FUNCTIONS OF INTERNAL COMBUSTION ENGINES COMPONENTS

(Vidaus degimo variklių veikimas)

PADALOMOJI MEDŽIAGA MOKYTOJUI

Slide 3

Task 1: Analyse the main terms of fuel delivery system. Put a plus next to the known terms. Underline the unknown ones.

Mokiniai lygina jau vartotus praėjusioje pamokoje (intake, exhaust, valve) ir naujus (manifold, a fuel injector, inlet, a spark plug, a camshaft, a flywheel, an oil pan) terminus.

Fuel delivery system consists of – kuro padavimo sistemą sudaro:

- **An intake manifold** – įsiurbimo kolektorius
- **An exhaust manifold** – išmetimo kolektorius.
- **A fuel injector –** kuro purkštuvas
- **An inlet valve** – įsiurbimo vožtuvas
- **An exhaust valve** – išmetimo vožtuvas
- **A spark plug (a sparking plug)** – uždegimo žvakė
- **A camshaft** – kumštelinis (skirstymo) velenas
- **A flywheel** – smagratis
- **An oil pan** – karteris

Slide 4

Task 2: Use the following words to better understand the functions of the main parts of a 4-stroke engine.

Functions of the main parts of a 4-stroke engine

- **Mixture** – mišinys (air/fuel mixture)
- **To burn-burnt-burnt** (or burned-burned) – degti (burnt – sudegęs)
- **Gas (-es)** – dujos
- **To transfer** – perduoti, paskirstyti
- **Seal** – sandarinimas; tarpiklis
- **Bore** - cilindro skersmuo
- **Via** – per
- **Reciprocating** action – slenkamasis (slankiojamasis) veiksmas

- **Rotary** motion – sukamasis judesys
- **To store** – kaupti

Now we'll learn about the functions of the main parts of a four-stroke engine. Read the text and try to understand the functions of the engine explained in English.

Intake valve

It opens at the correct time to allow the air/fuel mixture into the cylinder.

Exhaust valve

It opens at the correct time to allow the burnt exhaust gases out of the cylinder.

Piston

It travels up and down the cylinder. The pressure on it is then transferred to the crankshaft. A gas tight seal is formed between it and cylinder bore by using rings.

Crankshaft

The pressure on the piston is transferred to it via the connecting rod, which converts the reciprocating action of the piston to rotary motion of it, which turns the attached flywheel.

Flywheel

It stores energy to keep the engine running during non-power strokes.

Slide 5

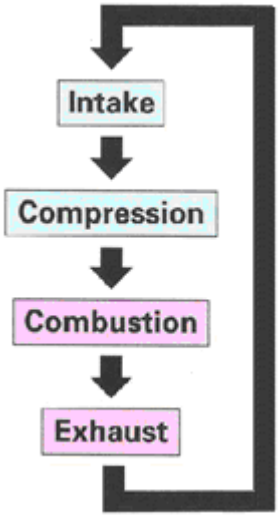
Task 3. Write the correct component according to the given function. One component is described twice. Which one?

When you try to do this exercise individually, you will remember the words better and more easily.

Component	Function
	A gas tight seal is formed between it and the cylinder bore.
	It opens at the correct time to allow the burnt exhaust gasses out of the cylinder.
	The pressure on the piston is transferred to it.
	It opens at the correct time to allow the air/fuel mixture into the cylinder.
	It moves up and down the cylinder and forms one portion of the combustion chamber.
	It stores energy to keep the engine running during non-power strokes.

Slide 6

You know that the spark ignition of a 4-stroke cycle engine requires 4 basic operations:



4 basic operations of a 4-stroke cycle engine:

(1) Intake stroke – įsiurbimas

(2) Compression stroke – suspaudimas

(3) Combustion (or power) stroke – degimas (darbo taktas)

(4) Exhaust stroke – išmetimas

Slide 7

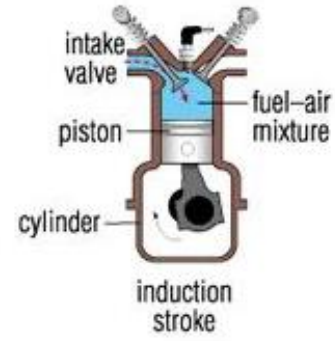
Task 4: Read the texts and examine the illustrations.

Task 5: Complete the table then check with the text.

Task 6. Fill in the gaps from the list of missing words. The words are given in the correct form.

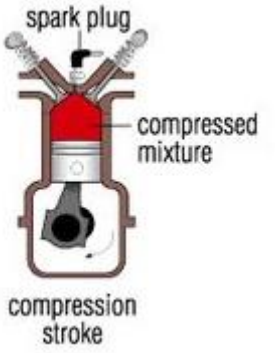
4 basic operations

The induction stroke



On the induction stroke, the inlet valve opens and the piston, moving down, creates a depression (this is a pressure which is less than atmospheric pressure), a mixture of air/fuel which has become vaporised is pushed into the cylinder via the open inlet valve by atmospheric pressure (a high pressure always flows to a low pressure trying to make pressure equal again).

The compression stroke

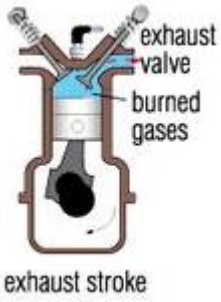


When the piston reaches its lowest limit of travel it then moves upwards, as this happens the inlet valve closes. The exhaust valve remains closed so the cylinder is sealed and nothing can get in or out. As the piston moves upwards the air/fuel mixture (a gas) is compressed to about one tenth its original volume. Thus the compression of the mixture increases the pressure and temperature in the cylinder.

The power stroke

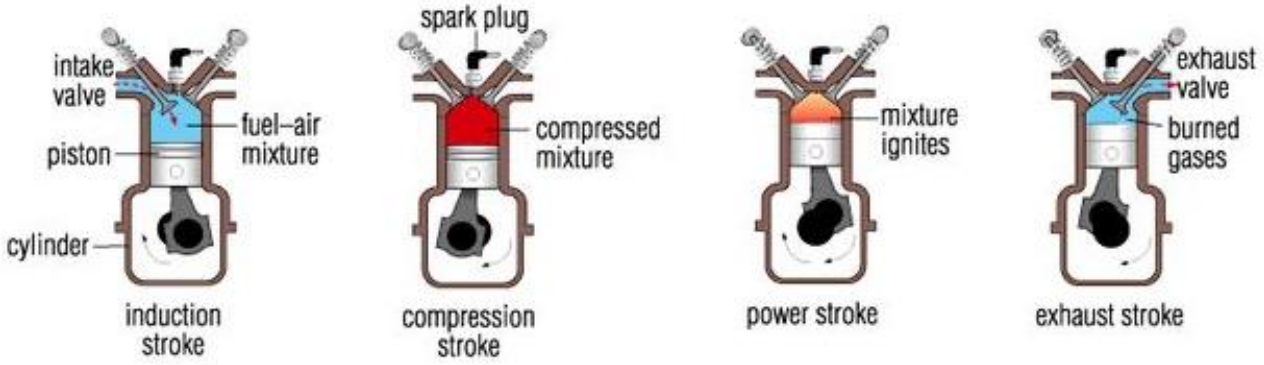
As the piston reaches the top of its travel on the compression stroke, a spark from the spark plug ignites the mixture, the mixture burns very rapidly and the cylinder pressure increases to approximately 40 times atmospheric pressure. All of this pressure against the piston forces it down the cylinder. The power is transmitted through the connecting rod to the crankshaft, which is rotated due to the force acting on it.

The exhaust stroke



As the piston reaches the bottom of its travel (stroke) the exhaust valve opens and the expanding gas escapes to the atmosphere via the exhaust valve port. The piston then starts to move up the cylinder forcing the remaining burnt gases out through the exhaust valve port. When the piston reaches the top of its travel, the exhaust valve closes and the inlet valve opens again. The four strokes continue to repeat during engine operation.

Summary



The inlet valve is open and the piston is moving down the cylinder

Both valves are closed and the piston is moving up the cylinder compressing the fuel/air mixture

The piston is forced down the cylinder due to the burning and expanding gas

The exhaust valve is open and the piston is moving up the cylinder

I think, you can answer the following questions: What stroke is described by the basic operation? Does piston travel up and down in this operation? Is intake valve open or closed? Is the exhaust valve open or closed during this operation?

Please, try to complete the table:

Stroke	**Piston travel**	**Basic operations**	**Intake valve**	**Exhaust valve**
Induction	Down	Intake air/fuel is enters the cylinder from the atmosphere.	Open	Closed
Compression	Up	The intake of air/fuel is compressed.	Closed	Closed
Power	Down	The compressed air/fuel is ignited.	Closed	Closed
Exhaust	Up	The burnt mixture (exhaust) is discharged from the cylinder to the atmosphere.	Closed	Open

Now do **Task 6. Fill in the gaps from the list of missing words. The words are given in the correct form.**

upwards	open	power
temperature	opens	exhaust
top	closes	four-strokes
bottom	ignites	pressure
compression	compressed	exhaust valve
up	vaporised	piston
increases	rotated	inlet valve

The induction stroke

On the induction stroke, the inlet valve ___*opens*___ and the ___*piston*_, moving down, creates a depression (this is a pressure which is less than atmospheric pressure), mixture of air/fuel, which has become __*vaporised*_, is pushed into the cylinder via the open __*inlet valve*__ by atmospheric pressure (a high pressure always flows to a low pressure trying to make pressure equal again).

The compression stroke

When the piston reaches its lowest limit of travel it then moves __*upwards*__ as this happens the inlet valve __*closes*_ The exhaust valve remains closed, so the cylinder is sealed, nothing can get out or in. As the piston moves upward the air/fuel mixture (a gas) is __*compressed*__ to about one tenth its original volume. Thus the compression of the mixture increases the __*pressure*___ and __*temperature*__ in the cylinder.

The power stroke

As the piston reaches the __*top*__ of its travel on the __*compression*___ stroke, a spark from the spark plug __*ignites*__ the mixture, the mixture burns very rapidly and the cylinder pressure __*increases*__ to approximately 40 times atmospheric pressure. All of this pressure acting against the piston forces it down the cylinder. The __*power*__ is transmitted through the connecting rod to the crankshaft, which is __*rotated*__ due to the force acting on it.

The exhaust stroke

As the piston reaches the __*bottom*___ of its travel (stroke) the __*exhaust*__ valve opens, the expanding gas escapes to atmosphere via the exhaust valve port, the piston then starts to move __*up*__ the cylinder forcing the remaining burnt gases out through the exhaust valve port, when the piston reaches the top of its travel the __*exhaust valve*___ closes and the inlet valve opens again, the __*four-strokes*__ continue to repeat during engine operation.

Slide 8

Listen and watch how 4-stroke engines work. Before watching, look through the list of the following words, they will help you to better understand the basic operations of a 4-stroke cycle engine:

Depression – išretėjimas (pvz.: oro);

To vaporise – virsti garais

Upwards – į viršų

Downwards - žemyn

RPM – **revolution per minute –** apsisukimai per minutę

Rotations - apsisukimai

Smoothly – sklandžiai, lygiai

Quietly - tyliai

Reliably - patikimai

To ignite - uždegti

(Rodoma animacija apie keturtakčio variklio darbo taktus)

How 4-Stroke Engines Work:

http://www.youtube.com/watch?v=P3tq3XmKx_Q

Slide 9 - HOMEWORK

- **Read the text „The Basics. The 4 Stroke Diesel Cycle“. You will find the text at the following address:**
  http://www.marinediesels.info/Basics/the_4_stroke_engine_explanation.htm -
  Next lesson you will have to tell what new information you have found in the text, what was there that we didn't discuss in today's lesson.
- **Learn the active words.**

You did a great job. Thank you. Have a nice day!

PADALOMOJI MEDŽIAGA MOKINIAMS: ACTIVE WORDS

(1) An intake manifold – įsiurbimo kolektorius

(2) An exhaust manifold – išmetimo kolektorius.

(3) A fuel injector – kuro purkštuvas

(4) An inlet valve – įsiurbimo vožtuvas

(5) An exhaust valve – išmetimo vožtuvas

(6) A spark plug (a sparking plug) – uždegimo žvakė

(7) A camshaft – kumštelinis (skirstymo) velenas

(8) A flywheel – smagratis

(9) An oil pan – karteris

(10) **Mixture** – mišinys (air/fuel mixture)

(11) **To burn-burnt-burnt** (or burned-burned) – degti (burnt – sudegęs)

(12) **To transfer** – perduoti, paskirstyti

(13) **Seal** – sandarinimas; tarpiklis

(14) **Bore** - cilindro skersmuo

(15) **Via** – per

(16) **Reciprocating** action – slenkamasis (slankiojamasis) veiksmas

(17) **Rotary** motion – sukamasis judesys

(18) **To store** – kaupti

(19) **Intake stroke** – įsiurbimas

(20) **Compression stroke** – suspaudimas

(21) **Combustion (or power) stroke** – degimas (darbo taktas)

(22) **Exhaust stroke** – išmetimas

(23) **Depression** – išretėjimas (pvz.: oro);

(24) **To vaporise** – virsti garais

(25) **Upwards** – į viršų

(26) **Downwards** - žemyn

(27) **RPM** – **revolution per minute –** apsisukimai per minutę

(28) **Smoothly –** sklandžiai, lygiai

(29) **Quietly** - tyliai

(30) **Reliably** - patikimai