into English:

1. Корпус автомобіля вважається одним з найважливіших компонентів автомобіля.
2. Основне призначення корпусу полягає у захисті деталей автомобіля, а також пасажирів від

вітру, бруду, холоду та дощу. 3. Корпус автомобіля прикріплюється до рами за допомогою багаточисельних гайок та болтів. 4. Усі болти ізольовані за допомогою гумових шайб або прокладок для запобігання прониканню вібрації й шуму від рами до корпусу. 5. Зовнішній вигляд автомобілів роблять обтічним, щоб зменшити опір повітря. 6. Корпус автомобіля складається зі зварних сталевих панелей. 7. У разі аварії панелі можуть бути замінені, якщо вони були сильно пошкоджені й немає можливості їх вирівняти.

GRAMMAR EXERCISES

(Grammar Revision: Дієслово “to do”)

XII. Translate the following sentences. Comment on the functions of the verb “to do”:

1. The body doesn't only protect the engine and other car components. 2. Does the body protect the engine and accessories? 3. As car speed increased the resistance of the air also increased, didn't it? 4. Automotive engineers could do it at the laboratory. 5. Engineer-mechanics have already done all the necessary work. 6. Cross members don't reinforce the frame.

XIII. Complete the questions with “do”, “does”, “did”. Give affirmative and negative short answers:

*Model: A: Does the automobile consist of four main components?
B: Yes, it does / No, it doesn't.*

1. ... the body protect the engine and accessories? 2. ... vehicle makers do this work yesterday? 3. ... streamlining help to reduce this air resistance? 4. ... it offer less resistance to the passage of the body through air? 5. ... the resistance of the air increase? 6. ... cross members reinforce the frame?

XIV. Choose the correct negative form in brackets:

1. Cross members (doesn't provide/don't provide) support for the engine and wheels. 2. The spring assembly (doesn't act/don't act) as a flexible beam. 3. The director of the Patent office (didn't do/don't do) this work yesterday. 4. This shaping of the car (doesn't reduce/don't reduce) air resistance. 5. This frame (didn't provide/don't provide) support for the engine, body, wheels and power-train members. 6. The spring (don't absorb/doesn't absorb) road shocks to a certain extent.

XV. Correct the statements if necessary. Comment on the use of the verb “to do”:

1. As you know the air resistance don't increase. 2. Auto-designers did everything in time. 3. This don't provide protection to the occupants from wind, dust, cold and rein. 4. The car speed increases, don't they? 5. Does streamlining help to reduce the air resistance? 6. The rubber don't absorb vibration and engine noise.

CONVERSATIONAL PRACTICE

XVI. Comment on the following joke:

– “What part of the car causes the most accidents?”
– “The nut that holds the wheel”.

WRITTEN PRACTICE

XVII. Give your arguments for or against the following statements in written form:

1. Car body is said to be one of the basic car components.
2. Shaping of the car must be streamlined.

TEXT B. FRAME. SPRINGS

Frame. The frame is the structural centre of any vehicle as it provides support for the engine, body, wheels and power-train members. It is usually made of U-shaped or channel sections carefully shaped and then welded or riveted together. Cross members reinforce the frame and also provide support for the engine and wheels. The frame is extremely rigid, and strong so that it can withstand the shock blows, twists, vibrations, and other strains to which it is put on the road.

The engine is attached to the frame in three or four points. Noise and some vibration are inherent in engine operation. To prevent this noise and vibration from passing to the frame and from there to the occupants of the car, the engine is insulated from the frame by some form of rubber pad or washer at each point of support. Engine mounting lugs are supported in the rubber and the mounting bolts pass through these rubber mountings so that there is no metal-to-metal contact. As a result, the rubber absorbs vibration and engine noise so that they are not carried to the frame.

Springs. The weight of the car is transmitted to the axles and wheels by springs. The springs absorb road shocks to a certain extent as the wheels encounter holes or bumps and prevent, to a large extent, any consequent jarring action or up-and-down motion from being carried through the frame and body. Springs may be of the leaf type or of the coil type. The coil spring is a heavy steel coil.

The leaf spring has been made in a number of forms, but the one that has been most commonly used is the semielliptical type. The leaf spring is made up of a series of leaves, of graduated length, one on top of another. The spring assembly acts as a flexible beam and is usually fastened at the two ends to the car frame and at the centre to the wheel axle.

Both types of springs coil and leaf are usually insulated mechanically from the frame by means of rubber bushing and pads. This prevents road vibration from being transmitted to the frame and body.

EXERCISES

I. Read the text and give the main idea of it.

II. Write down the key words and word combinations from the text.

III. Comprehension questions:

1. What does a frame provide?
2. How is a frame usually shaped?
3. What can a frame withstand?
4. What is the function of springs?
5. What types can springs be of?

IV. Give the situation from the text in which the following words and word combinations are used:

a structural centre, cross members, to reinforce, to be extremely rigid and strong, to withdraw smth.

V. Explain the difference between the coil spring and the leaf one.

VI. Comment on the following statements:

1. The frame is the structural centre of any vehicle.
2. Springs are considered to be one of the main elements of the chassis.

VII. Prepare to speak on the following topics:

- the function of the frame
- measures preventing noise and vibration from passing to the frame
- the purpose of springs
- types of springs

STEP 4

TEXT A. THE STEERING SYSTEM

PRE-TEXT EXERCISES

I. Translate the following international words:

system, motor, control, action, comfort, vertical.

II. Consult the dictionary and give all meanings of the following words:

a button, solid, light, a jacket, a boss, a spring, a column.

III. Read and memorize:

1. **steer** – рульовий механізм
2. **gear** – пристрій, привід, зубчасте зачеплення
3. **lever** – важіль, рукоятка
4. **horn** – рупор
5. **clamp** – затискач, лещата, скоба, хомут
6. **cowl** – капот, ковпак, дефлектор, розтруб, кожух
7. **housing** – кожух, корпус, картер (двигуна)
8. **arm** – плече, важіль
9. **linkage** – зчеплення, з'єднання, важільний механізм
10. **knuckle** – шарнір, кулак, палець

IV. Read and translate the text:

THE STEERING SYSTEM

Motor vehicles are steered by means of hand wheels, the wheel being secured to the upper end of a steering shaft at its lower end carries the steering gear proper. Control levers are no longer used on the steering wheel, and the only fitting now mounted is a horn button or horn ring which permits of using a solid steering shaft. The steering shaft usually is surrounded by a light tube or jacket which sometimes is clamped both in a boss on the steering-gear housing and in a bracket secured to the cowl and sometimes is supported by the cowl only. The assembly of steering shaft and tube is referred to as the steering column.

The steering gear which reduces the angular motion imparted to the steering wheel is located at the bottom of the column in a cast housing mounted on the frame of the vehicle. A shaft protruding from this housing carries a steering arm, which connects by a linkage to the two knuckle arms. As the steering-arm is spring-suspended while the knuckle arms are not this linkage must be so arranged that it is not influenced by spring action.

The steering column is always mounted on the car at an angle to the vertical, for comfort in driving. The proper inclination of the column, of course, is effected not only by considerations of driver comfort but also by the location of the steering gear on the frame which must be such that the steering linkage can be properly worked out, preferably without resort to the use of curved or bent links.

TEXT – BASED ASSIGNMENTS

LEXICAL EXERCISES

I. Look through the text, write down special terms and group them into 3 columns:

a) adjectives, b) nouns, c) verbs.

II. Give Ukrainian equivalents:

to be steered by means of, control levers, a horn button, a light tube, to be secured to the cowl, the assembly of steering shaft, to reduce the angular motion, a spring action, to be mounted on the car at an angle to the vertical.

III. Read the text again, find the word-combinations with the key words “steering”, “a wheel”, “a shaft” and translate them.

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

a vehicle – a car – an automobile – a truck – a lorry

V. Choose the correct word in brackets:

1. Motor vehicles are steered by means of (foot/hand) wheels. 2. Control levers are (no longer used/used) on the steering wheel. 3. The assembly of steering (wheel/shaft) is surrounded by a light tube or jacket. 4. The steering gear (reduces/raises) the angular motion. 5. The steering column is (always/seldom) mounted on the car.

VI. Translate the following word combinations into English and define which of them are not mentioned in the text: розбризкувати мастила, підтікання палива, автотранспортні засоби, рульовий механізм, створити тиск, свічка запалювання, рульовий механізм, рульові колеса, коливаючий важіль, розподільний вал, кулачковий вал, дросельна заслінка.

VII. Answer the questions:

1. How are motor vehicles steered by?
2. Are control levers used on the steering wheel?
3. What is the steering shaft surrounded by?
4. What is a steering column?
5. What reduces the angular motor?
6. Is the steering arm spring-suspended?
7. How is the steering column mounted?

VIII. Choose the correct continuation:

- | | |
|---|--|
| 1. Motor vehicles are steered | a) the assembly of steering shaft and tube |
| 2. The steering shaft usually is surrounded | b) on the car at an angle to the vertical |
| 3. The steering column is | c) spring-suspended |
| 4. The steering gear | d) by means of hand wheels |
| 5. The steering column is always mounted to the use of curved or bent links | e) properly worked out preferably without resort |
| 6. The steering arm is | f) reduces the angular motion imparted to the steering wheel |
| 7. The steering linkage can be | g) by a light tube or jacket |

GRAMMAR EXERCISES (Grammar Revision: Займенник)

IX. Use pronouns instead of the nouns:

1. Motor vehicles are steered by means of... (hand wheels). 2. The steering column is always mounted on ... (the car) at an angle to the vertical. 3. The steering gear should be to a certain degree irreversible, so that shocks will not be transmitted into... (the driver's) hands. 4. The primary object of the gear is to multiply the turning effect impressed on the wheel by... (the driver). 5. If ... (gears) are in neutral position, the power of the engine will end at the end of the secondary shaft of transmission.

X. Complete the following sentences translating the words in brackets into English:

1. (Де?) have steering gears been occasionally used? 2. (Які?) fundamental types of mechanism are there? 3. (Куди?) will shocks not be transmitted into? 4. (Хто?) can steer the vehicle without exerting too much physical effort? 5. (Чому?) have modern steering gears been refined?

XI. Give short negative answers to the questions using the pronouns *nothing, nowhere, nobody, neither*:

1. What is used on the steering wheel? 2. Where is the steering column always mounted? 3. Who can steer the vehicle without exerting too much physical effort? 4. Which of these light vehicles have steering gears been occasionally used in? 5. What is based on the same types of mechanism?

XII. Fill in the blanks using the pronouns *he, they, them, its, each other*:

1. The wheel being secured to the upper end of a steering shaft at ... lower end carries the steering gear proper. 2. When the two parts are separated, they are independent of ... and the engine can run without moving the car. 3. The primary object of the gear is to multiply the turning effect impressed on the wheel by the driver, so that ... can steer the vehicle without exerting too much effort. 4. Modern steering gears have been refined with a view to reducing friction and the effort required to operate 5. ... comprised either a pinion and rack or a bevel pinion and sector.

XIII. Define the types of the italicized pronouns:

1. There are mechanisms *that* are much more efficient. 2. Most of the earlier steering gears comprised either one or the other of *these* mechanisms. 3. Modern steering gears also are based on *these* same types of mechanism. 4. The steering shaft usually is surrounded by a light tube or jacket *which* is clamped in a boss on the steering-gear housing. 5. A shaft protruding from *this* housing carries a steering arm.

CONVERSATIONAL PRACTICE

XIV. Say whether you agree or disagree with the views expressed in the text. Give your arguments.

XV. Speak on:

- the steering shaft
- the steering gear
- the steering column

WRITTEN PRACTICE

XVI. Write down arguments for the necessity of having a steering system by any vehicle.

TEXT B.

STEERING GEAR REQUIREMENTS. TYPES OF STEERING GEAR

Steering gear requirements. The primary object of the gear is to multiply the turning effect impressed on the wheel by the driver, so that he can steer the vehicle without exerting too much physical effort. Then, the steering gear should be to a certain degree irreversible or back-locking, so that shocks sustained by the road wheels will not be transmitted into the driver's hands. These two requirements already conflict in a degree, for the more friction there is in the steering gear, the better the shocks are absorbed, while, on the other hand, with a great deal of friction in the gear it is difficult to operate it. Fortunately there are mechanisms that are much more efficient when transmitting motion in one direction than when transmitting it in the opposite direction and this difficulty, therefore, can be circumvented.

Types of steering gear. In very light vehicles (cycle cars and middle cars) steering gears have been used occasionally which, while they reduced the motion of the steering wheel, did not give a back-locking effect. They comprised either a pinion and rack or a bevel pinion and sector. For standard cars capable of high speeds the self-locking feature is essential to safety. There are two fundamental types of mechanism that give this self-locking effect, viz., the worm and worm wheel (or worm-wheel sector) and the screw and nut, and most of the earlier steering gears comprised either one or the other of these mechanisms. Modern steering gears also are based on these same types of mechanism, but have been refined with a view to reducing friction and the effort required to operate them. A sufficient degree of irreversibility is obtained by using a high reduction ratio. In the newer steering mechanisms sliding contact is replaced by rolling contact wherever practical.

EXERCISES

I. Read the text and find the key words and word-combinations in every passage.

II. Group terms from the text into 3 columns and translate them consulting the dictionary:

Adjective-terms	Noun-terms	Verb-terms

III. Comprehension questions:

1. What is the primary object of the gear?
2. What are steering gear requirements?
3. What are light vehicles?
4. What is essential to safety for standard cars capable of high speeds?
5. How is a sufficient degree of irreversibility obtained?

IV. Speak on:

- the steering gear requirements
- types of steering gear

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 ...

REVISION

I. Match the two columns:

- | | |
|----------|----------------------|
| A | B |
| 1. frame | a) ходова частина |
| 2. bolt | b) рульовий механізм |
| 3. dowel | c) привід |

4. transmission	d) коробка передач
5. gear	e) шарнір, палиць
6. shaft	f) обід
7. revolutions	g) рама
8. shim	h) гайка
9. cowl	i) болт
10. body	j) пружина
11. pinion	к) двигун
12. engine	l) капот, ковпак
13. knuckle	m) шпонка
14. spring	n) важіль
15. nut	o) оберти
16. rim	p) вал, вісь
17. clutch	q) корпус
18. lever	r) шестірня
19. steering	s) зчеплення
20. gearbox	t) прокладка

II. Give English equivalents:

горіти, ізолювати, рухатися, випаровуватися, стискати, закріпити, припасувати, вирівнювати, зварювати, зменшити, завершувати, змінювати, мати тенденцію, закріпити болтом, проектувати, повертати, забезпечити, замінити, надавати форму.

III. Give the meanings of the following words and illustrate them with your own examples:

body, power, plant, revolution, ring, plate, spring, nut.

IV. Explain the meaning of the following correlated terms and use them in phrases of your own:

- to complete – to finish – to graduate from
- to fix – to bolt – to attach – to mount

V. Translate the word combinations with the key words:

- “**body**”: a car body, to design a body, to offer less resistance to the passage of the body through air, to form the complete body, to be welded to the body, the body in most cases;
- “**clutch**”: the clutch driven plate, at the centre of the clutch plate, the clutch shaft, the clutch plate;
- “**plate**”: the driven plate of the clutch, the driven plate, the pressure plate, the pressure plate ring, lining of driven plate;
- “**flywheel**”: the ring gear of the flywheel, next to the flywheel, to fit within the flywheel, to be bolted on the flywheel, on the rim of the flywheel.

VI. Match the parts in A with parts in B:

- | A | B |
|--------------------------------|--|
| 1. The engine is | a) protect the engine from wind, dust, cold and rain |
| 2. The car body is attached to | b) an engine or a power plant |
| 3. The clutch shaft is | c) the source of power that makes the car move |
| 4. Most vehicles are steered | d) the frame by numerous nuts and bolts |
| 5. The body is designed to | e) the driven plate of the clutch |

- 6. A machine that produces mechanical power or energy is
- 7. Next to the flywheel is
- f) a part of the transmission
- g) by means of hand wheels

VII. Ask your group mates questions on the basic components and units of the automobile (Fig. 15):

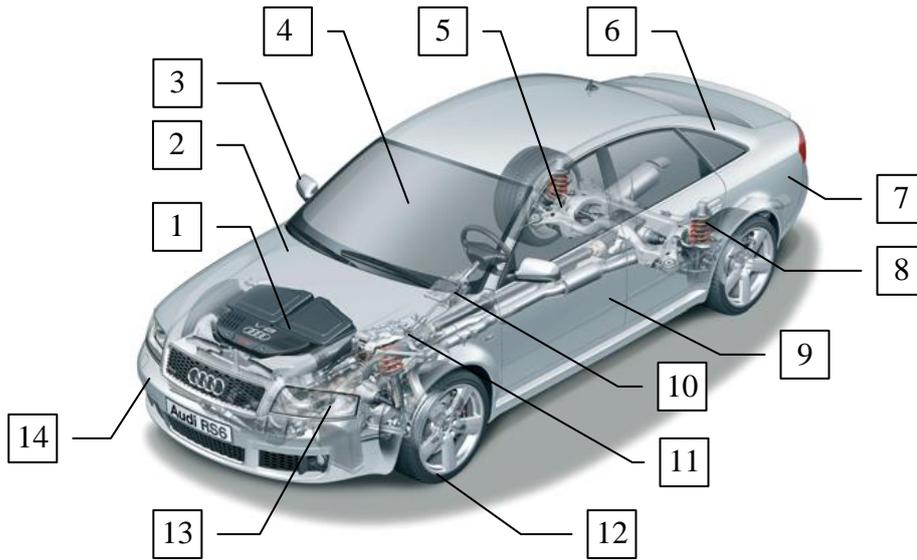


Fig.15. Basic components and units of the automobile

VIII. Fill in the table:

The function	of	the engine the clutch the transmission the gearbox the body the frame springs the steering system the steering gear	is to	
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IX. You are to deliver a lecture on the basic components of the automobile. What words and word combinations are you going to use? You may present them in the table.

X. Compare the front (Fig.16) and rear (Fig.17) suspensions:



Fig. 16. Front suspension



Fig. 17. Rear suspension

XI. Give your point of view as to the following statement: “There are no more or less important components of the automobile”.

XII. Change direct speech into indirect speech:

- Father: Are the tyres on the car all right?
- Son: “No, two of them are left”.

XIII. Comment on the following humorous situation:

- Are you sure you have shown me all the principal parts of this car?” asked the fair prospective purchaser.
- Yes, madam, all the main ones”, replied the dealer
- Well, then where is the depreciation? Tom told that was one of the biggest things about a car.”

XIV. Write down all components of the automobile you know in English. Compare your list with those of your group mates.