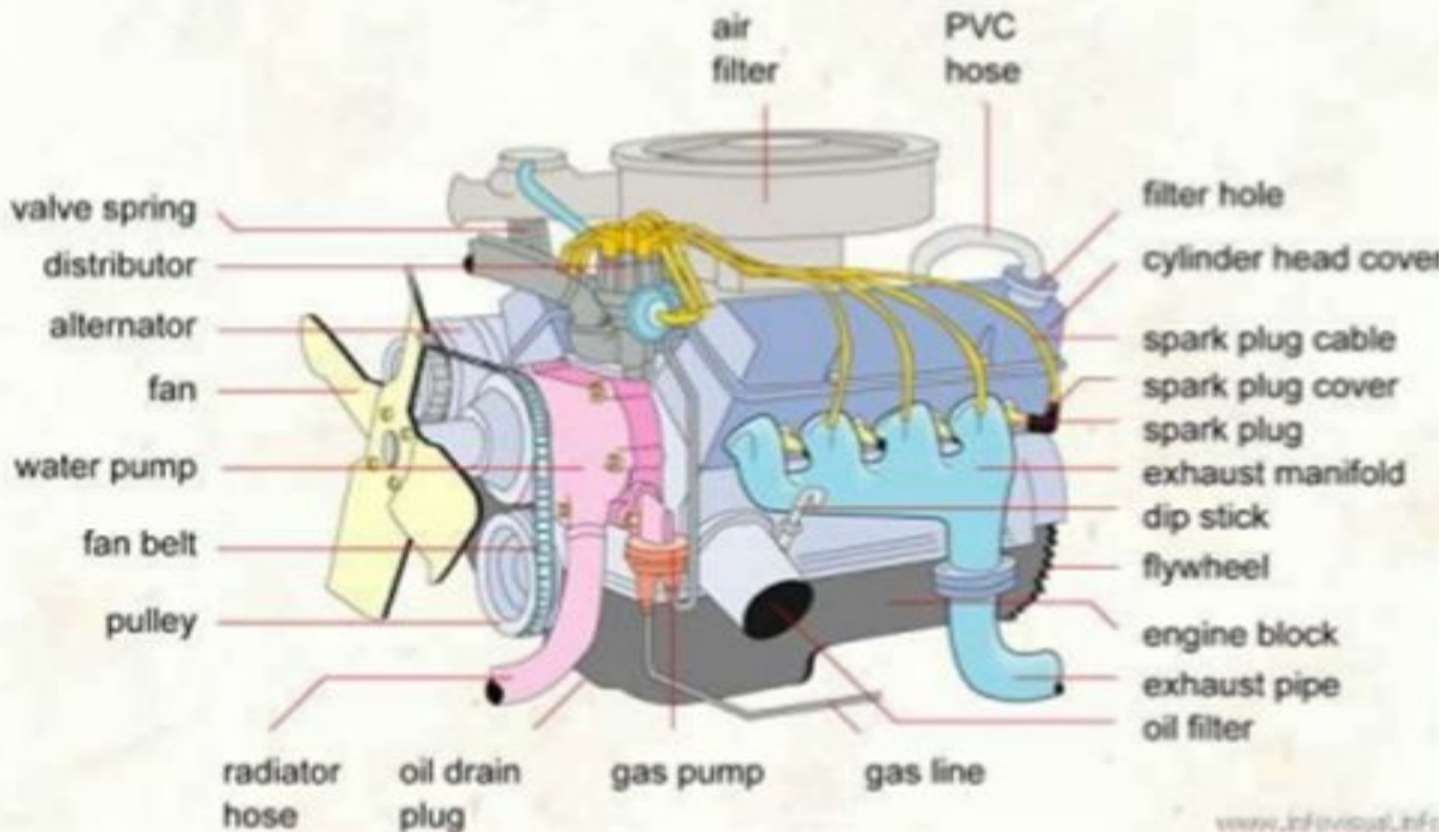
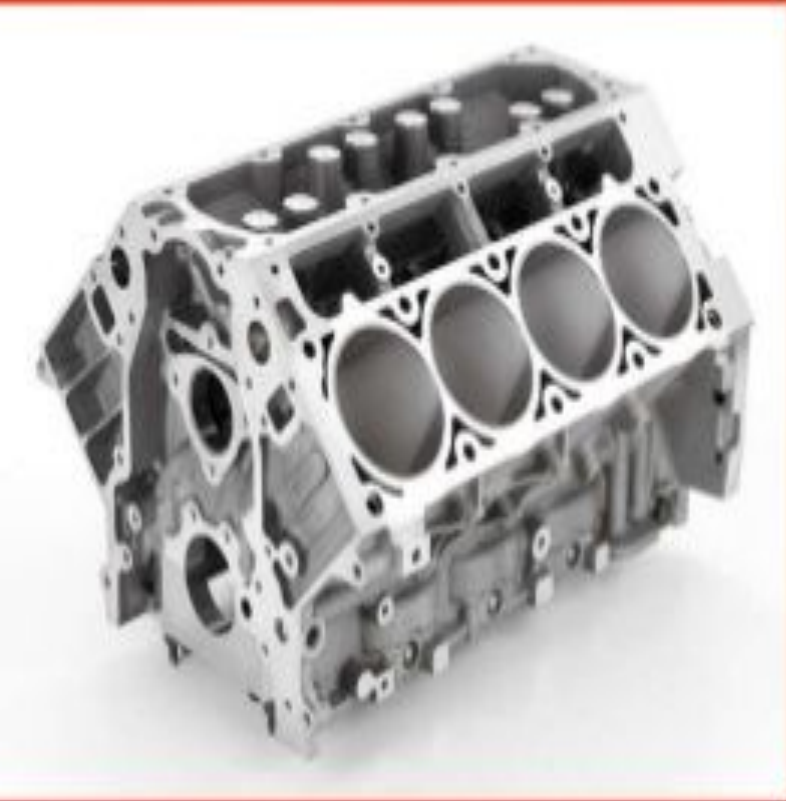


# ENGINE COMPONENTS

## AUTOMOBILE ENIGNE




# ENGINE BLOCK



- # Body of an engine containing the cylinders.
- # Normally made of ALUMINUM or CAST IRON.
- # Old engine also have a case for water jackets.

# CAMSHAFT

- # Rotating shaft used to push open valves at proper timing in engine cycle.
  - # Can be control HYDRAULICALLY or MECHANICALLY.
  - # Modern engine have more then two cams.
- 

# CRANKSHAFT

- # Mostly they made of forged steel or cast iron.
- # It is attached with the engine block by MAIN BEARING.
- # Rotates in circular motion
- # Having crank weights attached with crankshaft
- # It through which engine is work output supply to the system.
- # It rotate by which work



# CONNECTING ROD

# Rod connecting the piston with rotating crankshaft.

# Provided the contact from piston to the crankshaft.

# Usually made of STEEL or ALLOY FORGED but in small engine it can be made of ALUMINUM.



# PISTON

- # A cylindrical-shaped mass that reciprocate back and forth in the cylinder transmitting force to the crankshaft.
- # The top of the piston is called CROWN and the sides are called SKIRT.
- # PISTON is made up of cast iron, steel or aluminum.
- # Aluminum piston are light . Used for light engine .
- # Piston is one of the important component of engine.



# PISTON RING

- # Metal ring that fixed into a circumferential grooves around the piston.
- # Made up of highly polished chromed steel
- # It make a seal between piston and cylinder walls.
- # It also used for lubrication purpose.



# VALVES

- # Used to allow the flow into and out of the cylinder at proper time in the cycle .
- # VALVES are made of forged steel.
- # Two stroke engine do not have valves they have ports system (slot).





## VALVE SPRING

# The spring which attached at the valve.

# Push back the valve / closed the valve.



# CYLINDER OR COMBUSTION CHAMBER

# The end of the cylinder between head and piston face where combustion take place.



# CRANKCASE

- # The part of the engine block surrounding the rotating shaft.
- # The oil pan makes up part of the crank case housing.



# CARBURETOR

- # CARBURETOR is used for making a air and fuel mixture .
- # It is replaced by EFI system.
- # A proper mixture is needed for proper combustion so that carburetor used.
- # It mixing up the fuel and air .
- # Making a rich or lean mixture as requirement.



# RADIATOR

- # It is an HEAT EXCHANGER.
- # It is usually mounted in front of the engine in the flow of the air.
- # Used to cool down the engine and run proper thermodynamic cycle.



# SPARK PLUG

- # Electric device used to initiate combustion in SI engine.
- # Made up of the metal surrounded by the ceramic insulation.
- # Spark plugs only used in SI engine



# INTAKE MANIFOLD

- # Piping system which delivers incoming air to the cylinder.
- # They made up of cast metal ,plastic or composite materials.
- # In IS engine fuel added to the air in intake manifold.



# EXHAUST MANIFOLD

# Piping system which carry exhaust gases away from the system.

# Made up of CAST IRON.





# FLYWHEEL

# To store the energy , provide energy when it is needed and store.

# It keeps the engine rotating.



# FUEL INJECTOR

- # A pressurized nozzle which spray the fuel into the incoming air on SI engine.
- # Injector directly spray at the combustion chamber.
- # It is placed at the centre of the combustion chamber.



# OIL PAN

# Oil reservoir usually bolted at the bottom of the crankcase.

# Act as a oil sump.



# OIL PUMP

# Pump used to distribute oil from oil pan to the required point for lubrication purpose.



# OIL FILTER

# To filter the oil.

# Clean oil is need for proper lubrication.



# STARTER

Starter is an electrical device which is used to provide initial torque to the engine at the time of start.



# TURBO CHARGER

# Turbine compressor used to compress incoming air into the engine.

# The turbine is powered by the exhaust flow of the engine so it take very little useful work from engine.



Engine



# What is an engine ?

An engine is an device which is use to convert chemical energy into mechanical energy or work.

Engine

Chemical energy -> mechanical energy

# Types of Engine

On the basis where combustion takes place,  
there are two types of engine-

- 1.External combustion engine (E.C. engine)
- 2.Internal combustion engine (I.C. engine)

# External Combustion Engine

E.C. Engine - In external combustion engine the fuel is burn outside from the engine cylinder and the heat generated then transferred to the main working fluid to vaporises it, and a high pressure is generated which helps to move the piston.

Example - steam engine



# Internal Combustion Engine

I.C. Engine - In internal combustion engine working fluid burns inside the cylinder and the heat generated due to burning is then help to move the piston

Example - Petrol engine,  
Diesel engine



# Difference between E.C and I.C

## E.C. Engine

1. two working fluid in this type of engine.
2. combustion of the fluid take place outside the cylinder.
3. Large in size due to many accessories.
4. As we know that heat transfer take place from one fluid to the another so, heat losses in this type of engine is more.
5. example of such types of engines are  
- steam engine, steam turbine.

## I.C. Engine

1. one working fluid in this type of engine
2. combustion of the fluid take place outside the cylinder
3. small and simple in size as compare to E.C. engine.
4. In this type of engine no heat transfer occurs, so the heat losses are less.
5. example of such type of engines are –  
S.I. engine, CI engine.

# Engine's Main Parts

1. Cylinder block
2. Cylinder
3. Piston
4. Combustion chamber
5. Inlet manifold
6. Exhaust manifold
7. Inlet valve
8. Exhaust valve
9. Spark plug
10. Connecting rod
11. Crank shaft
12. Cam shaft
13. Piston rings
14. Gudgeon pins
15. Fly wheel



Figure 11

# Classification of Heat Engine

- 1. On the basis of operating cycle** – (i) SI Engine ( Otto cycle engine)  
(ii) CI engine (Diesel cycle engine)
- 2. On the basis of ignition method** - (i) SI engine (ii) CI engine
- 3. On the basis of working strokes** - (i) Four stroke engine (ii) Two stroke engine
- 4. On the basis of fuel used** - (i) petrol or gasoline engine (ii) Diesel engine
- 5. On the basis of cooling system** - (i) Air cooled engine (ii) Water cooled engine
- 6. On the Basis of Cylinder Arrangement** - (i) Line Arrangement (ii) V-Engine  
(iii) Radial engine (iv) Opposed cylinder engine
- 7. On the Basis of Ignition System** - (i) Magneto ignition system engines (ii) Battery ignition system engine

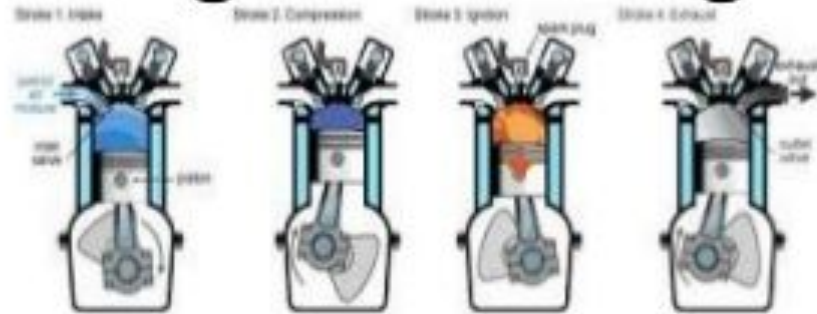
# Important terms used in Engine

- 1. Cylinder bore (D)** - it is the nominal inner diameter of the working cylinder.
- 2. piston area (A)** - it is the area of the circle of diameter equal to cylinder bore.
- 3. stroke length (L)** - the nominal distance through which a working piston moves between two successive reversals of its direction of motion.
- 4. Dead centre** - the position of the working piston and the moving parts which are mechanically connected to it at the moment when the direction of the piston motion is reversed (at either end point of the stroke).  
  
Top dead centre - when the piston held at its top position in the cylinder then this top position is called top dead centre.  
  
Bottom dead centre - when the piston position occurs at the lowest position of the motion then this lowest position is called bottom dead centre.
- 5. Swept volume ( $V_s$ )** - the volume swept by piston while moving from top dead centre to bottom dead centre is called "swept volume".
- 6. Clearance volume ( $V_c$ )** - The volume of the cylinder from its top most surface to top dead centre (T.D.C.) is called "clearance volume".
- 7. Compression ratio ( $r$ )** - It is the ratio of total volume of the cylinder to the clearance volume.



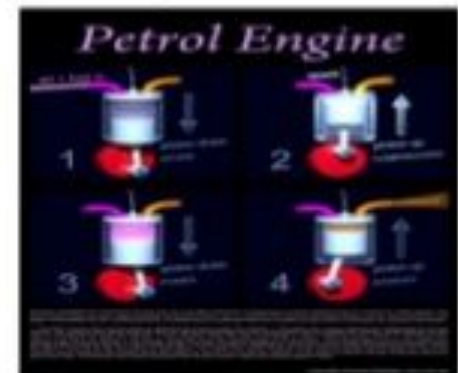
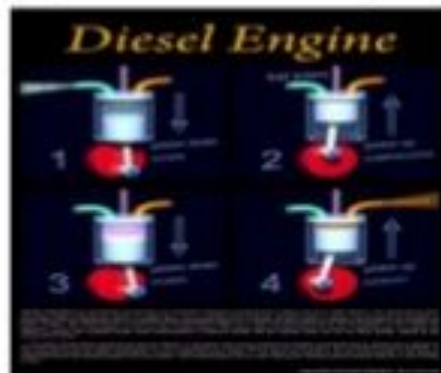
# 4-stroke spark ignition engine

In four stroke cycle engine –  
revolutions of the crankshaft - 2  
crank rotation - 720 degree



- 1. Suction stroke** - In this stroke the fresh charge come into the cylinder and the piston moves from top to bottom dead centre.
- 2. Compression stroke** - in this stroke the movement of the piston from bottom dead centre to the top dead centre and thus the fresh charge get compressed. Both valves remain closed during this stroke.
- 3. Expansion or power stroke** – In this stroke both valves remains closed and ignition of compressed charge takes place and power for wheels and for completion of rest of three stroke takes place. Piston moves from bottom to top dead centre.
- 4. Exhaust stroke** - In this stroke the piston moves from bottom dead centre to top dead centre. Thus the burnt charge sweeps out from cylinder to atmosphere.

# Four Stroke Compression Ignition Engine



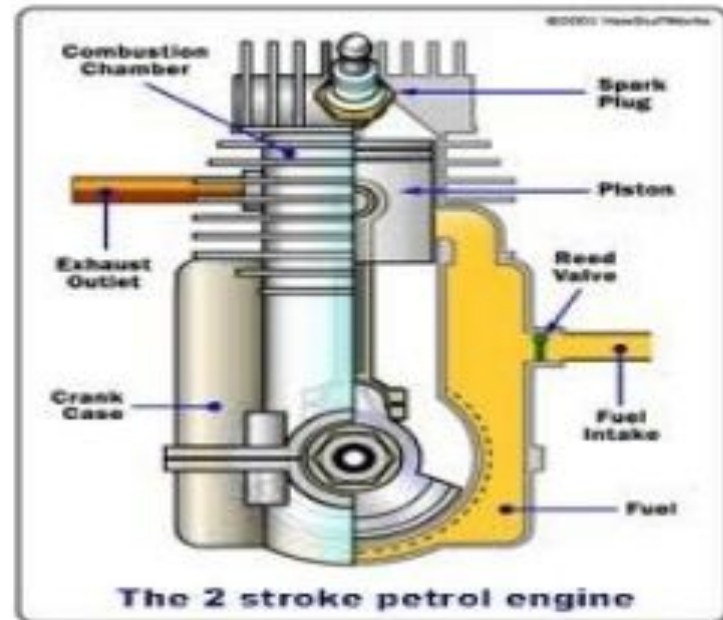
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In four stroke cycle engine –  
revolutions of the crankshaft - 2  
crank rotation - 720 degree

- 1.Suction stroke** - in this stroke the fresh charge (air) come into the cylinder and the piston movement takes place from top to bottom dead centre. Only inlet valve opened in this stroke.
- 2.Compression stroke** - in this stroke the movement of the piston from bottom dead centre to the top dead centre and thus the air get compressed. Both valve remains closed during this stroke.
- 3.Expansion or power stroke** – In this stroke at the end of compression stroke the injector inject diesel into the cylinder and thus ignition of the diesel takes place and power is obtained. Both valve remain closed in this stroke.
- 4.Exhaust stroke** - In this stroke the piston moves from bottom dead centre to top dead centre. Thus the burnt charge sweeps out from cylinder to atmosphere. Only outlet valve opened in this stroke.

## 2-STROKE ENGINE

Revolution of the Crankshaft - one  
Crank rotation - 360 degree



In two stroke engine suction and compression stroke occurs together and expansion and exhaust strokes occurs together. when the piston is at its bottom dead centre then fuel comes in the cylinder through the port, when piston moves upward the fuel get compressed and thus we obtain high pressure and temperature. After the ignition of the fuel a high pressure will occurs on the piston head and piston moves downward, this stroke is known as power stroke. With this stroke the exhaust stroke also occurs.









## INTERNAL COMBUSTION ENGINES

### Engine Classifications تصنيف المحركات

اولاً - تصنيف المحركات على اساس الموقع الذي يحترق فيه الوقود ..الى نوعين:

1-محركات الاحتراق الخارجي EXTERNAL COMBUSTION ENGINES

2-محركات الاحتراق الداخلي INTERNAL COMBUSTION ENGINES

ثانياً - تصنيف المحركات حسب نوع الوقود الذي يستخدم لتشغيلها ..الى ثلاث انواع:

1-محركات الكيروسين (النفط الابيض) Kerosene Engines

2-محركات البنزين Petrol Engines

3-محركات الديزل (زيت الغاز) Diesel Engines

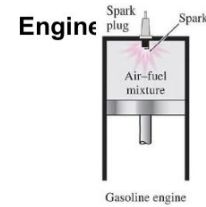
ثالثاً - تصنيف محركات الاحتراق الداخلي حسب طرق حرق الوقود.. الى نوعين:

2 - محركات الاحتراق بالضغط

1- محركات الاحتراق بالشرارة

Compression Ignition Engines

Spark Ignition

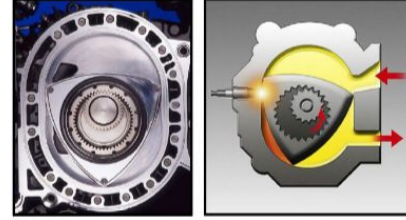




رابعاً – تصنيف المحركات حسب طبيعة حركة الاجزاء المنتجة للطاقة.. الى نوعين:

1- المحركات الترددية **Reciprocating Engines**

2- المحركات الدورانية **Rotational Engines**



Rotary Engine (Wankel Engine)

خامساً – تصنيف المحركات الاحتراق على اساس الدورة الحرارية..الى نوعين:

1-محركات ثنائية الاشواط **Engines Two Stroke**

2-محركات رباعية الاشواط **Engines Four Stroke**

سادساً – تصنيف المحركات على اساس نوع التبريد..الى نوعين:

1-محركات تبرد بالماء **Engines Water Cooling**

2-محركات تبرد بالهواء **Engines Air Cooling**