INTERNAL COMBUSTION ENGINES

STUDENT' WORKSHEET

Names:		Surnames:		Group:	Qualification
				Date:	

COMBUSTION ENGINES II
INTERNAL COMBUSTION ENGINES

INFORMATION ABOUT ACTIVITIES:

 **Individual activity**

 **Work in pairs**

 **Work in groups of three**

 **Work in groups of four**

PREVIOUS ACTIVITY (SELF-ASSESSMENT ACTIVITY)

 **Previous activity (*16 Points*)** To know your previous knowledge, choose the best answer for these questions. If the questions can have more than one possible answer (indicated) choose all of them. If it isn't indicated, and there is more than one correct answer, choose the best one). At the end of the activity, you will know the correct answers. Each correct answer: 1 point. If you don't find the response, don't worry, it's just to know your previous knowledge.

1. Which of the following internal combustion engines need the spark-plug to power the explosion? (More than one possible answer)
    a. Diesel cars.
    b. Petrol cars.
    c. Motorbike cars.
    d. Wind turbine engines.

2. If we compare a diesel engine and a petrol engine: (More than one possible answer)
    a. Diesel engine is stronger than petrol engine.
    b. Diesel engine consumes more fuel.
    c. Petrol engine has a better performance.
    d. Diesel engines use to be more resistant and harder than the petrol car.
    e. Petrol car usually accelerate faster than the diesel engine.
    f. Diesel car is a compressor-explosion engine and doesn't need spark-plug.
    g. Petrol car is an ignition-explosion engine and doesn't need spark-plug.
    h. Diesel car is an external combustion engine and petrol car is an internal combustion engine.
    i. Diesel engines use to produce more sulphur oxides than petrol cars.
    j. Petrol cars use to produce more environmental pollution than diesel cars.

3. An internal combustion engine could be: (More than one possible answer)
    a. A wind turbine.
    b. A solar cell.
    c. A steam engine.
    d. A car engine.
    e. A steam turbine.
    f. A turbofan (plane engine).

4. A gas turbine can be used in:
   a. Steam engines.
   b. Car engines.
   c. Diesel cars.
   d. Electric trains.
   e. Power stations to obtain electricity.

5. The power of a car: (More than one possible answer)
   a. Show us how quickly a work is done.
   b. Can be measured in H.P. (horse power)
   c. Is measured in J (Joules).
   d. Is the same as the energy developed by a car.
   e. Could be measured in w (watts).
   f. Is the product of energy per time.
   g. More power usually supposes more fuel consumption.
   h. Less power usually supposes more fuel consumption.
   i. A car with more power can accelerate faster to obtain a velocity than one with less power.

6. A plane usually has the engine in:
   a. Next to the pilot cabin.
   b. In the plane wings.
   c. In load zone.
   d. Next to the cabin crew seats.

CORRECT ANSWERS (each correct answer 1 point; some have more than one point. Maximum 13 points):

1: **b, c**

2. **a, d, e, f, l.**

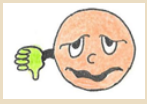
3. **d, f**

4. **e**

5 a, b, e, g, i

6 b

FINAL SCORE (PREVIOUS KNOWLEDGE)

			
Less than 3 correct answers	4-7correct answers	8-11 correct answers	12-16 correct answers
COULD BE BETTER	**SATISFACTORY**	**GOOD**	**YOU ARE AN COMBUSTION ENGINES EXPERT**

INTERNAL COMBUSTION ENGINES

Internal combustion engines have, the space where combustion reaction takes place, inside the engine itself. For example, in a petrol engine, combustion reaction takes place inside the engine. This means having quite smaller machines that external combustion engines, which facilitates the transport.

Internal combustion engines could be classified in two different groups; **piston engines** and **rotary engines**.

Piston engines use cylinders (where combustion reaction takes place) with a piston per cylinder. Pistons have an alternative linear movement (up-down).

Some piston engines need a spark plug to produce the fuel combustion; they are called **Spark-ignition engines**, such as the petrol cars. Others produce combustion reaction (spontaneously) by strong compression of the air and fuel mix, not needing the spark plug, they are called **Compression-ignition engines**, such as the diesel engines.

The number of the piston movements into the cylinder, to complete a thermodynamic cycle (stroke), should be four (**four-stroke engines** such as the petrol and de diesel cars) or two (**two-stroke engines** such as some motorbikes).

Rotary engines don't need pistons because the combustion reaction produce a rotary movement directly. **Wankel engine** is a rotary engine used in some cars. **Gas turbines** can be used in power stations and in jet engines.

EUROPE AND THE INTERNAL COMBUSTION ENGINES

The emergence of internal combustion engines took place thanks to European scientists and engineers, whose work allowed the World to be transformed by their inventions.

The first practical petrol engine (four-stroke petrol engine) was built in 1876 by the German Nicolaus August Otto, although there had been previous attempts by the Belgian engineer Étienne Lenoir, the German Siegfried Marcus, the Austrian Julius Hock and the American George Brayton.

The first commercial two-stroke engine involving cylinder compression is attributed to the Scottish Dugald Clerk who patented his design in 1881, and the German Karl Benz produced a two-stroke gas engine in 1879 patented in 1880. The first truly practical two-stroke engine is attributed to the British Alfred Angas Scott.

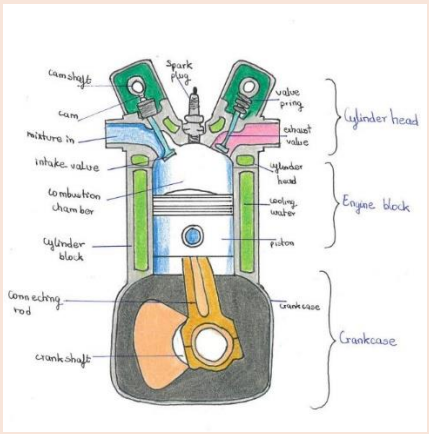
The first diesel four-stroke engine was invented by the German mechanical engineer Rudolf Diesel in 1893.

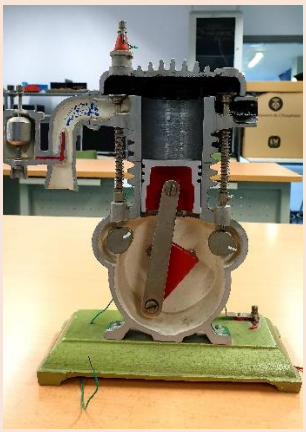
The Wankel rotary four-stroke engine was invented by the German mechanical engineer Felix Wankel and was patented in 1929.

In relation to jet engines, based on the idea of motion generation by directing a jet of fluid in the opposite direction, described in the 1st Century AD by the Greek mathematician Hero of Alexandria who invented a device (Aeolipile) propelled by squirting steam out of two opposing nozzles, the British engineer Frank Whittle, designed a jet engine that worked successfully in 1937. Previously, the French engineer Maxime Guillaume was granted a patent for simple jet engine. At the same time that Frank Whittle, the German physicist Hans von Ohain had hit on a similar design, allowing to achieve the first flight of a jet aircraft.

The engine in piston engines

The most important part in a car is the engine. In the following drawing the main parts of a **petrol** (spark-plug) engine are shown:





- The **engine block** is the largest part of an engine where it provides protection. Inside the engine block there are the cylinders (where the combustion reaction takes place and where the piston is moving up-and-down) and the mechanisms that join the piston and the crankshaft.

 Cylinders in V Cylinders	 Cylinders in line	 Cylinders in opposite situation Tecnicas_3_.jpg (600×467) (motorgiga.com)

- The **cylinder head** is on the top of the engine block. Inside the cylinder heat there are the valves (through the inlet valve the combustible and the air enter the cylinder. Fumes are expelled through the exhaust valve. Each cylinder usually has two or four valves, with the same number of inlet valves and exhaust valves), and the spark plug (that is the piece that produces the spark needed to start the combustion reaction (in the petrol cars)). In both parts, the engine block and the cylinder head there are some water conductions used to cold the engine.

 Spark plug

- The **oil sump (crankcase)** is under the engine block. Inside this case there is oil used to lubricate the engine.

Activity 1 ***(15 Points)*** After reading the text: "The engine", do the activities below:

Some grammar help:

DEFINING				
…..	is (a) are was/were	place, person thing, concept device instrument, tool, designed, build	(where) (who) (which) (that)	…..

RELATION CAUSE-EFFECT. GIVING REASONS	**MAKING DESCRIPTIONS**
as a result because for example, for instance so that is why such as	Talking about … First of all, define what is that you are talking about and where it comes from: This is a … It comes from … Then describe its appearance, structure, etc: It has … It looks like … It has a ... It is made up of … It hasn't got … Describe the location: It is found in … Describe the function: … has the job of …-ing (verb ending in ing) … It also does …

GIVING OPINIONS
In my opinion … From my point of view … I think … I would answer …. I think so. I don't think so. I agree. I don't agree. I disagree. Give me a reason for that.

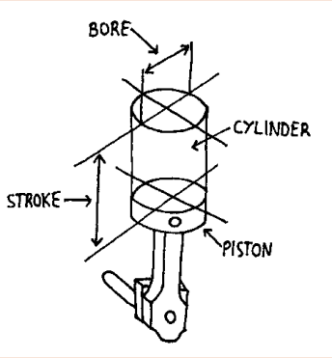
1. (6 Points) Write the name of six elements of a piston engine saying in which part of the engine (cylinder head, engine block or crankcase) each one is located.
2. (3 points) What happens inside a cylinder in a combustion reaction? (some help in: http://www.animatedengines.com)
3. (2 Points) What is the use of the spark plug in a piston engine?
4. (2 Points) In a 16V car that has 4 cylinders; how many valves does each cylinder have?
5. (2 Points) In your opinion, what is the use of water in an engine?

The engine cylinder volume

The **engine cylinder volume** is the total of all the volume cylinders in an engine. The Bore is the diameter of the circular chambers cut into the cylinder block, and the stroke is the length of the piston movement inside the cylinder.

One cylinder volume: $Vu = \frac{\pi \bullet bore^2}{4} \bullet stroke$

Usually bore and stroke are measured in cm, so that Vu is usually measured in cm^3 (cc).
The engine cylinder volume will be: $\mathbf{V_T = n \bullet Vu}$ (usually measured in cm^3 or cc), where **n** is the engine cylinder number.



Example: How to calculate a car engine cylinder volume:

Car: VW Golf 1.6
n: 4 cylinders.
Bore: 81 mm
Stroke: 77, 4 mm

To calculate Vu we have to solve the equation (*remember that bore and stroke should be expressed in cm*):

$$Vu = \frac{\pi \bullet bore^2}{4} \bullet stroke = \frac{\pi \bullet 8{,}1^2}{4} \bullet 7{,}74 = 398{,}84 cm^3$$

So that, the engine cylinder volume will be: $\mathbf{V_T = n \bullet Vu = 4 \bullet Vu = 4 \bullet 398,\ 84 = 1595,\ 36\ cm^3}$. For this reason, this car is sold such as **1,6 engine cylinder volume**. (VW Golf 1,6)

Activity 2 ***(16 Points)*** After reading the text: "The engine cylinder volume", do the activity below:

Find the engine cylinder volume of the following cars.

	CAR A	**CAR B**
n (cylinders number)	6	4
Bore (mm)	82,6	90
Stroke (mm)	87	80

ANSWERS:

CAR A: (5 Points) Vu =

(2 Points) V_T =

CAR B: (5 Points) Vu =

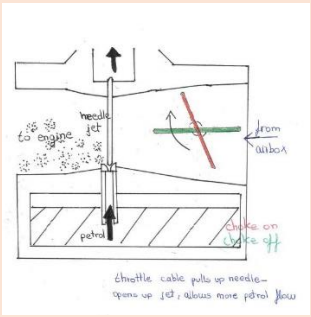
(2 Points) V_T =

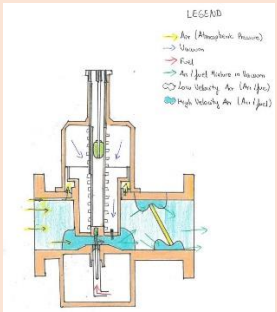
CAR A will be sold as (1 Point) … engine cylinder volume, and CAR B will be sold as (1 Point) … engine cylinder volume.

Mechanisms to put the combustible and air into the engine cylinder.

- The carburettor:

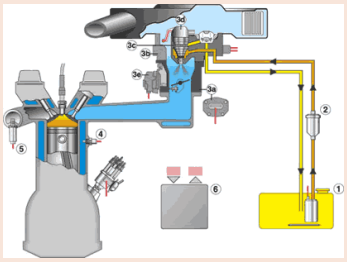
The carburettor is used to supply a mixture of air and vaporized petrol to the petrol engine. It is based on the 'Venturi' effect. Engines that have carburettors are called atmospheric engines because the atmospheric pressure pushes the air and combustible mixture. A diesel engine doesn't have a carburettor because air and the combustible aren't put into the engine at the same time. Their use is being reduced.





- Electronic injection

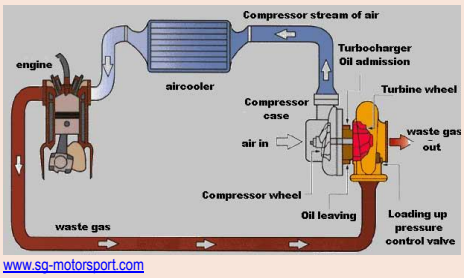
Nowadays, the most usually system is to put petrol and air into the engine. With electronic injection it is possible to achieve better performance. This system is controlled by an electronic circuit that puts the exact quantity of combustible into the engine, according to the power that is needed.



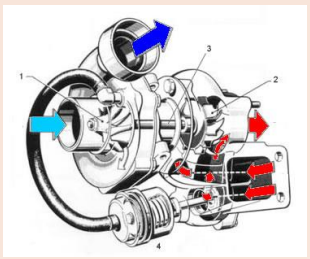
065168.1-lg.gif (412×307) (theautochannel.com)

- Turbo compressor (Turbo system)

In this system, combustible gases, which have a higher pressure than the atmosphere in the cylinder, are used to obtain more power from the engine.



www.sg-motorsport.com



turbo-esquema.jpg (374×310) (fullcustom.es)

 **Activity 3** ***(7 Points)*** True-false activity. Put a cross in the correct square. If the sentence is false, you have to correct it. Each correct answer 1 Point and each correction 1 Point.

	T	F
1. An engine that uses a carburettor is called an atmospheric engine.		
2. The electronic injection system uses more combustible than carburettor system.		
3. With the turbo compressor system, it is possible to achieve less power in an engine.		
4. Petrol and diesel engines use carburettors.		

Corrections:

1.
2.
3.
4.

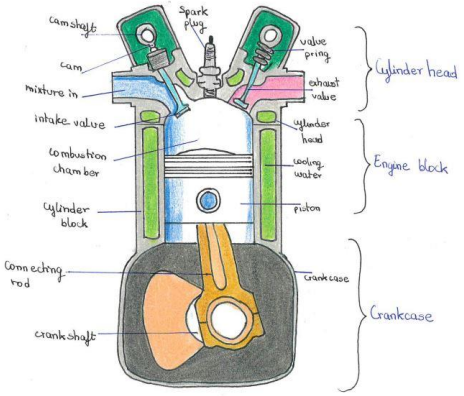
 **Activity 4** ***(49 Points)*** "Experts Jigsaw" activity. Teacher will make groups of three. One of you will be student A, another student B and the other student C. This group will be your main group. Choose a leader of the group. This leader must write down the answers to the final questions. You can find some simulations on the web pages added. Teacher will give you a text with some information about different piston combustion engines. This information **can't be showed** to your partners. Each of you will be an expert in a piston combustion engine. You have to share your information to answer the proposed questions.

STUDENT A

You have to understand how a petrol four-stroke works in order to explain it to the members of your original team. Discuss it with the members of your Student A team. You have to memorize the parts of the petrol four-stroke engine, the name of each stroke, and what happen in each stroke. You can take some notes about the aspects proposed before, underlined the key words, or/and drawing some pictures.

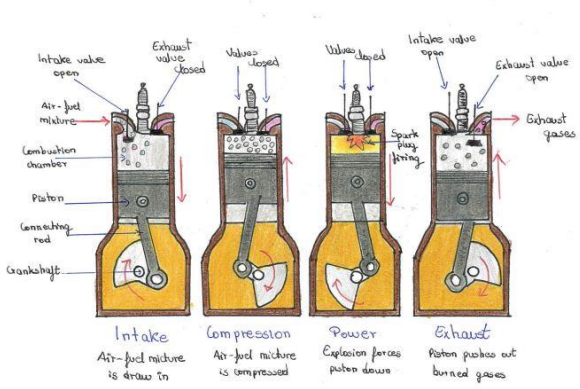
Petrol four-stroke engine

Four-stroke engine were designed by the German engineer Nikolaus Otto (1876). Follow the thermodynamic cycle with his name. A four-stroke engine completes the thermodynamic cycle in four movements of the piston (between the moment in which petrol come inside the cylinder and it is repeated this action, piston has four movements); for this reason, is called four-stroke engine. Use petrol as a combustible (to initiate the combustion process it is needed an air-fuel mixture). With a crankshaft and connecting rod system, the lineal movement is transformed in rotary motion. These engines are lightweight than Diesel engines.



Four-strokes: (You have the help of a draw)

1. **INTAKE STROKE**: Piston goes down, sucking a mixture of air and fuel into cylinder through the intake port. The intake valve then closes.
2. **COMPRESSION STROKE**: With both intake and exhaust valves closed, piston goes up, compressing fuel and air mixture. This heats mixture.
3. **POWER STROKE**: Spark from spark plug ignites mixture. Gases expand and force piston down.
4. **EXHAUST STROKES**: Piston rises again while the exhaust valve is open, pushing out remains of burned gases as exhaust fumes.



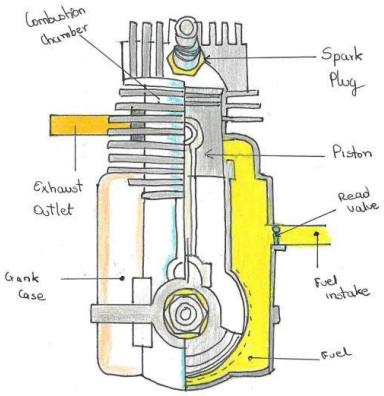
Go to this webpage to watch a simulation: http://auto.howstuffworks.com/engine1.htm or http://www.myrctoys.com/faqs/engine-diagrams-and-animations (in this last page you have to go to A 4 -Cycle engine and click on a picture) and http://www.animatedengines.com (search for your internal combustion engine).

STUDENT B

You have to understand how a two-stroke works in order to explain it to the members of your original team. Discuss it with the members of your Student B team. You have to memorize the parts of the two-stroke engine, the name of each stroke, and what happen in each stroke. You can take some notes about the aspects proposed before, underlined the key words, or/and drawing some pictures.

Two-stroke engine

Invention of the two-stroke cycle is attributed to Scottish engineer Dugald Clerk who invented the 2-stroke engine in 1878 and in 1881 patented his design. The two-stroke engines follow the Otto thermodynamic cycle as well, but this engine complete the cycle in two movements of the piston; for this reason, is called two-stroke engine. This is accomplished by using the beginning of the compression stroke and the end of the combustion stroke to perform simultaneously the intake and exhaust functions. Two-stroke engines require a specific oil to gas ratio. It is used in some motorbikes.



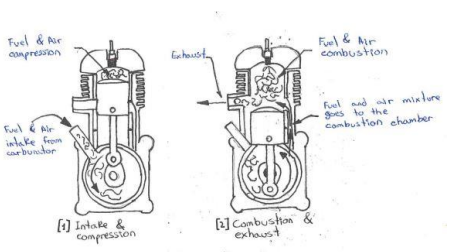
Two-strokes: (You have the help of a draw)

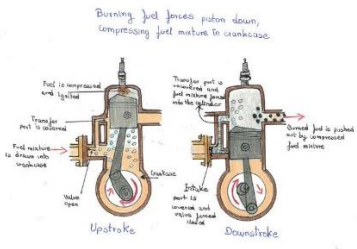
1. **INTAKE AND COMPRESSION:**

   Piston starts its movement from the bottom of the cylinder starting to go-up. The intake port is uncovered and the mixture of combustible and air is pushed to the crankcase where is pressurized by the piston movement. In its up movement, piston covered the exhaust port. When fuel and air in the cylinder have been compressed the spark plug fires the mixture ignites.

2. **COMBUSTION AND EXHAUST:**

   The resulting explosion drives the piston downward. As the piston approaches the bottom of its stroke, the exhaust port is uncovered. The pressure in the cylinder drives most the exhaust gases out of cylinder. Note that as the piston moves downward, it is compressing the air/fuel mixture in the crankcase.





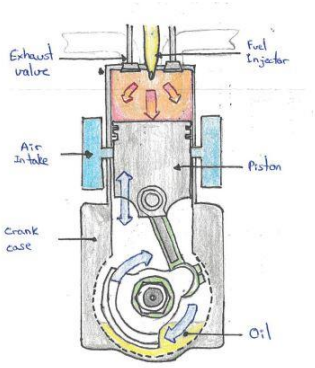
Go to this webpage to watch a simulation: http://science.howstuffworks.com/transport/engines-equipment/two-stroke2.htm or http://www.myrctoys.com/faqs/engine-diagrams-and-animations (in this last page you have to go to A 2 -Cycle engine and click on a picture) and http://www.animatedengines.com (search for your internal combustion engine).

STUDENT C

You have to understand how a diesel four-stroke works in order to explain it to the members of your original team. Discuss it with the members of your Student C team. You have to memorize the parts of the diesel four-stroke engine, the name of each stroke, and what happen in each stroke. You can take some notes about the aspects proposed before, underlined the key words, or/and drawing some pictures.

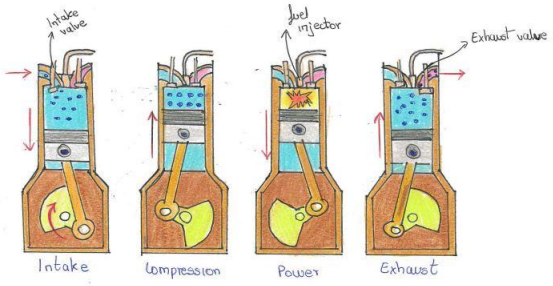
Diesel four-stroke engine

Diesel engine was designed by the German engineer Rudolf Diesel in 1897. Follow the thermodynamic cycle with his name (Diesel). Diesel engine is used mainly by larger vehicles and some trains, and in the last years is becoming more popular in private cars in Europe. Diesel engines work in a similar way to petrol engines, but at stroke one, only air is taken into the cylinder. This is compressed and heated to a very high temperature at stroke two. Diesel fuel is forced into the cylinder at stroke three, where it is so hot that the fuel burns without a spark. So, this kind of engines doesn't need spark plug. Diesel engines can be used for much more time than the petrol engines. Diesel engines have the highest thermal efficiency of any regular internal or external engine; the fuel is Gasoil. Diesel engines are noisier than petrol engines.



Four-strokes: (You have the help of a draw)

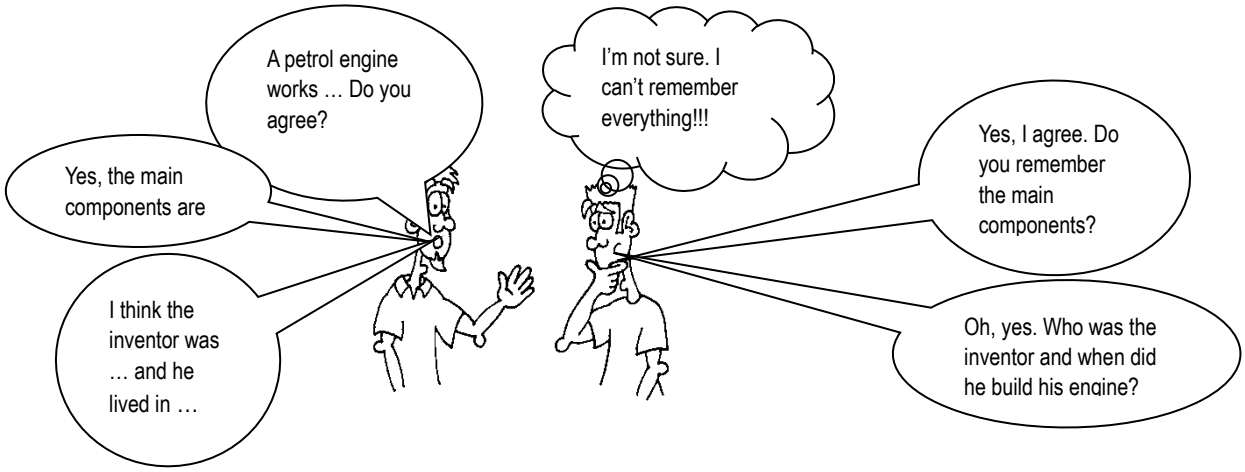
1. **INTAKE STROKE**: Piston goes down, sucking air into cylinder through the intake port. The intake valve then closes.
2. **COMPRESSION STROKE**: With both intake and exhaust valves closed, piston goes up, compressing the air. This heats the air.
3. **POWER STROKE**: As the piston reaches the top, fuel is injected at just the right moment and ignited with the hot air. Gases expand and force piston down.
4. **EXHAUST STROKES**: Piston rises again while the exhaust valve is open, pushing out remains of burned gases as exhaust fumes.



Go to any of these webpage to watch a simulation: http://auto.howstuffworks.com/diesel1.htm or http://www.myrctoys.com/faqs/engine-diagrams-and-animations (in this last page you have to go to Diesel engine and click on a picture) and http://www.animatedengines.com (search for your internal combustion engine).

With all the information, do next activities with your partners:

HELP GRAMMAR AND SPEAKING to do activity 4.



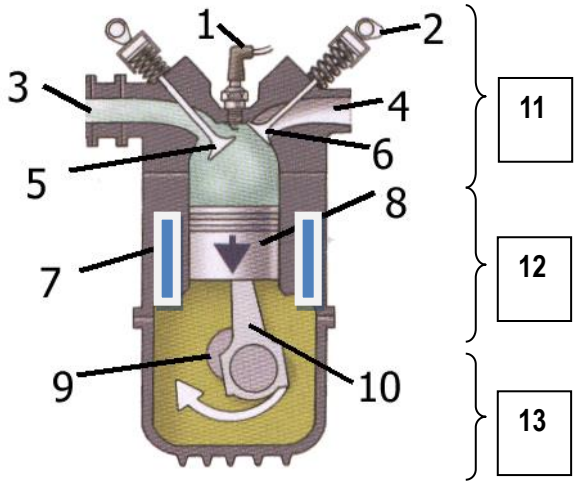
GIVING OPINIONS TO COMPARE ANSWERS
What do you think about…? What is your opinion about …? Why do/does/did …? What are your answers in ….? What have you written in …? In my opinion … From my point of view … I think … I would answer …. I think so. I don't think so. I agree. I don't agree. I disagree. Give me a reason for that.

DEFINING				
…..	is (a) are was/were	place, person thing, concept device instrument, tool, designed, build	(where) (who) (which) (that)	…..

RELATION CAUSE-EFFECT. GIVING REASONS	**COMPARING AND CONTRASTING (For differences)**
as a result because for example, for instance so that is why such as	in contrast compared with/in comparison with … is different from … (in that …) on the one hand/on the other hand however/otherwise … differs from … in respects: (firstly, secondly, finally,) from a different point of view/perspective

Question 1 ***(14 Points):***

1. What is the name of this piston engine? (1 Point) …….. Match a number with the words in the box below (13 Points):



Exhaust port	Crankshaft	Valve spring	Engine block	Piston	Cooling water
Spark plug	Intake port	Connecting rod	Crankcase	Cylinder head	Exhaust valve
Intake (Inlet) valve					

Question 2 ***(12 Points):***

Write the name of the four-stokes of a Diesel engine, and describe each one with your own words.

First stroke:

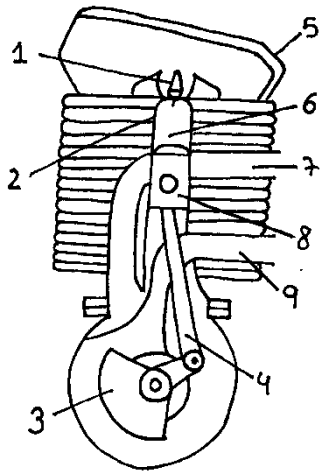
Second stroke:

Third stroke:

Fourth stroke:

Question 3 ***(10 Points):***

What is the name of this piston engine? (1 Point) ..... Match a number with the words in the box below (9 Points):



Spark plug	Cylinder head	Connecting rod	Piston	Crankshaft
Cylinder	Intake port	Combustion chamber	Exhaust port	

Question 4 ***(12 Points):***

Which is the use of the following components?

a) Spark plug:

b) Connecting rod:

c) Crankshaft:

d) Valves:

Activity 5 ***(20 Points)*** Write a composition (150 words) comparing the three different piston engines studied. (Advantages and disadvantages, differences, etc) **HELP**: You can use internet. Some pages (some interactive) where you can find some information are:

TEACHER: GIVE A MODEL TO STUDENTS, AND AFTER READING TAKE IT OUT.

https://www.youtube.com/watch?v=mRcFO7X8yP4

http://www.animatedengines.com

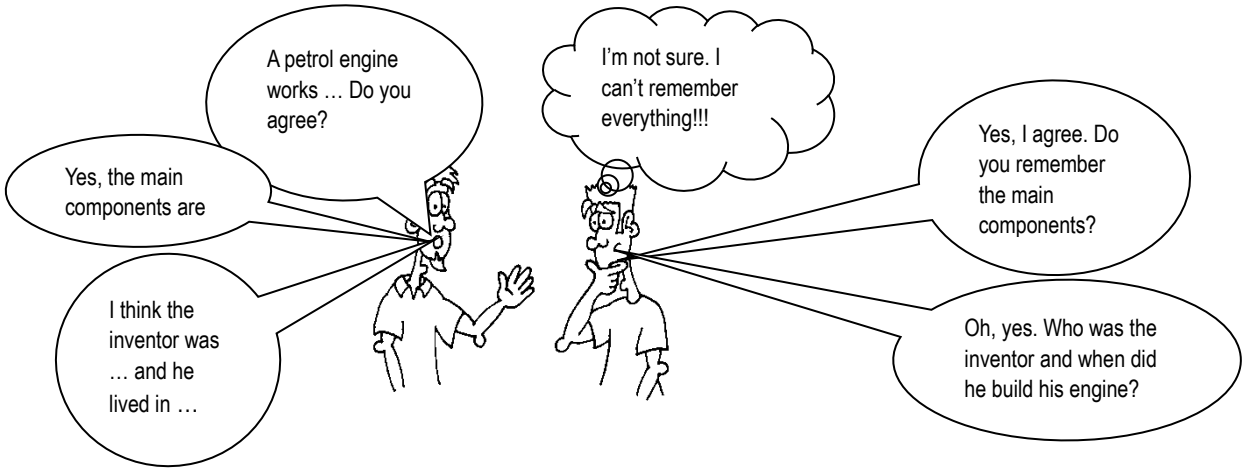
http://www.myrctoys.com/faqs/engine-diagrams-and-animations

http://www.cars.com/go/advice/intercar/ic_index.jsp

http://www.chooseindia.com/engineering/how-2-stroke-engines-work.htm

http://www.gm.com/corporate/responsibility/education/5-8/technology/ice_intro.jsp (In this website you have to go to interactive tour (in blue); it is possible to play some games (Mr. Stephens's Engine Shop is useful to distinguish different components in a car) or to know how to build a car.

HELP GRAMMAR AND SPEAKING to do activity 5.



DEFINING				
…..	is (a) are was/were	place, person thing, concept device instrument, tool, designed, build	(where) (who) (which) (that)	…..
RELATION CAUSE-EFFECT. GIVING REASONS as a result because for example, for instance so that is why such as		**COMPARING AND CONTRASTING (For differences)** in contrast compared with/in comparison with … is different from … (in that …) on the one hand/on the other hand however/otherwise … differs from … in respects: (firstly, secondly, finally,) from a different point of view/perspective		

GIVING OPINIONS TO COMPARE ANSWERS
What do you think about…?
What is your opinion about …?
Why do/does/did …?
What are your answers in ….?
What have you written in …?
In my opinion …
From my point of view …
I think …
I would answer ….
I think so.
I don't think so.
I agree.
I don't agree. I disagree.
Give me a reason for that.

COMPARATIVE TEXT MODEL: (Activity 5)

Buy a car: Toyota Corolla versus a BMW

When it comes to buying a car, an automobile, one has to decide which type of car to buy. The Toyota Corolla is a less luxurious than a BMW since its design is simple and does not have leather cushioning. With a price tag of 30.000 euros, the BMW is more expensive than a Toyota Corolla. With a gas mileage of 15 kilometres per litre vs. 8 kilometres per litre, the Toyota Corolla is more efficient than the BMW. In other words, you spend less money than on a BMW. However, the BMW is a sport car is which it can reach a speed of up to 200 kilometres, whereas the Toyota Corolla's maximum is 130. Thus, the BMW is an automobile with a greater velocity capacity than the Toyota Corolla. On the other hand, regarding car repairs, the cost repairing a Toyota Corolla are less expensive than a BWM. When it comes down to making a decision, factors such as, price (budget), features and consumer needs, it what will determine which car to buy.

By Assad Sikundr Malik

New combustion engines

Due to the environmental problems of air pollution caused by combustion engines, the European Union has considered replacing them with others that pollute less or encourage people to use these last ones. Nowadays we can find different possibilities. The more considered are:

- **Electric engines**: We are not going to talk about them, because they are not combustion engines.
- **Hydrogen engines**: They are rapidly evolving and are expected to be the combustion engines of the future. The hydrogen combustion reaction doesn't produce environmentally harmful gases. Nowadays they are quite expensive.

- **Gas engines**: They use natural gas (or any L.P.G. (liquified petroleum gas) such as propane, butane, etc.). Although they are fossil fuels, they pollute less than the usual fossil fuels (petrol and diesel) and they have a better performance (they have a higher calorific value).

- **Hybrid engines**: Hybrid engines use two different engines, one of them should be more environmentally friendly. We have different possibilities:

  - Engines that use a **petrol/diesel engine and a gas (natural gas, butane, propane, etc.) engine**. Natural gas engine pollutes less than the usual fossil fuels (petrol and diesel) and they have a better performance (they have a higher calorific value).

  - Engines that use a **petrol/diesel engine and electric engine**. These cars can use one or both engines simultaneously to get the desired power. We have two possibilities:

    - **HEV** engines (hybrid electric engine) that are powered by an internal combustion engine (petrol or diesel) in combination with one or more electric engines that use energy stored in batteries, that could be recharged while the car is running (with braking for example). These engines have a low electric autonomy and can't run with the electric engine in high velocities.

    - **PHEV** engines (plug-in electric vehicles), that are similar to HEV engines, but batteries can be recharged using a wall outlet or charging equipment. These engines allow to have an electric autonomy about 50 kilometres, and during this autonomy period you can arrive to the desired speed with the electric engine. The batteries could be recharged while the car is running (with braking for example) or by a wall outlet or charging equipment.

 **Activity 6** ***(10 Points)*** Compare gas engines, HEV engines and PHEV engines. Write the advantages and disadvantages of each one. (As a help, you can read the comparative text model given in the previous activity (5))

Some grammar help:

DEFINING				
…..	is (a) are was/were	place, person thing, concept device instrument, tool, designed, build	(where) (who) (which) (that)	…..
RELATION CAUSE-EFFECT. GIVING REASONS as a result because for example, for instance so that is why such as			**COMPARING AND CONTRASTING (For differences)** in contrast compared with/in comparison with … is different from … (in that …) on the one hand/on the other hand however/otherwise … differs from … in respects: (firstly, secondly, finally,) from a different point of view/perspective	

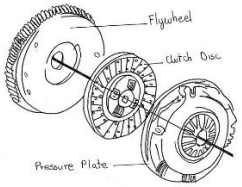
 **Activity 7** ***(20 Points)*** Search on the net for some information about hydrogen engines, hydrogen combustion reaction and hydrogen engine cars that you can buy now and their prices. Summarize the information and write a composition about it (150 words).

Some grammar help:

DEFINING				
…..	is (a) are was/were	place, person thing, concept device instrument, tool, designed, build	(where) (who) (which) (that)	…..
RELATION CAUSE-EFFECT. GIVING REASONS as a result because for example, for instance so that is why such as			**COMPARING AND CONTRASTING (For differences)** in contrast compared with/in comparison with … is different from … (in that …) on the one hand/on the other hand however/otherwise … differs from … in respects: (firstly, secondly, finally,) from a different point of view/perspective	

Activity 8 ***(29 Points)*** **Main components of a car**. Below are the definitions of the main components of a car. Label the car using the definitions. There are eleven additional definitions that don't appear in the drawing of the car. If you have any problems with the vocabulary, you can use the dictionary or search on the net, and build a glossary (list of words).

1) This mechanism allows you to connect and to disconnect, voluntarily or automatically, a conductor shaft and a conduit shaft. This mechanism is used to change gears (to change the speed):



2) This mechanism is an energy dissipater which allows the speed to be reduced:

3) Rotating object that contains pointed cams, which converts rotational motion to reciprocal motion (are used to open and close the engine valves):


4) This mechanism allows changing a gear. It can be manual or automatic:


Manual

Automatic

5) This case contains the lubrication oil (oil sump); it is located under the engine block:

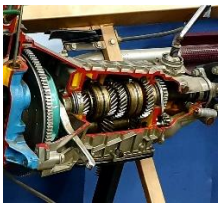
6) Belt that synchronizes the rotation of the crankshaft and the camshaft coordinating the opening and closing of the engine's valves:

7) This mechanism allows the car to run on the roads without lots of movement. The external part is called the tyre and is usually made of plastic (rubber) and has air inside:

8) Mechanical system of components that allows a vehicle to follow a desired course:

9) This mechanism is made up of two parts, a spring and a damper. The spring compresses and expands as the wheel goes over a bump:

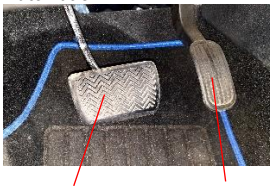
10) This mechanism is a system of gears that transmits an engine's power to the wheels. A series of shafts and gears converts the up-and-down motion of the pistons into a rotating motion used to turn the wheels of the car:



11) Devices located on the floor of the driver's side of the car, which allow to control the power and speed of the car. Manual cars have three (accelerator, brake and clutch) and automatic cars two (accelerator and brakes):

Manual:

Automatic:



12) This mechanism is a vital part of a car's transmission. It is a system of gears on the axles which allows the wheels to spin at different speeds. This is necessary for corners, when the outer wheels turn faster than the inner ones:

13) Mechanism composed by toothed wheels that can alter the relation between the speed of a driving mechanism (the engine of a vehicle) and the speed of the driven parts (the wheels):

14) This mechanism powers the electrical system:

15) Control panel facing the driver's seat where most of the instruments and switches are:

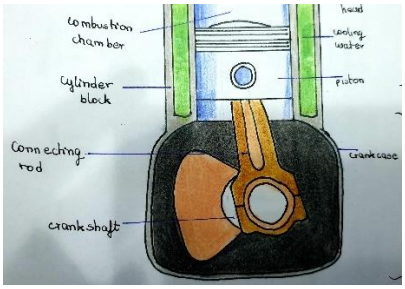
16) This device keeps the engine cool. It is at the front of the car. Usually, a fluid (as for instance water with an antifreeze fluid) and a ventilator are used:

17) This component is located under the car and extracts fumes from the engine. It usually has catalytic converters to reduce environmental pollution:

18) This component allows the driver to decide the direction the car has to take:

19) Window at the front of a car that gives protection from the wind, etc.

20) Mechanism connected to the piston that transform its reciprocating motion into rotation motion and vice versa.



21) This device allows driving at night:

22) Device on the frontal and on the back glasses of a motor vehicle used to maintain clean the windscreen of a car:


23) Lamp mounted at the rear of a motor vehicle that makes it possible for the vehicle to be seen in the dark:

24) Belt that fastens around you when you are travelling in a vehicle or aircraft and holds you in your seat, in order to reduce the risk of being injured in an accident:

25) This component is the most important component in a car. It is the place where the combustion reaction takes place:

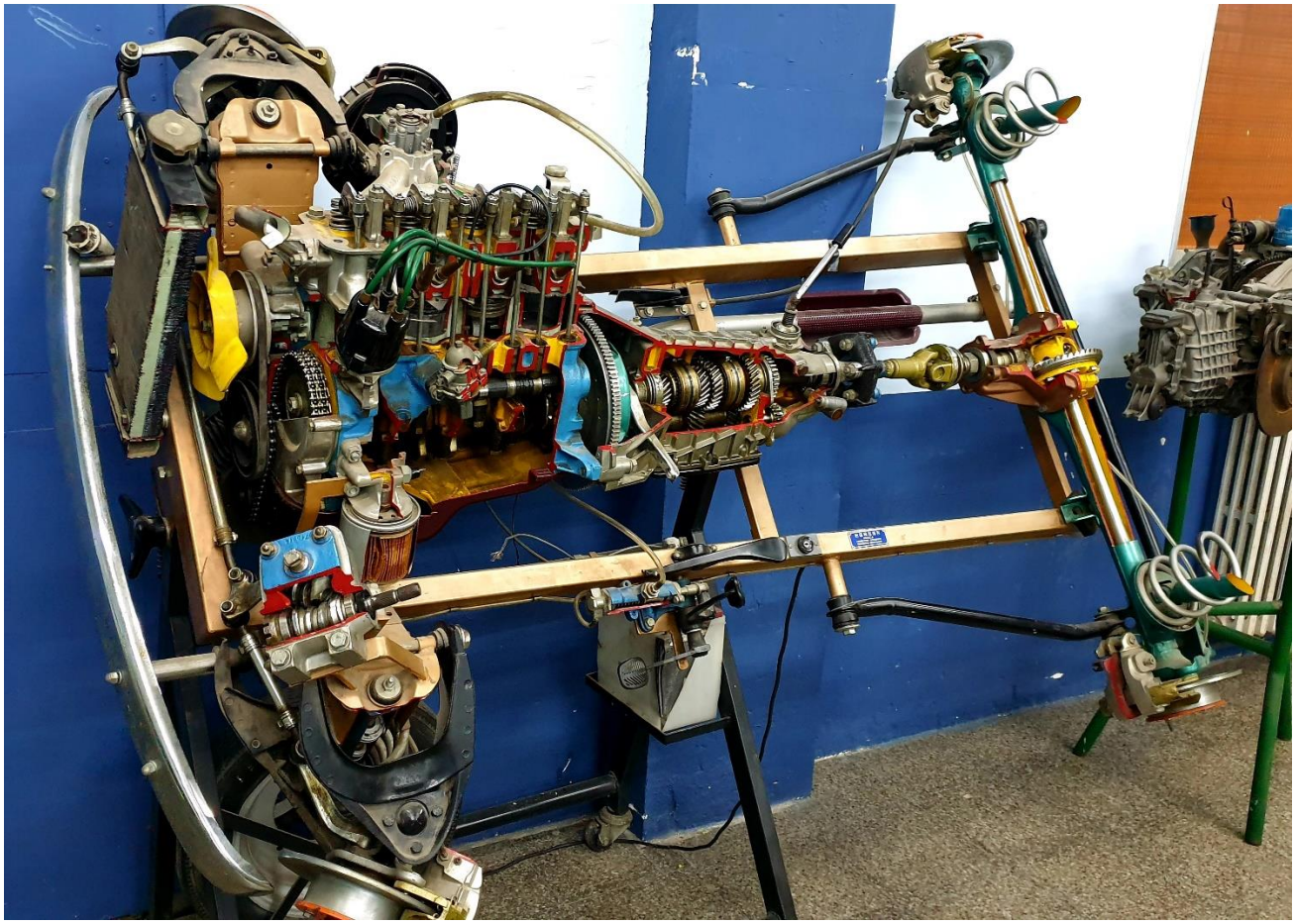
26) Device for absorbing shock or preventing damage in collisions. Bar at either end of an automobile:


27) These components allow the driver to look back. They are very useful when changing lanes:

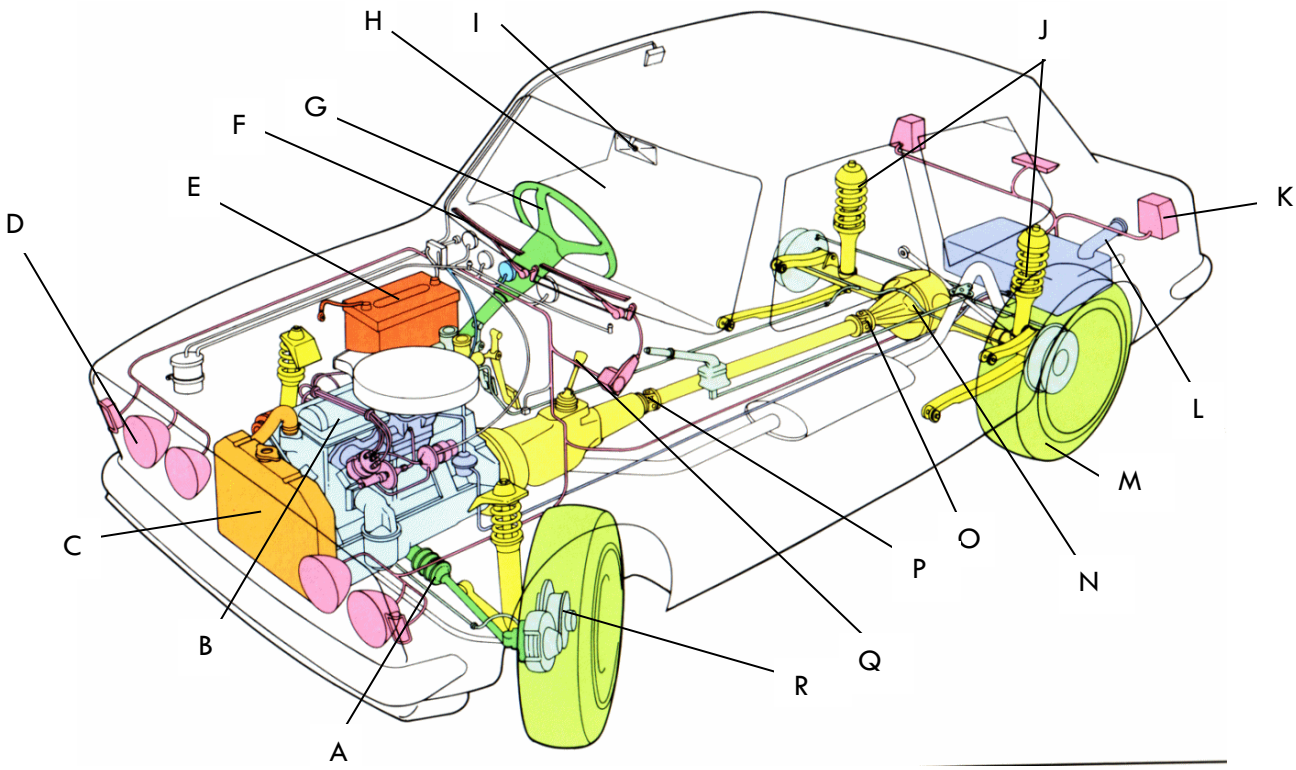

28) Universal joint consisting of a cross-shaped piece, opposite ends which rotate within the forked end of each of the two shafts connected:

29) Device located into the cylinder head that produce a spark at the required time to ignite the combustion mixture:

Some components of a car:

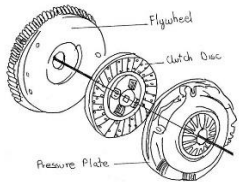


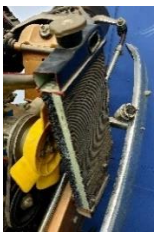
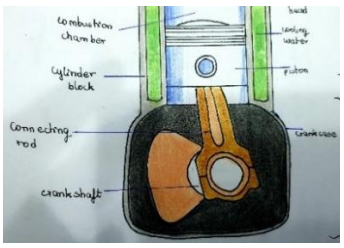
Write the numbers/draws of the definitions in the car below (matching numbers and numbers/draws):



The eleven definitions that don't appear in the drawing of the car are the numbers:

Activity 9 ***(29 Points)*** Match the definitions given in activity 8 (previous activity) and the draws with the words from the box below: (some help is given in the draws)

Definition 1:  Its name starts with a **C**	**Definition 2:**  Its name starts with a **B**	**Definition 3:**  Its name starts with a **C**
Definition 4:  Its name starts with a **G… L…**	**Definition 5:**  Its name starts with a **C**	**Definition 6:**  Its name starts with a **T… B…**
Definition 7:  Its name starts with a **W**	**Definition 8:**  Its name starts with a **S**	**Definition 9:**  Its name starts with a **S**
Definition 10:  Its name starts with a **T**	**Definition 11:**  Its name starts with a **P**	**Definition 12:**  Its name starts with a **D**
Definition 13:  Its name starts with a **G**	**Definition 14:**  Its name starts with a **B**	**Definition 15:**  Its name starts with a **C… D…**

Definition 16:  Its name starts with a **R… F…**	**Definition 17:**  Its name starts with a **E… P…**	**Definition 18:**  Its name starts with a **S… W…**
Definition 19:  Its name starts with a **W**	**Definition 20:**  Its name starts with a **C… R…- C…**	**Definition 21:**  Its name starts with a **H**
Definition 22:  Its name starts with a **W… W…**	**Definition 23:**  Its name starts with a **C… R… L…**	**Definition 24:**  Its name starts with a **S… B…**
Definition 25:  Its name starts with a **E**	**Definition 26:**  Its name starts with a **C… B…**	**Definition 27:**  Its name starts with a **R… V… M…**
Definition 28:  Its name starts with a **C**	**Definition 29:**  Its name starts with a **S… P…**	

Suspension	Clutch	Exhaust Pipe	Differential	Engine
Gear lever	Crankcase (Oil sump)	Rear-view mirror	Headlight	Radiator fan
Transmission	Battery	Steering Wheel	Brakes	Wheel
Connecting rod-crankshaft		Camshaft	Timing belt	Steering
Car bumper	Pedals	Gears	Cardan	Spark plug
Seat belt	Windscreen	Wiper washer	Car dashboard	Car rear light

Answers:

Definition 1:
Definition 2:
Definition 3:
Definition 4:
Definition 5:
Definition 6:
Definition 7:
Definition 8:
Definition 9:
Definition 10:
Definition 11:
Definition 12:
Definition 13:
Definition 14:
Definition 15:
Definition 16:
Definition 17:
Definition 18:
Definition 19:
Definition 20:
Definition 21:
Definition 22:
Definition 23:
Definition 24:
Definition 25:
Definition 26:
Definition 27:
Definition 28:
Definition 29:

Go to the webpage https://x-engineer.org/engine-piston/ where you will find more information related to some car components.

Activity 10 ***(10 Points)*** We are going to create a wiki with a catalogue of different cars on the European market, indicating their most important characteristics and the approximate price. You can follow the given example:

Hybrid car:

Toyota C-HR. Price: 28000 € (approx.) (adapted from: https://www.toyota-europe.com/new-cars/c-hr/ and https://www.carwow.co.uk/toyota/c-hr/specifications#gref)

Toyota C-HR main characteristics:
Fuel combined: from 4,8 l/100 Km
CO_2 WLTP: from 109 g/Km
Dimensions: 1565 mm
Exterior length: 4390 mm
Exterior width: 1795 mm
Exterior height: 1555 mm
Front tread: 1550 mm
Rear tread: 1570 mm
Overhang Front: 935 mm
Overhang Rear: 815 mm
Wheelbase: 2640 mm
Number of seats: 5 seats
Interior length: 1800 mm
Interior width: 1455 mm
Interior height: 1210 mm
Luggage capacity (5 seat mode): 377 litres
Luggage capacity (2 seat mode): 443 litres
Wheels: 18'' Dark Chrome Alloy wheels and Tyre Repair Kit (TRK)

ENGINE SPECIFICATIONS:

Environmental performance:
LTP CO_2: 112 to 120 g/Km
Fuel Economy: 53,2 to 56,4 mpg
Fuel Grade-recommended: 95 or higher
Fuel tank capacity: 43 l
Euro Class: Euro 6 AP
Carbon monoxide: 130,7 mg/Km
Hydrocarbons (THC): 15,8 mg/Km
Hydrocarbons NMHC: 13,7 mg/Km
Nitrogen Oxides (NO_x): 1,9 mg/Km
Sound Level Drive by: 66,7 dB(A)

Engine:
Engine code: 2ZR-FXE
Number od Cylinders: 4 cylinders in line.
Valve Mechanism: 16-valve DOCH with VVT-i
Fuel Injection System: SFI
Displacement: 1798 cc
Bore x Stroke: 80,5 x 88,3 mm
Compression ratio: 13,0:1
Maximum output: 90 Kw@/122 DIN hp
Maximum torque: 142/366 Nm@rpm
Total hybrid system output: 90 Kw/122 DIN hp
Electric Front Motor: Type permanent magnet Motor
Electric Front Motor: Maximum output: 53 Kw
Electric Front Motor: Maximum torque: 163 Nm
Hybrid vehicle battery: Type Lithium-ion
Hybrid vehicle battery: Number of modules: 56
Hybrid vehicle battery: Capacity: 3,6 Ah

Transmission: Type Automatic

Performance:
Maximum Speed: 105 mph
Acceleration 0-62 (mph): 11 seconds

Weights and Towing capacity:
Gross Train Weight Total: 2585 Kg
Gross Vehicle Weight- Total: 1860 Kg
Kerb Weight/Unladen Weight: 1425-1460 Kg
Maximum Trailer Weight-Braked: 725 Kg
Maximum Trailer Weight-Unbraked: 725 Kg
Gross Vehicle Weight-Front: 1050 Kg
Gross Vehicle Weight-Front: 1080 Kg

Suspension:
Suspension Front: McPherson Strut
Suspension Rear: Double-wishbone

Brakes:
Brakes Front: Ventilated disc 1-cylinder
Brakes Rear: Solid disc 1- cylinder

Steering:
Turning Radius tyre: 5,2 m

Off road:
Min. running ground clearance: 142 mm
Approach Angle: 14º
Ramp break-over angle: 26º

Other important things:

Safety:

Intelligent Front parking sensors with clearance sonar & automatic braking
Intelligent Rear parking sensors with clearance sonar & automatic braking
Simple Intelligent Parking Assist (S-IPA)
Reversing Camera
Pre-Collision System with Cyclist Detection, Day & Night-time Pedestrian Detection
Lane Departure Alert (LDA) with Steering Control
Road Sign Assist (RSA)
Automatic High Beam (AHB)
Intelligent Adaptive Cruise Control
LED Adaptive Front light System (AFS)
Adjustable Speed Limiter (ASL)
Automatic headlight levelling
Blind Spot Monitor (BSM)
Glass-breaking alarm sensors
Hill-start Assist Control (HAC)
Immobiliser
Intrusion Alarm
Intrusion Sensor
Lane Trace Assist (LTA)
LED Daytime running lights
LED Front fog lights
LED headlights
LED high mounted stop light
LED Rear brake lights
LED rear combination lights
Motion sensor alarm
Rear Cross Traffic Alert with automatic Braking (RCTA-B)
Tyre Pressure Monitoring System (TPMS)
Tyre Pressure Warning System (TPWS)
Vehicle Stability Control (VSC)
Supplemental Restraint System (SRS) airbags - 5 air bags
Driver & front passenger Whiplash Injury Lessening (WIL) seats
Front seat belt reminder
ISOFIX child restraint system
Passenger airbag on/off-switch
Pre-tensioners and force limiters
Rear seat belt reminder

Comfort:

Smart Entry & Push-button start
Auto headlights
Auto wipers
Automatic headlight cut-off
Auto-retractable door mirrors
Boot door release with Push-button
Power-adjustable door mirrors
Electric heated door mirrors
Follow-me-home headlights
Headlight cut-off reminder
Puddle lights
Remote door lock
Dual-zone automatic air conditioning
12v power outlet – Front
60:40 split-folding rear seats
Adjustable Speed Limiter (ASL) switch on steering wheel
Anti-jam protection on power windows
Assist grips - Centre pillar
Assist grips - Front pillar
Audio switches on steering wheel
Electro chromatic auto-dimming rear view mirror
Boot light
Clean air filter
4.2" Colour multi-information display
Driver & front passenger personal lights
Front power windows
Electric Power Steering (EPS)
Auto up & down function on power windows
Front sports seats
Heated driver & front passenger seats
Heated steering wheel
Illuminated entry system
Lane Departure Alert (LDA) switch on steering wheel
Light on driver sun visor
Light on passenger sun visor
Manual telescopic steering wheel
Manual tilt steering wheel
Manually height-adjustable front passenger seat
Mirror on driver sun visor
Mirror on passenger sun visor
Noise reduction layer on front windows
Noise reduction layer on windscreen
Pollen air filter
Power door lock
Power passenger window lock
Power-adjustable lumbar support on driver seat
Power-height-adjustable driver seat
Power-reclining driver seat
Power-sliding driver seat
Power-adjustable lumbar support on driver seat
Rear power windows
Rear window defogger
Rear window wiper
Telephone switches on steering wheel
UV-filter on driver & front passenger windows
UV-filter on rear windows
Voice recognition switch on steering wheel
Multimedia switches on steering wheel

Style:

Black & body-coloured rear bumper
Black lower front grille
Body-coloured front bumper
LED Front light guide
Privacy Glass
Shark-fin antenna
Dark brown upper dashboard
Silver deco line on upper dashboard
3-spoke Leather steering wheel
Black centre console
Chrome interior door handles
Electronic parking brake
Leather gear shift
Light blue ambient lighting on front cup holders
Light blue ambient lighting on front doors

Multimedia:

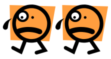
Toyota Touch® 2 with Go Navigation
8" Toyota Touch® 2 multimedia system
6 speakers
Aux-in connector
Bluetooth® Connectivity
Digital Audio Broadcast (DAB)
Microphone on front personal light
USB connector
Voice recognition
Wi-Fi connectivity
Smartphone integration incl. Apple CarPlay™ & Android Auto™

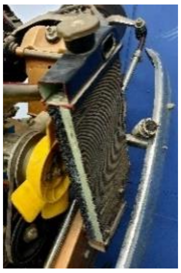
Storage:

Front cup holders
Hard tonneau cover
Driver & passenger seatback pockets
Hooks for luggage holding net
Shopping bag hooks
Glovebox with light

1.8 Petrol Hybrid (122hp)	**2.0 Petrol Hybrid (184hp)** **Automatic (Front Wheel Drive - FWD)**
	

Activity 11 ***(10 Points)*** Write the name of ten European car manufacturing companies.

 **Activity 12 *(18 Points)*** Match pictures with definitions.

Window at the front of a car that gives protection from the wind, etc.

Component that allows the driver to decide the direction the car has to take.

Mechanism that allows the car to run on the roads without lots of movement. The external part is called the tyre and is usually made of plastic (rubber) and has air inside.

The most important component in a car. It is the place where the combustion reaction takes place.

Belt that fastens around you when you are travelling in a vehicle or aircraft and holds you in your seat, in order to reduce the risk of being injured in an accident.

Device that keeps the engine cool. It is at the front of the car. Usually, a fluid (as for instance water with an antifreeze fluid) and a ventilator are used.

Component located under the car that extracts fumes from the engine. It usually has catalytic converters to reduce environmental pollution.

Device that allows driving at night.

Mechanism that allows changing a gear. It can be manual or automatic.

Mechanism that powers the electrical system.

Mechanism that is an energy dissipater which allows the speed to be reduced.

Components that allow the driver to look back. They are very useful when changing lanes.

Control panel facing the driver's seat where most of the instruments and switches are.

Device on the frontal and on the back glasses of a motor vehicle used to maintain clean the windscreen of a car.

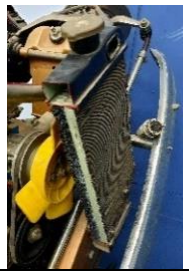
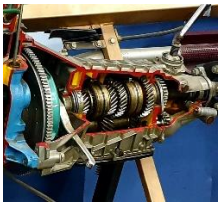
Device located into the cylinder head that produce a spark at the required time to ignite the combustion mixture.

Mechanism made up of two parts, a spring and a damper. The spring compresses and expands as the wheel goes over a bump.

Device for absorbing shock or preventing damage in collisions. Bar at either end of an automobile.

Devices located on the floor of the driver's side of the car, which allow to control the power and speed of the car. Manual cars have three (accelerator, brake and clutch) and automatic cars two (accelerator and brakes).

Activity 13 ***(15 Points)*** Match pictures with the correct name.

WINDSCREEN	**STEERING WHEEL**	**WHEEL**	**SUSPENSION**
SEAT BELT	**RADIATOR FAN**	**EXHAUST PIPE**	**HEADLIGHT**
GEAR LEVER	**BATTERY**	**BRAKES**	**REAR-VIEW MIRROR**
TRANSMISSION	**WIPER WASHER**	**SPARK PLUG**	

Activity 14 ***(10 Points)*** Write the name of the studied car components that you can identify in next pictures (each correct answer one point. Maximum 10 points):

The engine in rotary engines

A rotary engine is an engine in which combustion reaction produce a rotary movement directly. The most commons rotary engines are the **Wankel engine** and the **gas turbines**.

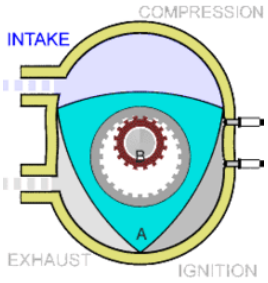
A rotary engine is a type of internal combustion engine that has been used to power all kinds of vehicles, from cars and trucks to boats and planes.

Some rotary engines have cylinders arranged radially around a central crankshaft, the crankshaft remains stationary and the entire cylinder block rotates around it. In this case they run, like a piston engine, carrying out four jobs to power the vehicle: intake, compression, combustion and exhaust, but in a different way.

Others, by causing combustion reaction, the gases produced move the turbine blades.

Activity 15 Go to the website http://www.animatedengines.com where you will find animations about how different combustion engines work. Take notes about the key words, the main sentences, and descriptions about how each engine works. Specially take notes about how rotary engines (Wankel engine, Gnome rotary engine and jet propulsion)

Activity 16 ***(4 points)*** Put this text about the Wankel engine in order:

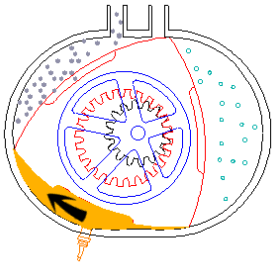
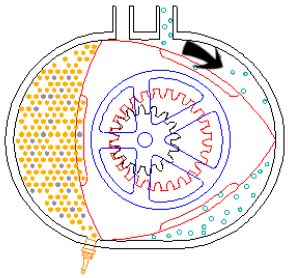
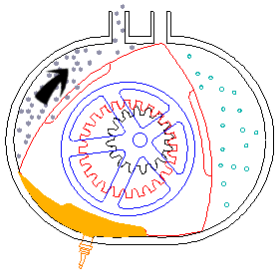
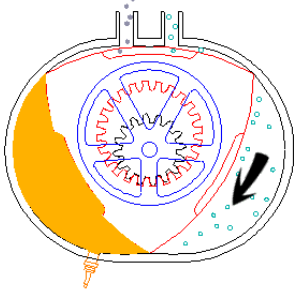
A. *convert pressure into rotating motion instead of using reciprocating pistons. It is a four-stroke engine where the motion*
B. *design, Wankel rotary engine have been installed in a variety of vehicles and devices such as automobiles*
C. '*The Wankel engine is a type of internal combustion engine which uses a rotary design to*
D. *(some cars made by the Japanese Mazda), aircrafts, go-karts, personal water craft, chain saws and auxiliary power units*'.    Wankel engine
E. *takes place in an oval space. The rotor is like a triangle. Due to its compact*

Adapted from: http://en.wikipedia.org/wiki/Wankel_engine

ANSWERS:

1.
2.
3.
4.
5.

Activity 17 ***(4 points)*** Match a picture with its suitable stroke:

Intake The fuel/air mixture is drawn in the intake port during this phase of the rotation.	 A
Exhaust And the exhaust is expelled	 B
Compression The mixture is compressed.	 C
Power The mixture burns, driving the rotor around.	 D

From; http://www.animatedengines.com/wankel.shtml

ANSWERS: Intake: ……; Exhaust: ……; Compression: ……; Power: ……

Activity 18 ***(10 points)*** Write a small composition describing how a Wankel engine works (100 words).

Some grammar help:

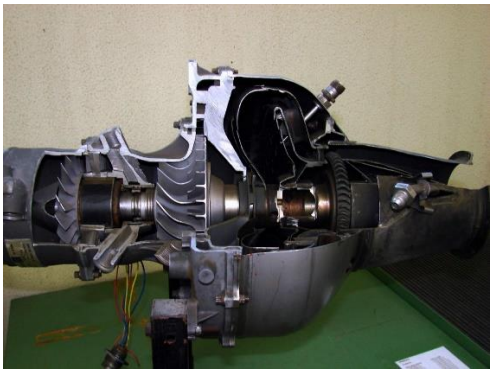
DEFINING				
…..	is (a) are was/were	place, person thing, concept device instrument, tool, designed, build	(where) (who) (which) (that)	…..

RELATION CAUSE-EFFECT. GIVING REASONS	**COMPARING AND CONTRASTING (For differences)**
as a result because for example, for instance so that is why such as	in contrast compared with/in comparison with … is different from … (in that …) on the one hand/on the other hand however/otherwise … differs from … in respects: (firstly, secondly, finally,) from a different point of view/perspective

Activity 19 ***(12 Points)*** Read next text (adapted from '*Energy, forces & motion*' *The Usborne library of science*) and fill in the gaps with a word from the box below: (Remember that in the box there are more words than gaps)

Gas turbines

A gas turbine is a _____ machine similar in principle to a steam turbine and it consists of three main components: a _____, a combustion chamber, and a turbine. The _____ after being compressed in the compressor is heated by burning _____ in it.



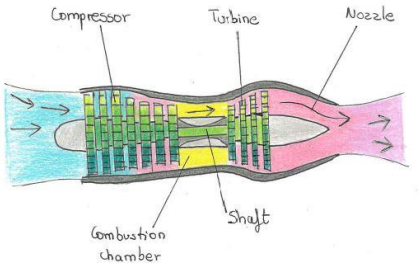
Gas turbine

Tilyudaj https://search.creativecommons.org/photos/43d7c05a-e387-4765-9526-ec00680b9338

Jet engines

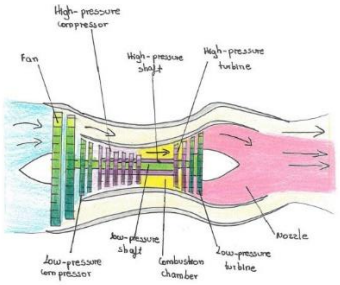
A jet engine is any engine that creates force by releasing a high-speed jet of a liquid or a gas. Most jet engines are internal _____ engines used by aircraft. The hot _____ produced in the combustion reaction are forced to turn the turbine blades (for this reason jet engines are also called gas _____ engines), and to go out of the back of the engine at high-speed pushing the _____ through the air.

The turbojet engine is very fast, but noisy and less _____ with fuel than a turbofan engine. They are only used for high-speed jet planes.



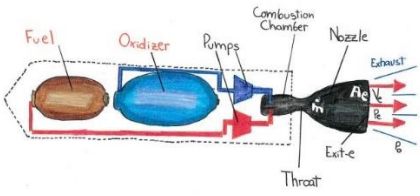
Turbo jet

Turbojet and turbofan engines are similar, but turbofan has a big fan in the front of the turbine that promotes its turn. The exhaust gases speed is lower in turbofan engines than in turbojet engines. This makes them not to be as _____ as turbojets, but turbofans are more efficient, quieter and use less fuel than the turbojet. They used to serve as a _____ jet.



Turbofan

A rocket engine produces force by pushing gases at high speed. Instead of using air for the combustion reaction, rocket engines burn with liquid _____. For this reason, rocket engines can travel in space where there is no air.



Rocket engine

fast	turbine	oxygen	rotary	gases	passenger	fuel
efficient	plane	compressor	air	combustion	water	pollution

Summarize activities:

 **Activity 20** ***(10 Points)*** **Taboo** or **Pictionary**. According to your ability, explaining in English some words or drawing a picture, select a game: Taboo (best abilities in explaining) or Pictionary (best abilities in drawing).

Teacher will make groups of two or four students. You have to define the word (in **bold**) that appears in your card (Explaining the word (Taboo) or drawing a picture (Pictionary)).

In any case you can say the words that appear in your card.

Some grammar help:

DEFINING				
…..	is (a) are was/were	place, person thing, concept device instrument, tool, designed, build	(where) (who) (which) (that)	…..
RELATION CAUSE-EFFECT. GIVING REASONS as a result because for example, for instance so that is why such as			**COMPARING AND CONTRASTING (For differences)** in contrast compared with/in comparison with … is different from … (in that …) on the one hand/on the other hand however/otherwise … differs from … in respects: (firstly, secondly, finally,) from a different point of view/perspective	

TABOO-PICTIONARY CARDS

ENGINE	**STEAM**	**WATT**
NEWCOMEN	**AEOLIPILE**	**TURBINE**
SAVERY	**BOILER**	**FURNACE**

COAL	**COMBUSTION**	**CYLINDER**
PISTON	**FLYWHEEL**	**EXHAUST VALVE**
SEAT BELT	**PRESSURE**	**ROTOR**
STATOR	**SUSPENSION**	**GEAR LEVER**

TRANSMISSION

CLUTCH

CRANKCASE

BATTERY

REAR-VIEW MIRROR

STEERING WHEEL

HEADLIGHT

BREAKS

RADIATOR FAN

WHEEL

CARBURETTOR

ELECTRONIC INJECTION

TURBO COMPRESSOR

SPARK PLUG

CYLINDER HEAD

ENGINE BLOCK

CYLINDERS IN V

BORE

STROKE

ENGYNE CYLINDER VOLUME

FOUR-STROKE ENGINE

TWO-STROKE ENGINE

GASES

FUEL

EXHAUST STROKE

POWER STROKE

COMPRESSION STROKE

INTAKE STROKE

GASOIL

INTAKE PORT

CRANKSHAFT

CONNECTING ROD

WANKEL ENGINE

JET ENGINE

DIESEL ENGINE

PETROL ENGINE

CARBON DIOXIDE

HEAT

SULPHUR OXIDES

CARBON MONOXIDE

GLOBAL WARMING

ACID RAIN

GREENHOUSE EFFECT

CHEMICAL FOG

NITROGEN OXIDES

CAR DASHBOARD

WINDSCREEN

CAR BUMPER

WIPER WASHER

CARDAN

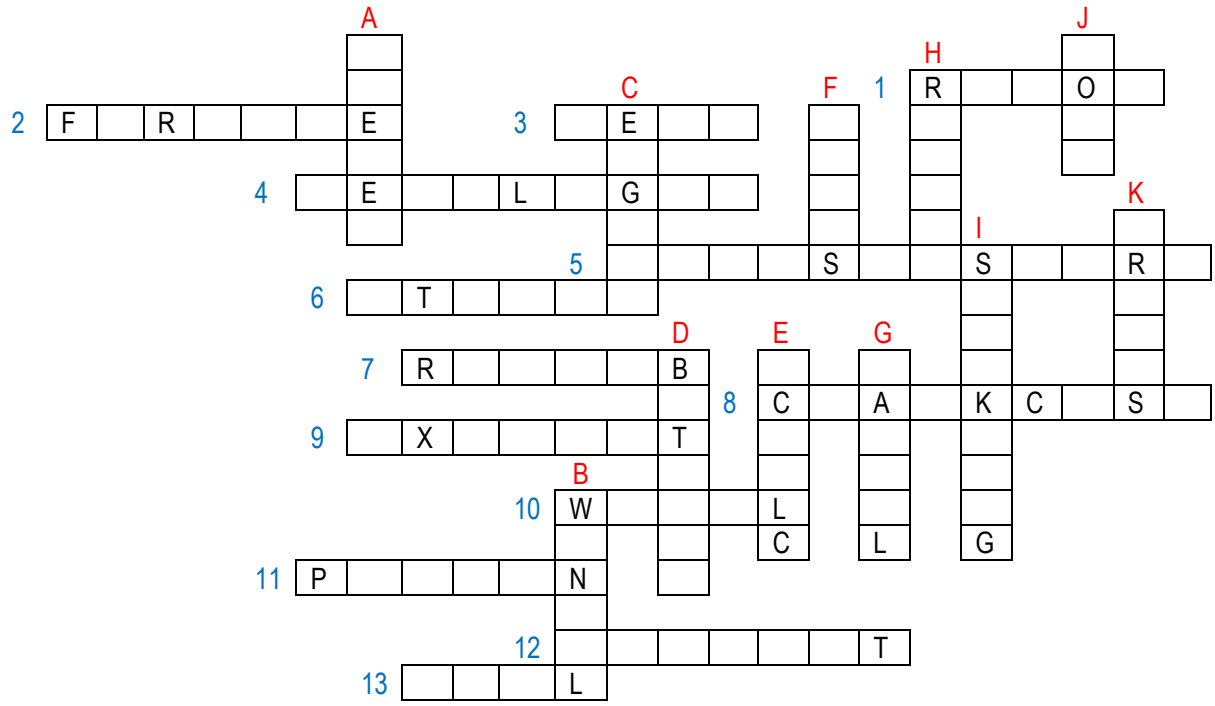
ROCKET ENGINE

CAMSHAFT

STEERING

GAS TURBINE

Activity 21 ***(24 Points)*** Complete the crossword below:



ACROSS

1. (Back) Name of the third stroke in a four-stroke engine. POWER
2. Place where a fossil fuel (such as coal) is burned. The heat produced is normally used to heat water. FURNACE
3. Machinery in a vehicle that turns engine power into movement forwards or backwards. GEAR
4. This device allows driving at night. HEADLIGHT
5. (Back) This mechanism is a system of gears that transmits an engine's power to the wheels. TRANSMISSION
6. The length of the piston movement inside the cylinder. STROKE
7. (Back) The place in a steam engine where the water is heated to be transformed in steam. BOILER
8. This case contains the lubrication oil; it is located under the engine block. CRANKCASE
9. Name of the fourth stroke in a four-stroke engine. EXHAUST
10. This mechanism allows the car to run on the roads without lot of movements. The external part is called a tyre and usually is made of plastic (rubber) with air inside. WHEEL
11. Piece inside a cylinder that has an up-and-down motion. PISTON
12. (Back) This engine is composed of blades and steam or the gas makes turning its blades to achieve rotation movement. TURBINE
13. Solid fossil fuel. COAL

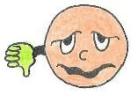
DOWN

A. Compression-ignition engine that doesn't need spark plug to initiate the combustion reaction. DIESEL
B. This engine uses a rotary design to convert pressure into a rotating movement following the thermodynamic Otto cycle. WANKEL
C. Machine that converts the energy stored in fuel into movement. (Useful work). ENGINE
D. This mechanism powers the electrical system. BATTERY
E. (Up) This mechanism allows to connect and to disconnect, voluntarily or automatically, a conductor shaft with a conduit shaft. This mechanism is used to change gears (to change the speed). CLUTCH
F. (Up) Gas obtained when the water is heated at more than 100 ºC. STEAM
G. Fuel used by the diesel cars. GASOIL
H. (Up) This component allows the driver to look back. MIRROR
I. Component that produces the spark needed to start the combustion reaction in the petrol cars (2 words). SPARK PLUG
J. Diameter of the circular chambers cut into the cylinder block. BORE
K. These mechanisms are an energy dissipater that allows reducing speed. (Plural) BRAKES
L. Engine used to transform steam into movement. (2 words). STEAM ENGINE
M. Steam engine used to produce electricity. (2 words) STEAM TURBINE
N. Component of a car used to drive the car and decide the direction the car has to take. (2 words) STEERING WHEEL
O. Chemical reaction in which a fossil fuel is burned with oxygen to produce water (steam), carbon dioxide and energy (heat). COMBUSTION

Self-assessment Assess yourself. Name _____

About the scenario:

1. Make a cross in the table below, according to the things you have learned in this scenario:

What to evaluate				
	Could be better 1	**Satisfactory 2**	**Good 3**	**Very good 4**
I learned some vocabulary related to combustion engines.				
I can identify the two types of combustion engines.				
I can describe a combustion reaction and the products obtained in it.				
I can describe briefly what is an engine.				
I'm able to search on the net real and important information related to the different combustion engines.				
I can describe briefly how an internal combustion engine works.				
I can describe the main components of an internal combustion engine.				
I can identify and describe the main components of a car.				
I can describe some uses of internal combustion engines.				
I can identify and describe different internal combustion engines.				
I can relate the products obtained in a real combustion reaction with the environmental problems related to them.				
I can calculate the cylinder volume of a internal combustion engine.				
I can identify and describe briefly the new internal combustion engines.				
I´m able to define a word without using some words.				
I can work in collaborative groups.				
I can watch a video giving conclusions about it.				
I'm able to defend my position representing a character in a role play.				
I can draw an imaginary world.				
I can write a composition explaining, describing, giving my opinion, etc.				
I'm able to give reasons, expressing my opinion.				
I enjoy working in groups.				
TOTAL				**/84**

2. Write your mark with a cross (a number between 1 and 10).

1	2	3	4	5	6	7	8	9	10

3. What have you learned from this scenario?
4. What was easy for you?
5. What did you find difficult?
6. What would you find most helpful?
7. What did you like doing most?
8. What did you like doing least?
9. Write the most important words (key words) learned in this scenario.
10. Any suggestions?

In this scenario you have…

- Used English as a way to communicate.
- Worked in pairs, respecting and analysing critically the decisions made by your partners.
- Learnt some vocabulary related to combustion engines.
- Described the most important aspects related to combustion engines.
- Described the products obtained in a combustion reaction.
- Related the products obtained in a real combustion engine with the environmental problems due to them.
- Identified and classified internal combustion engines.
- Described how an internal combustion engines work.
- Identify and describe the main components in an engine and in a car.
- Describe some uses of combustion engines.
- Related historical moments with the combustion engines used.
- Watched videos and simulations giving conclusions about it.
- Understood the importance of Europe in the development in the combustion engines.
- Used internet to improve your knowledge.
- Learnt how to write a definition in English.
- Learnt how to compare in English.
- Participated in a role play, defining or drawing a word.
- Learnt how to give opinions in English.
- Assessed in a critically and respectfully way the work done by your partners.
- Valued the European contribution in the development of the societies.