



UNIT IV

TWO AND FOUR STROKE ENGINE

Basic Civil and Mechanical Engineering

KARTHICK B

ASSISTANT PROFESSOR / MECHANICAL ENGG



INTRODUCTION



Heat Engine:

- Heat Engine is a machine which converts heat energy supplied to it into mechanical work.
- Heat energy is supplied to the engine by burning the fuel.



CLASSIFICATION OF HEAT ENGINES



• Internal Combustion Engines (IC Engines)

In IC engines, combustion of fuel takes place inside the engine cylinder.

Examples: Diesel Engines, Petrol Engines, Gas engines.

• External Combustion Engines (EC Engines)

In EC engines, combustion of fuel takes place outside the working cylinder.

Examples: Steam Engines and Steam turbines



CLASSIFICATION OF IC ENGINES

IC Engines are classified into,

(1) Cycle of operation (No of Strokes per cycle)

- Two Stroke cycle Engines
- Four Stroke Cycle Engines

(2) Thermodynamic Cycle or Method of Heat addition:

- Otto Cycle Engines (Combustion at constant volume)
- Diesel Cycle Engines (Combustion at constant Pressure)
- Semi Diesel Engines (Dual Combustion Engines)

(3) Types of Fuel Used :

- Petrol Engines
- Diesel Engines
- Gas Engines

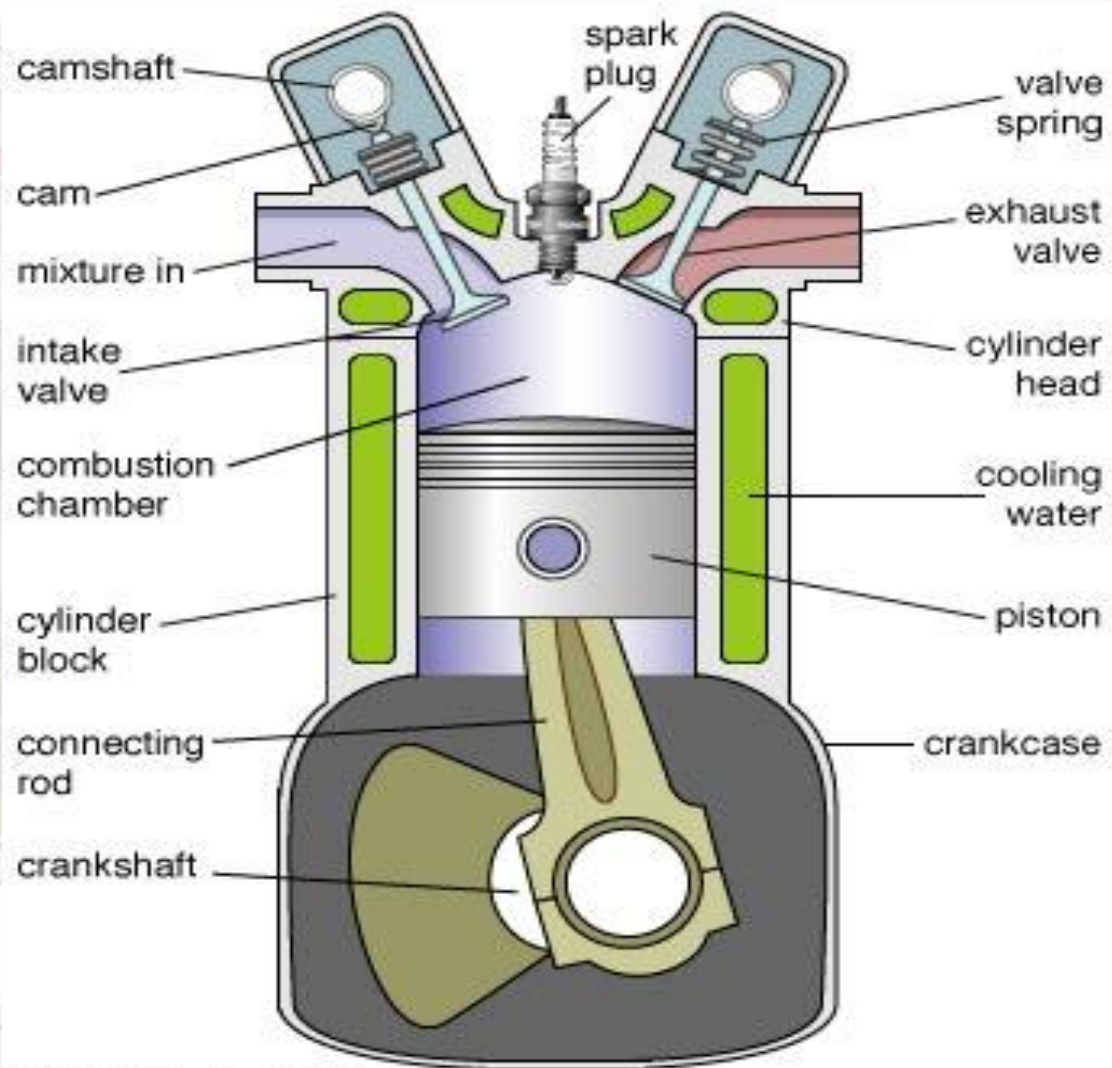


CLASSIFICATION OF IC ENGINES

IC Engines are classified into,

(4) Ignition Method :

- Spark Ignition (SI)
- Compression Ignition (CI)



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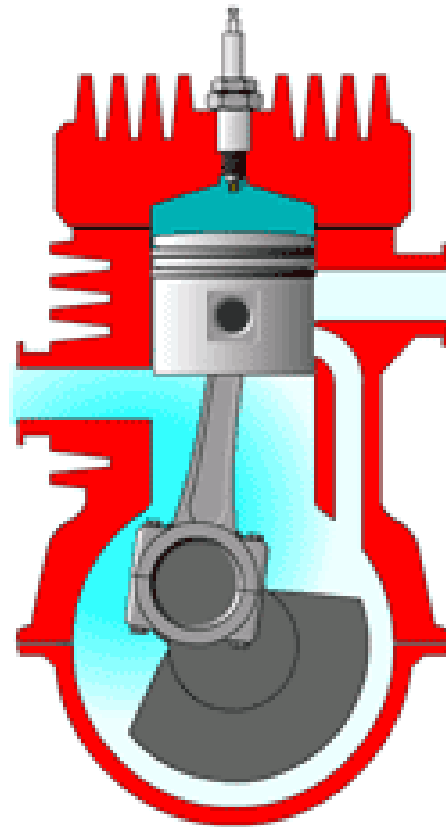
CLASSIFICATION OF PETROL ENGINES



- Two Stroke cycle Petrol Engines
- Four Stroke cycle petrol Engines

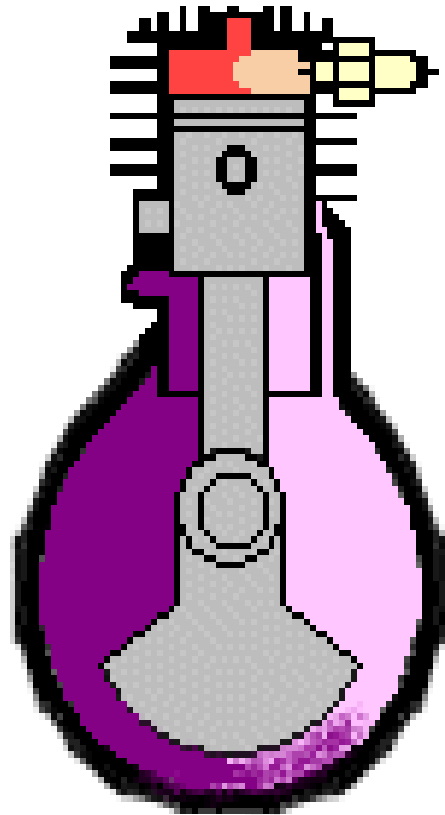


TWO STROKE CYCLE PETROL ENGINES





TWO STROKE CYCLE PETROL ENGINES





PORTS IN TWO STROKE ENGINE

1. Inlet Port
2. Exhaust Port
3. Transfer Port



STROKES IN TWO STROKE ENGINE



Stroke-1 (Upward)

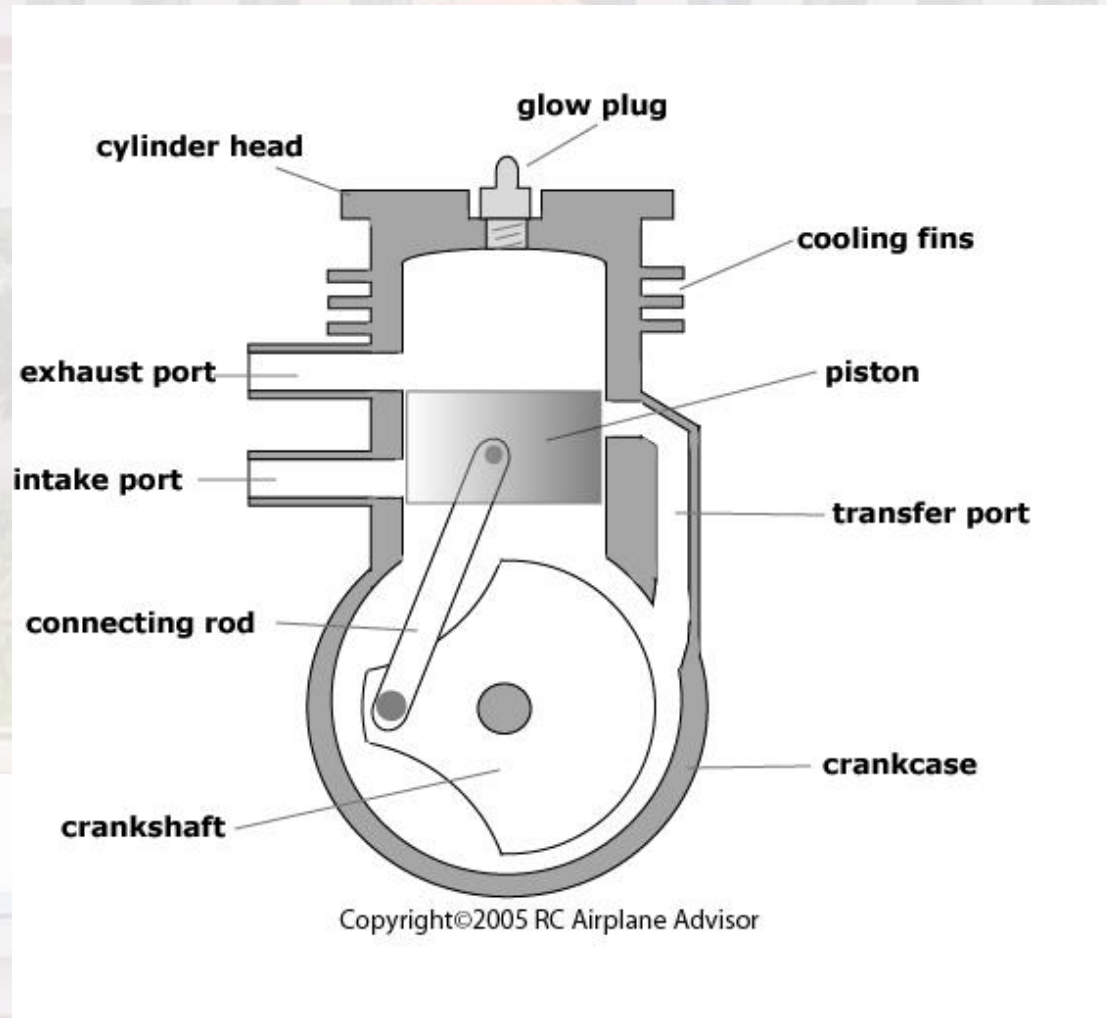
Compression
Ignition

Stroke-2 (Downward)

Power/Expansion
Exhaust

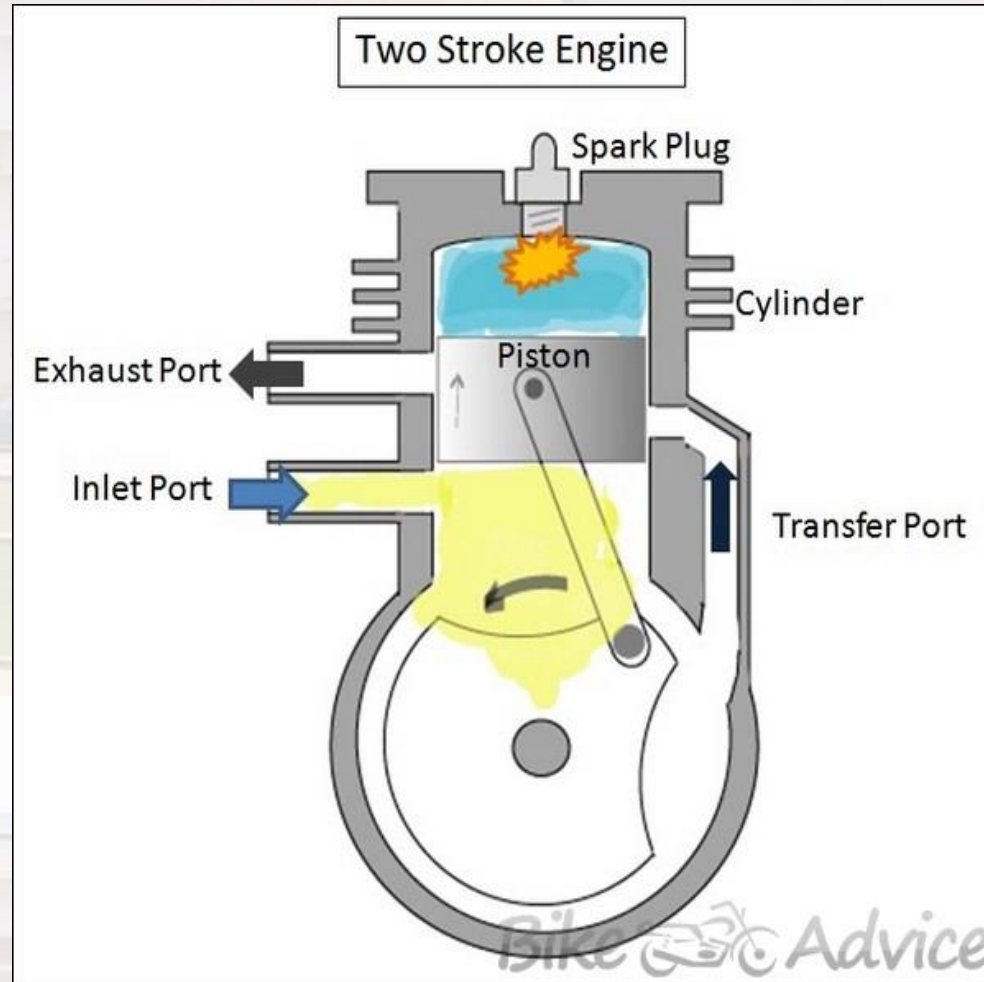


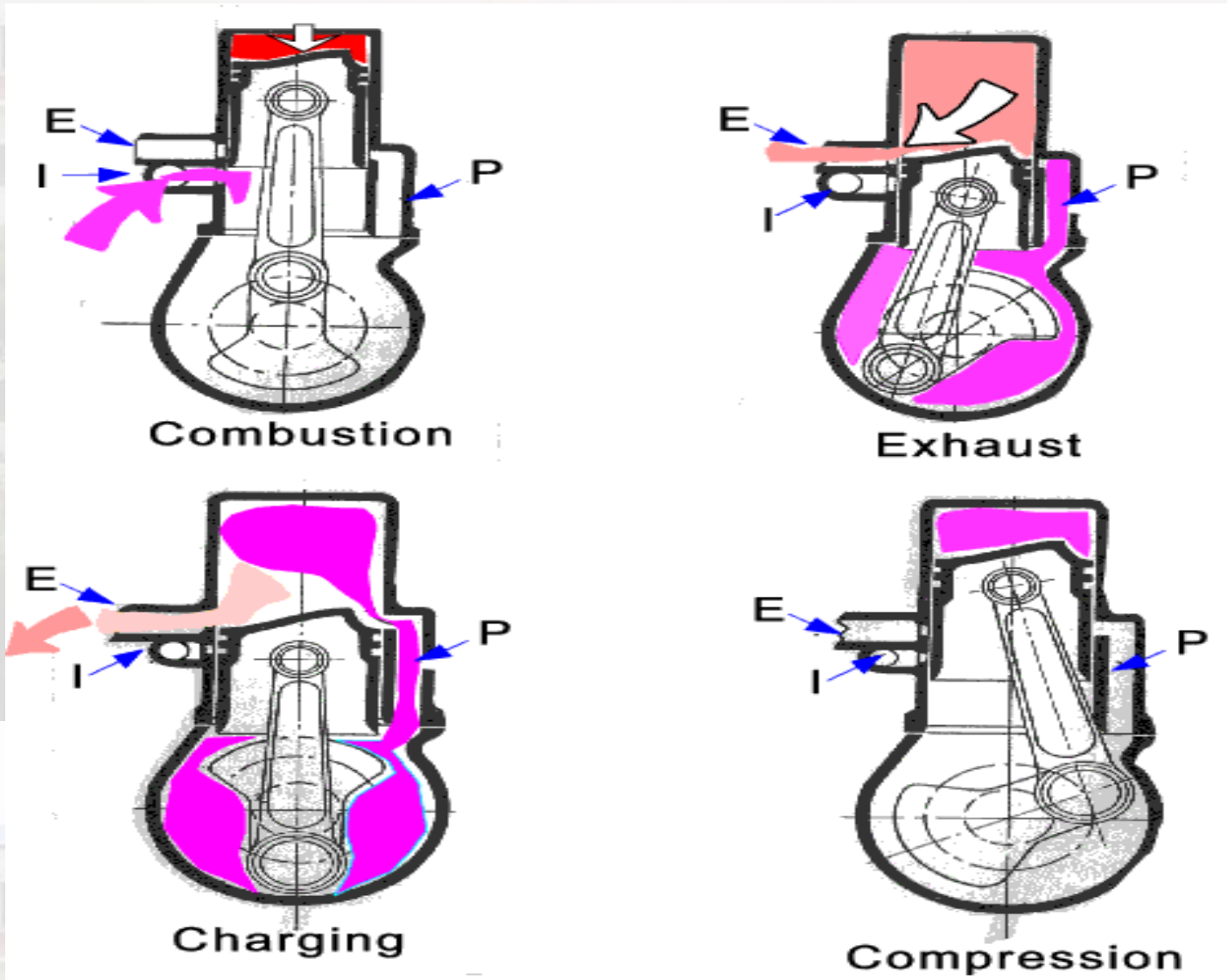
TWO STROKE ENGINE





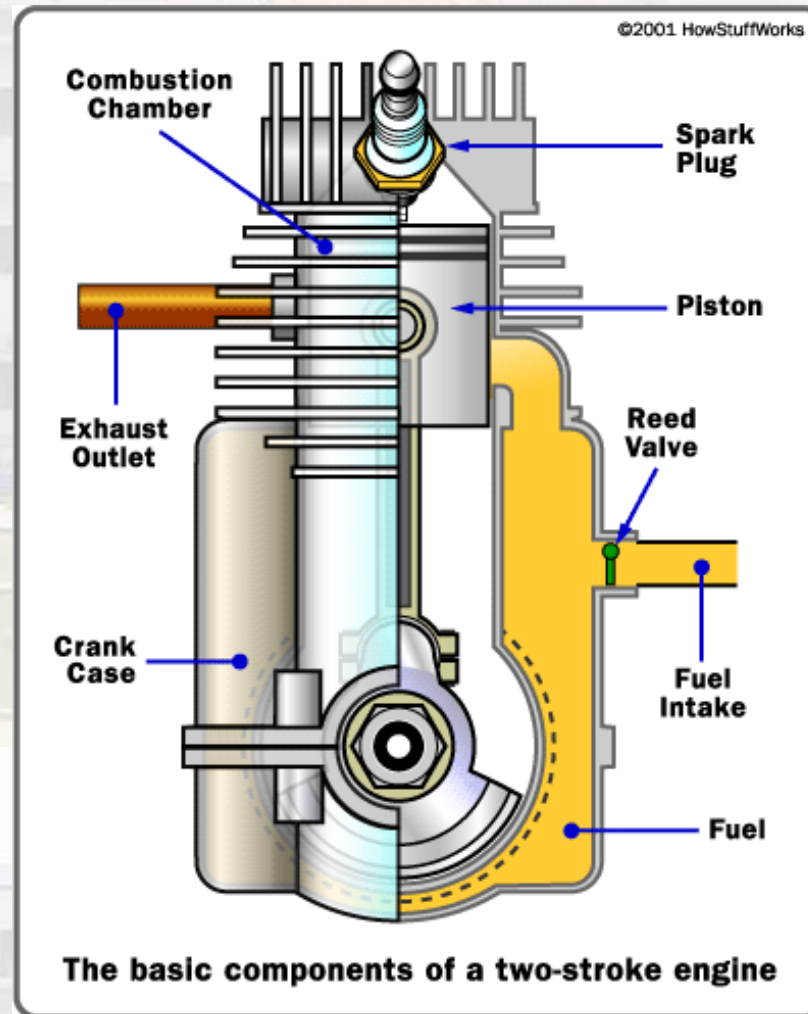
TWO STROKE ENGINE







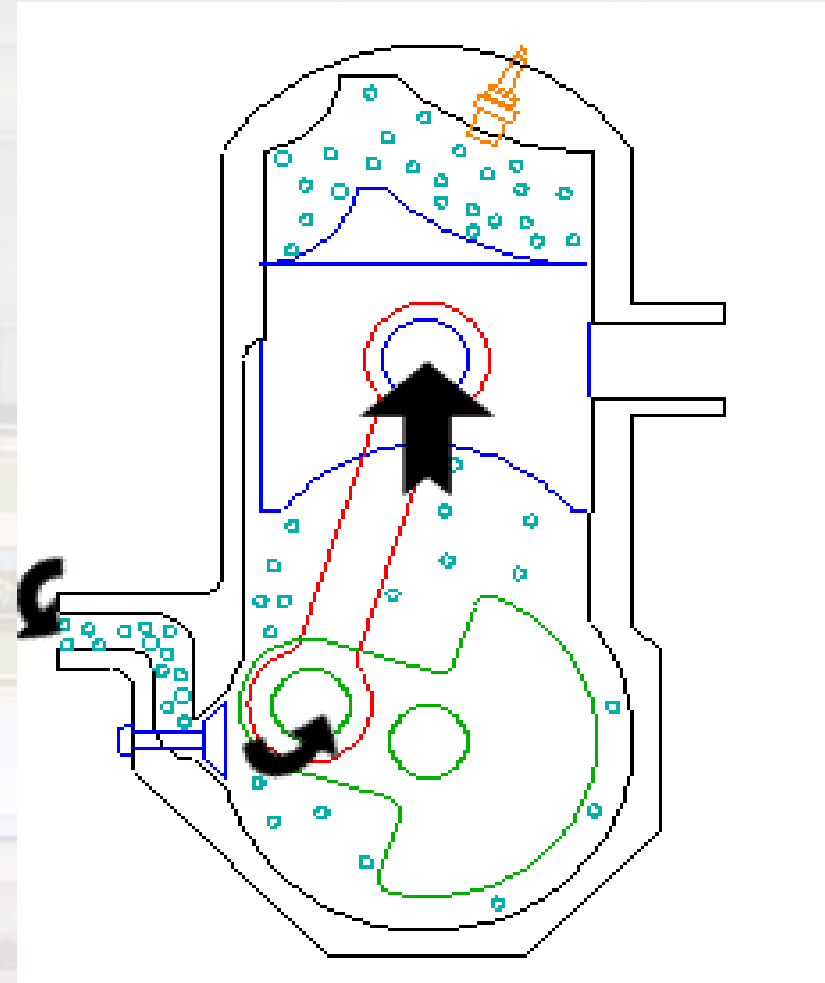
COMPONENTS OF TWO STROKE ENGINES





INTAKE

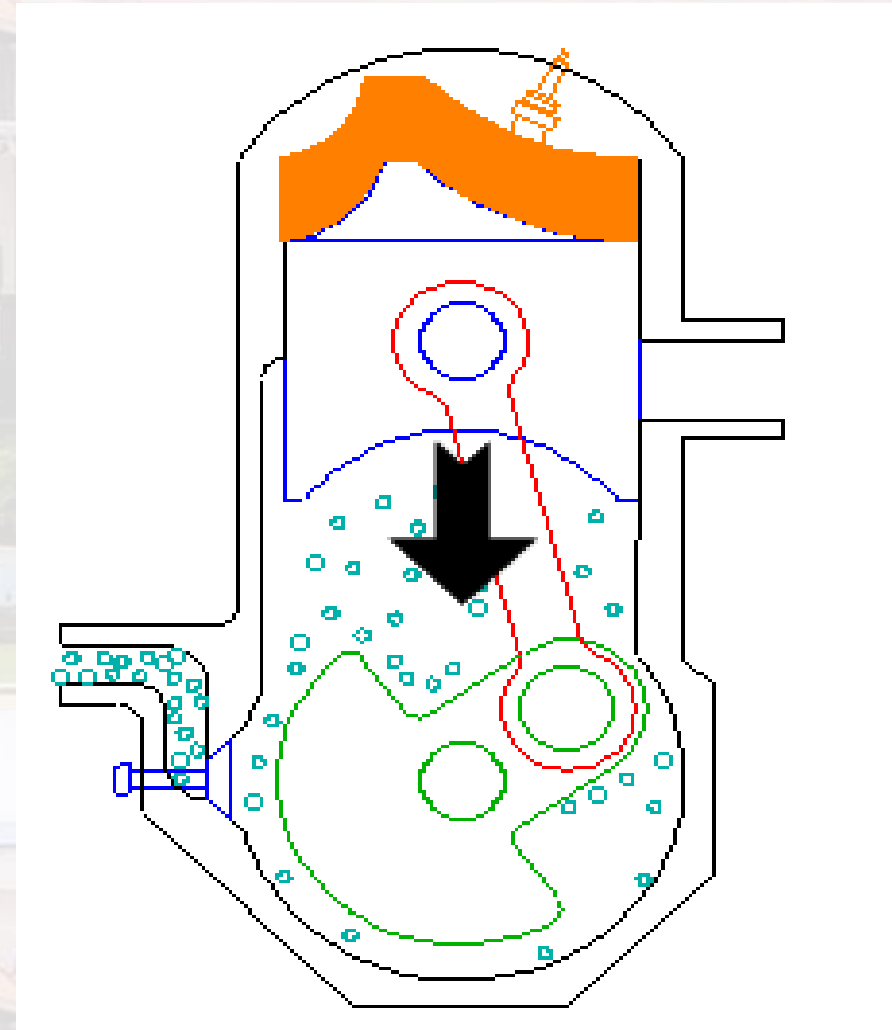
The fuel/air mixture is first drawn into the crankcase by the vacuum that is created during the upward stroke of the piston. The illustrated engine features a poppet intake valve; however, many engines use a rotary valve incorporated into the crankshaft.





CRANKCASE COMPRESSION

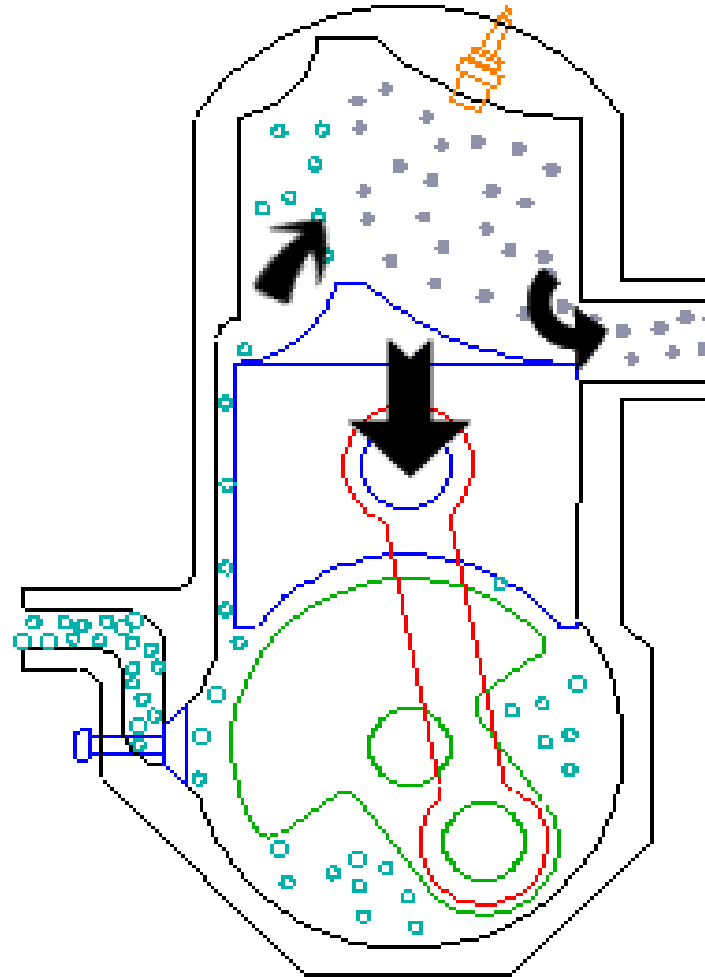
During the downward stroke, the poppet valve is forced closed by the increased crankcase pressure. The fuel mixture is then compressed in the crankcase during the remainder of the stroke.





TRANSFER/EXHAUST

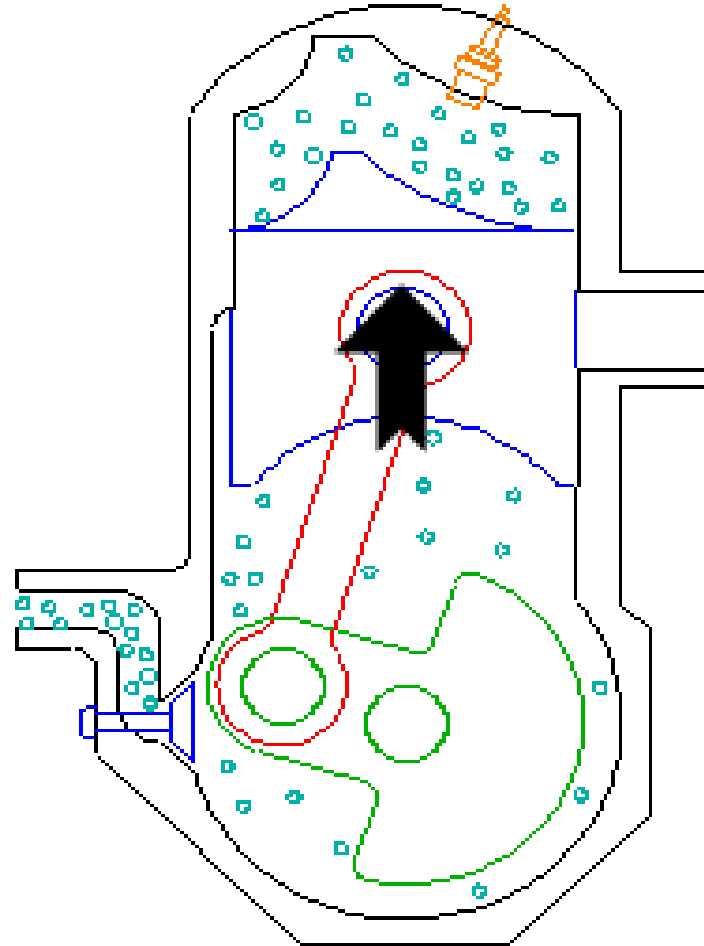
Toward the end of the stroke, the piston exposes the intake port, allowing the compressed fuel/air mixture in the crankcase to escape around the piston into the main cylinder. This expels the exhaust gasses out the exhaust port, usually located on the opposite side of the cylinder. Unfortunately, some of the fresh fuel mixture is usually expelled as well.





COMPRESSION

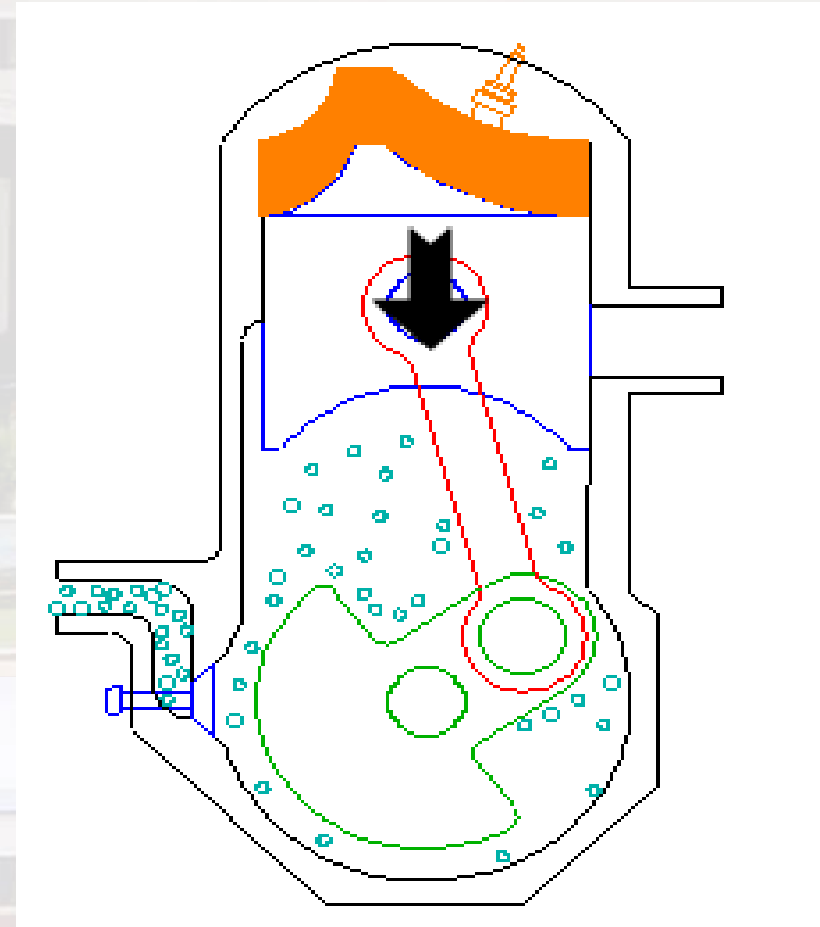
The piston then rises, driven by flywheel momentum, and compresses the fuel mixture. (At the same time, another intake stroke is happening beneath the piston).





POWER

At the top of the stroke, the spark plug ignites the fuel mixture. The burning fuel expands, driving the piston downward, to complete the cycle. (At the same time, another crankcase compression stroke is happening beneath the piston.)





TWO STROKE CYCLE PETROL ENGINE - CONSTRUCTION



Construction :

- A piston reciprocates inside the cylinder
- It is connected to the crankshaft by means of connecting rod and crank
- **There are no valves in two stroke engines, instead of valves ports are cut on the cylinder walls.**
- There are three ports, namely **inlet**, **exhaust** and **transfer** ports.
- The closing and opening of the ports are obtained by the movement of piston. The crown of piston is made in to a shape to perform this.
- A spark plug is also provided.



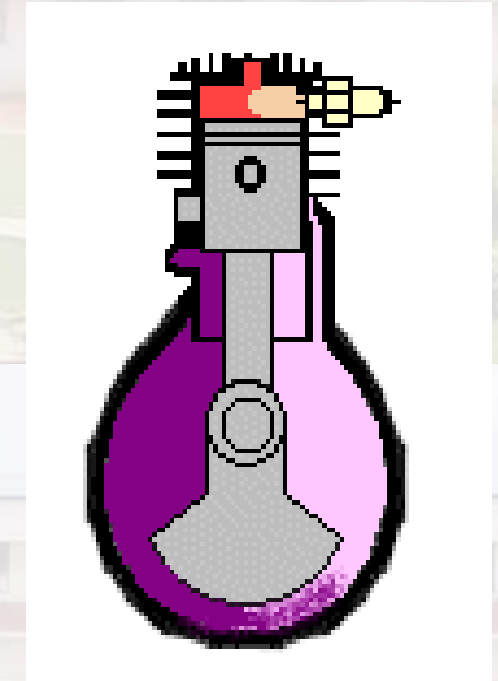
TWO STROKE CYCLE PETROL ENGINES - WORKING



First Stroke : (Compression, ignition and inductance) (Upward stroke of piston)

(a) compression:

- The piston moves up from Bottom Dead Centre (BDC) to Top Dead Centre (TDC)
- Both transfer and exhaust ports are covered by the piston.
- Air fuel mixture which is transferred already into the engine cylinder is compressed by moving piston.
- The pressure and temperature increases at the end of compression.





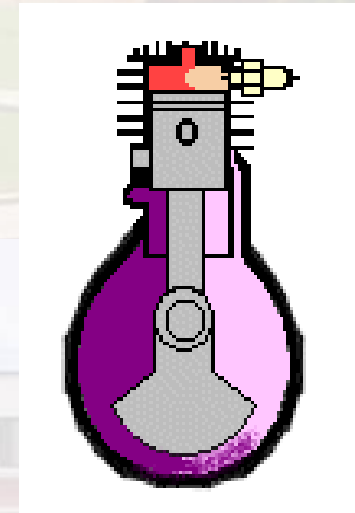
TWO STROKE CYCLE PETROL ENGINES - WORKING



First Stroke : (Compression, ignition and inductance) (Upward stroke of piston)

(b) Ignition and Inductance:

- Piston almost reaches the top dead centre
- The air fuel mixture inside the cylinder is ignited by means of an electric spark produced by a spark plug
- At the same time, the inlet port is uncovered by the plane.
- Fresh air fuel mixture enters the crankcase through the inlet port.





TWO STROKE CYCLE PETROL ENGINES - WORKING

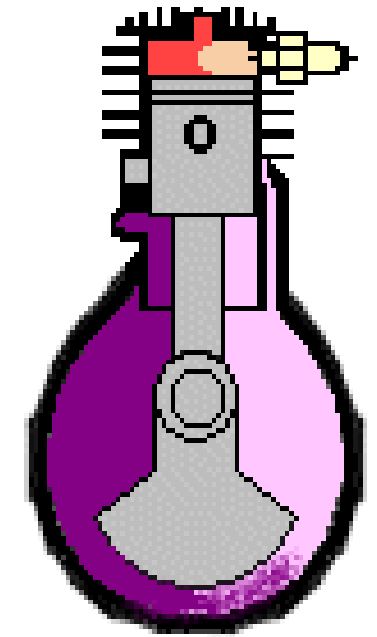


Second Stroke: (Downward Stroke of the engine) :

(c)Expansion and Crankcase compression

- The burning gases expand in the cylinder
- The burning gases force the piston to move down. Thus useful work is obtained.
- When the piston moves down, the air fuel mixture in the crankcase is partially compressed.

This compression is known as *Crank case compression.*





TWO STROKE CYCLE PETROL ENGINES - WORKING



Second Stroke: (Downward Stroke of the engine) :

(d) Exhaust and transfer:

- At the end of expansion, exhaust port is uncovered.
- Burnt gases escape to the atmosphere.
- Transfer port is also opened. The partially compressed air fuel mixture enters the cylinder through the transfer port.
- The crown of the piston is made of a deflected shape. So the fresh charge entering the cylinder is deflected upwards in the cylinder.
- Thus the escape of fresh charge along with the exhaust gases is reduced.



TWO STROKE CYCLE DIESEL ENGINES- CONSTRUCTION



- Two stroke cycle diesel engines require air supply
- This air is used to blow out the exhaust gases and to fill the cylinder with clean air
- This air is supplied by a blower or air compressor which is driven by engine itself.
- These engines may be valve or port type.
- A plate is provided in the crank case to admit air into the crank case.
- Transfer and exhaust ports are provided in the cylinder.
- These ports are covered and uncovered by the moving piston.



TWO STROKE CYCLE DIESEL ENGINES- WORKING



First Stroke (Upward Stroke of the piston)

(a) Compression and inductance:

- The piston moves upwards from Bottom Dead Centre (BDC) to Top Dead Centre (TDC).
- Both transfer and exhaust ports are covered.
- Air which is transferred already into the engine cylinder is compressed by moving piston.
- The pressure and temperature of the air increases.
- At the same time, fresh air is admitted into the crankcase through the plate valve (reed valve)



TWO STROKE CYCLE DIESEL ENGINES- WORKING



First Stroke (Upward Stroke of the piston)

(b) Ignition and inductance.

- Piston almost reaches the top dead centre.
- The fuel is injected into the hot compressed air inside the cylinder. The fuel mixed with hot air and burns.
- The admission of fresh air into the crankcase continues till the piston reaches the top centre.



TWO STROKE CYCLE DIESEL ENGINES- WORKING



Second Stroke (Downward Stroke of the piston)

(c) Expansion and crank case compression:

- The burning gases expand in the cylinder.
- Burning gases force the piston to move down. Thus useful work is obtained.
- At the same time, the air in the crank case is compressed by the movement of the piston.
- All the ports and the plate valve are in closed position



TWO STROKE CYCLE DIESEL ENGINES- WORKING



Second Stroke (Downward Stroke of the piston)

(d) Exhaust and Transfer:

- At the end of expansion, the exhaust port is uncovered.
- The burnt escape to the atmosphere through the exhaust port.
- Transfer port is also uncovered shortly after the exhaust port is opened.
- The partially compressed air from crank case enters the cylinder the transfer port.
- This air is deflected upwards by the deflected shape of the piston.
- Thus the entering air helps in forcing out the combustion products from the cylinder
- The plate valve remains during this period.



THANK YOU