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## 1. How a car engine Works

The process by which a car works is a lot simpler than you may think. When a driver turns a key in the ignition:

- The car battery powers up sending
- Power to the starter motor, which
- Turns the crankshaft, which
- Gets the pistons moving
- With the pistons moving the engine fires up and ticks over
- A fan draws air into the engine via an air filter
- The air filter removes dirt and grit from the air
- The cleaned air is drawn into a chamber where fuel (petrol or diesel) is added
- This fuel-air mix (a vaporised gas) is stored in the chamber
- The driver presses the accelerator pedal
- The throttle valve is opened
- The gas-air mix passes through an intake manifold and is distributed, through intake valves, into the cylinders. The camshaft controls the opening and closing of the valves.
- The distributor makes the spark plugs spark, which ignites the fuel-air mix. The resulting explosion forces a piston to move down which in turn causes the crankshaft to rotate.

What happens in the cylinders is the magic that gives power and motion to the car wheels. Most car engines use a four-stroke combustion cycle. This cycle starts with piston at the top of the cylinder.

### A) Complete the following sentences

Read the video “How a 4 stroke petrol engine works” and fill in the blanks.

**Intake stroke** - intake valve .....and the piston moves.....allowing the fuel-air mix to ..... the open space.

**Compression stroke** - the piston moves ..... This compresses the fuel-air mix by forcing it into a smaller space. Compression makes the fuel-air mix explode with greater force. The temperature is about 300 at 350°C and the pressure 8 at 12 bar.

**Power cycle** - Spark from a spark plug ..... the fuel-air mix. The explosion forces the piston ..... the cylinder.

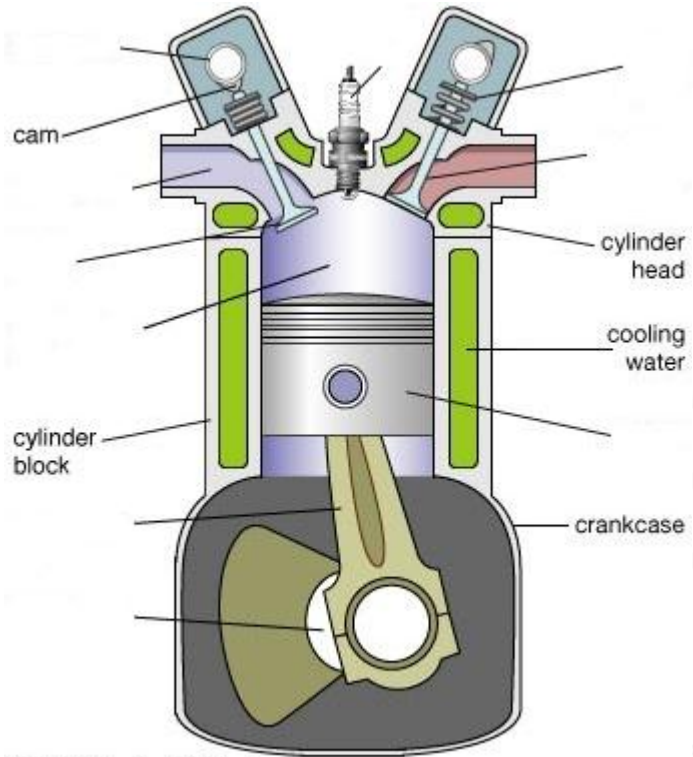
**Exhaust cycle** - the exhaust valve ..... and the piston moves .....to the top of the cylinder which forces the ..... fumes out.

The bottom of each piston is attached to the crankshaft.

As the pistons are forced ..... and ..... they rotate the ....., which after sending the power through the transmission, turns wheels.

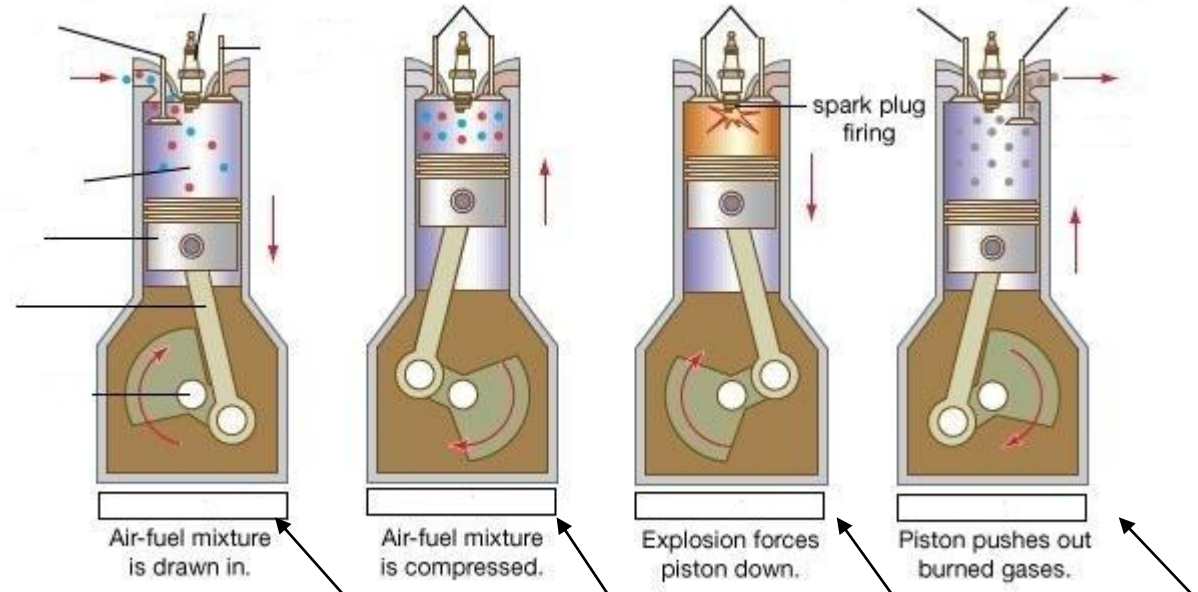
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**B) Name the different parts on the drawing below (for the valves, say if they are opened or closed) :**



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**Four-stroke cycle**



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Name the stroke cycle

Fig. 1 : Inside a cylinder

Fig. 2 : Four stroke combustion cycle

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**2. What Are Revolutions Per Minute?**

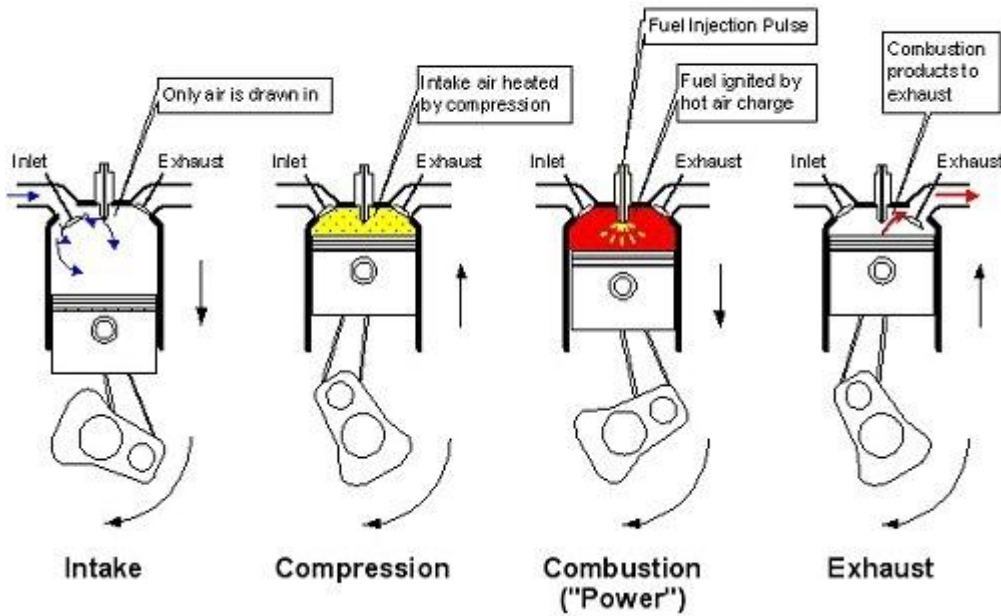
The four-stroke cycle repeats itself thousand of times a minute. These repetitions are more commonly known as Revs.

A rev counter tells you how many thousand times per minute the cycle is repeated

**3. What is the difference between a Petrol and Diesel Engine?**

Read the video “How a 4 stroke Diesel engine works” and explain below the differences with a petrol engine.

**4-stroke Compression-ignition (Diesel) Engine Cycle**



**Complete the 4 stroke Diesel Engine :**

**Intake stroke :** \_\_\_\_\_

\_\_\_\_\_

**Compression stroke -** \_\_\_\_\_ . *The temperature is about 600 at 650°C and the pressure 30 at 40 bar.*

**Power cycle :** \_\_\_\_\_

\_\_\_\_\_

**Exhaust cycle :** \_\_\_\_\_

\_\_\_\_\_

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**4. Complete the table below :**

	Advantages	Disadvantages
<b>Petrol engine</b>		
<b>Diesel engine</b>		

**Conclusion:** We have talked about the difference between petrol (gas) and diesel engines and those differences can be noticed by looking at the advantages and disadvantages of these engines.

- If you will make less than 20.000 miles/year and most of the time you will be driving that car in a city, probably the best car for you **would be a car with a gas engine.**

- If you will make more than 20.000 miles/year and most of the driving will be on the highway, **you should know that a diesel produces more miles/gallon** and this is very important ( or better said economical ), especially if you make more than > 20.000 miles / year.

As you can see, you need to choose the engine by thinking at how many miles you will make by year and for how long you will keep the car. At least a couple of years and many miles go for the diesel otherwise you may choose a gas engine.

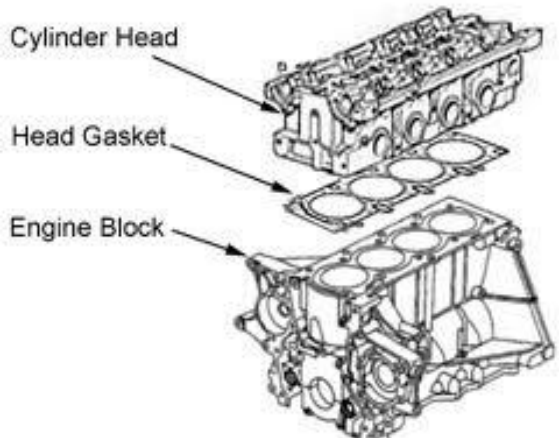
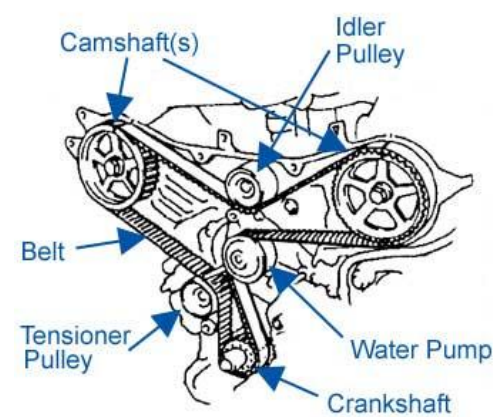
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## 5. More questions :

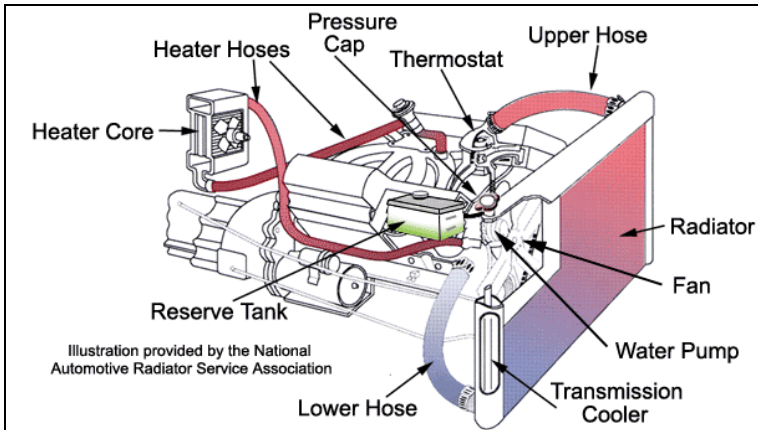
Read paragraph 6 and complete the following table :

Function	Component or system
Allow a quickly temperature rise of the engine and keep this one in a temperature range of operation	
Synchronize the movement of the piston with the movement of the camshaft.	
A part sits between the engine block and cylinder head in an internal combustion engine. Allow for expansion between the engine block and cylinder head	
Metering the amount of fuel depending on the amount of air and different parameters at a given time cycle	
Reduce friction, cool the engine parts, remove impurities	

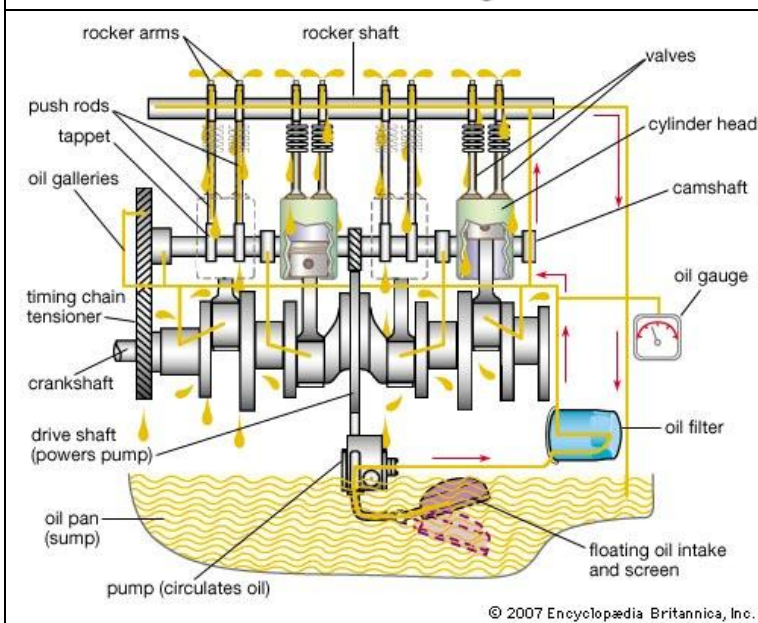
## 6. Other Engine Components or systems

 <p>Cylinder Head</p> <p>Head Gasket</p> <p>Engine Block</p>	<p><b>Head Gasket</b> - the cylinder head (a block that seals all the tops of the cylinders) and the engine block (which contains the main bodies of the cylinders) are separate components that need to fit seamlessly together. The head gasket is a piece of metal that sits between them and connects them.</p>
 <p>Camshaft(s)</p> <p>Idler Pulley</p> <p>Belt</p> <p>Tensioner Pulley</p> <p>Water Pump</p> <p>Crankshaft</p> <p>Typical V6 Timing Belt</p>	<p><b>Timing Belt</b> - a belt connected to both the camshaft and crankshaft ensuring that they work in time with each other.</p> <p>The timing belt synchronize two movements:</p> <ul style="list-style-type: none"> <li>• The movement of the piston connecting with the crankshaft</li> <li>• The movement of the camshaft which controls the movement of valves (opening and closing).</li> </ul>

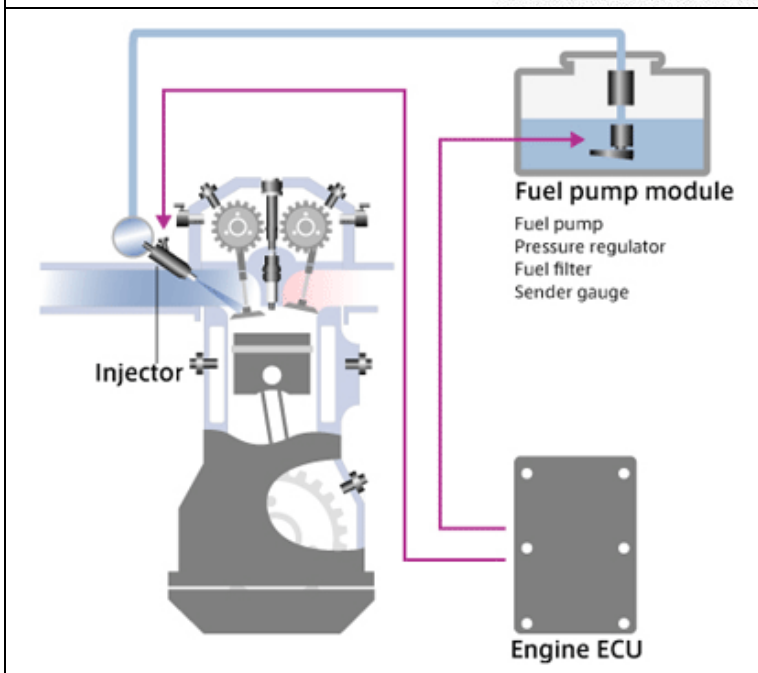
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**Cooling System** - car engines produce a lot of heat. This heat needs to be controlled. To do this water is pumped through passages that surround the cylinders and then through the radiators to cool down.



**Oil system** - a car engine consists of many moving parts. Oil lubricates these parts and allows them to move smoothly. In most car engines oil is pumped out of the oil pan through a filter that removes any dirt and then is squirted under high pressure onto the bearings and cylinder walls. The oil then trickles down to the sump where the process starts over.



**Fuel injection system** - The fuel injection system consists of several different SENSORS located in various locations all around the car. There are sensors to detect air pressure, air temperature, throttle angle, air density, fuel temperature, fuel pressure, oil pressure, coolant temperature, exhaust temperature, crank angle, timing, engine rpm, and speed, to name a few. Every time the car is started, the ECU (electronic control unit) scans all of the sensors to determine their functionality. The ENGINE CHECK LIGHT comes on during this function and goes off if all sensors are OK.