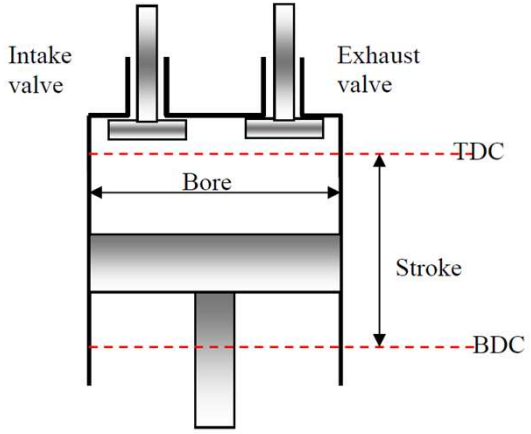
Engine parts:

S. No.	Name of the Parts
1.	Cylinder head
2.	Cylinder liner
3.	Engine block
4.	Piston
5.	Piston pin
6.	Connecting rod
7.	Piston rings
8.	Connecting rod bearings
9.	Main bearings
10.	Crankshaft
11.	Camshaft
12.	Timing gears
13.	Push rods
14.	Engine valves
15.	Valve springs
16.	Manifolds
17.	Crankcase
18.	Flywheel
19.	Studs and bolts
20.	Gaskets

Engine Nomenclature



Reciprocation engine.

Top dead center (TDC): It is the dead center when the piston is farthest from the crank shaft. in HZ. Engine it is called inner dead center

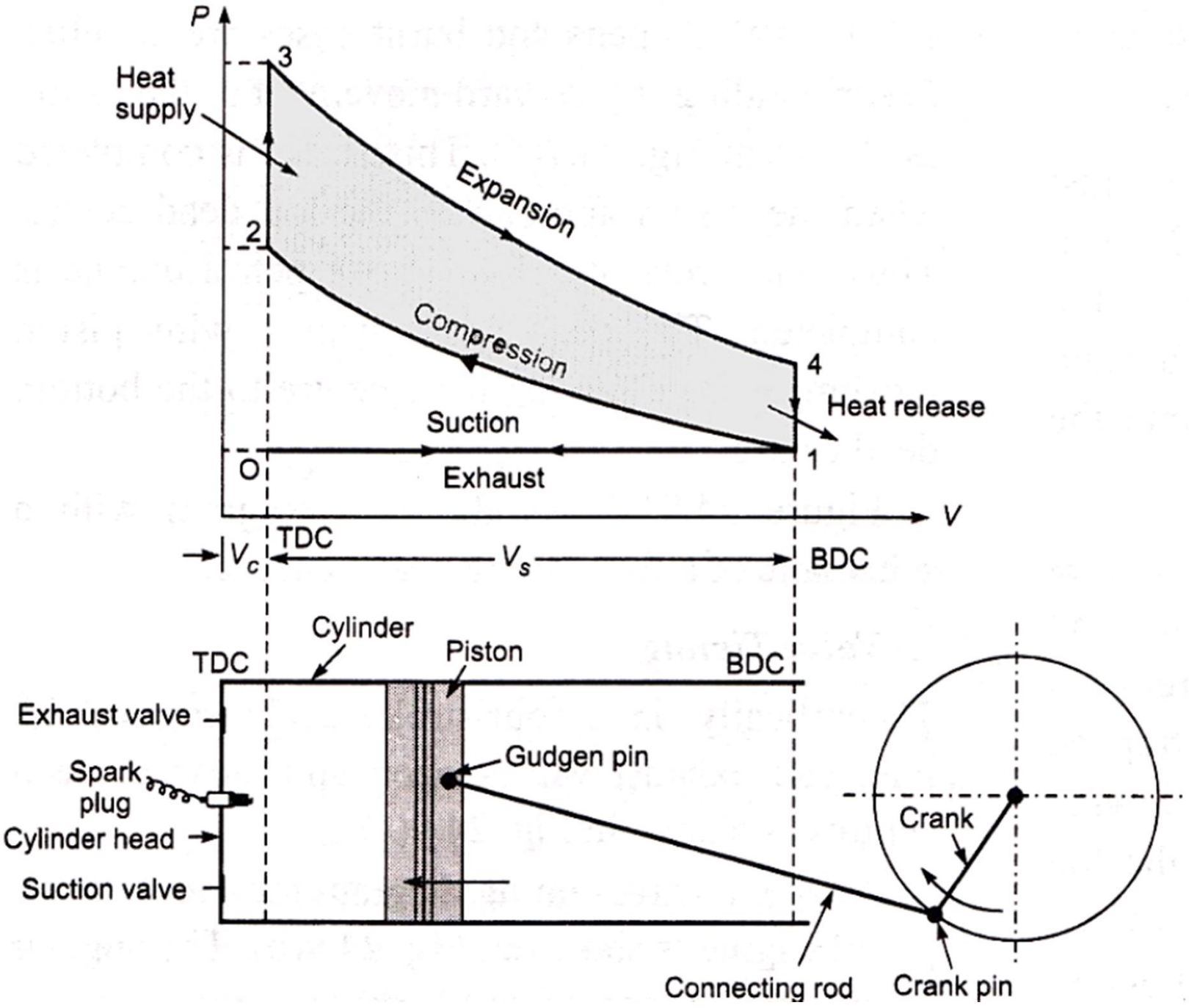
Or The position of the piston when it forms the smallest volume in the cylinder.

Bottom dead center (BDC): Dead center when the piston is nearest to the crankshaft . in HZ. Engine it is called Outer dead center

or The position of the piston when it forms the largest volume in the cylinder.

Stroke length (L): The nominal distance through which a working piston moves between two Dead center

Bore: The diameter of the piston.


P
3
Heat supply
Expansion
2
Compression
4
Heat release
Suction
O
Exhaust
1
V
V_c
TDC
V_s
BDC
Cylinder
Piston
TDC
BDC
Exhaust valve
Spark plug
Cylinder head
Suction valve
Gudgen pin
Crank
Connecting rod
Crank pin

Cylinder bore (D): The nominal inner diameter of the working cylinder.

Displacement volume or swept volume (Vs): The nominal volume generated by the working piston when travelling from the one dead Centre to next one and given as,

$$Vs = A \times L$$

Clearance volume (Vc): the nominal volume of the space on the combustion side of the piston at the top dead centre.

Cylinder volume (V): Total volume of the cylinder.

$$V = Vs + Vc$$

Compression ratio (r): $\mathbf{r =} \quad \frac{V_1}{V_2} = \quad 1 + \frac{V_s}{V_c}$

4-stroke SI Engine

4-S SI engine have compression ratio : 6-10 .

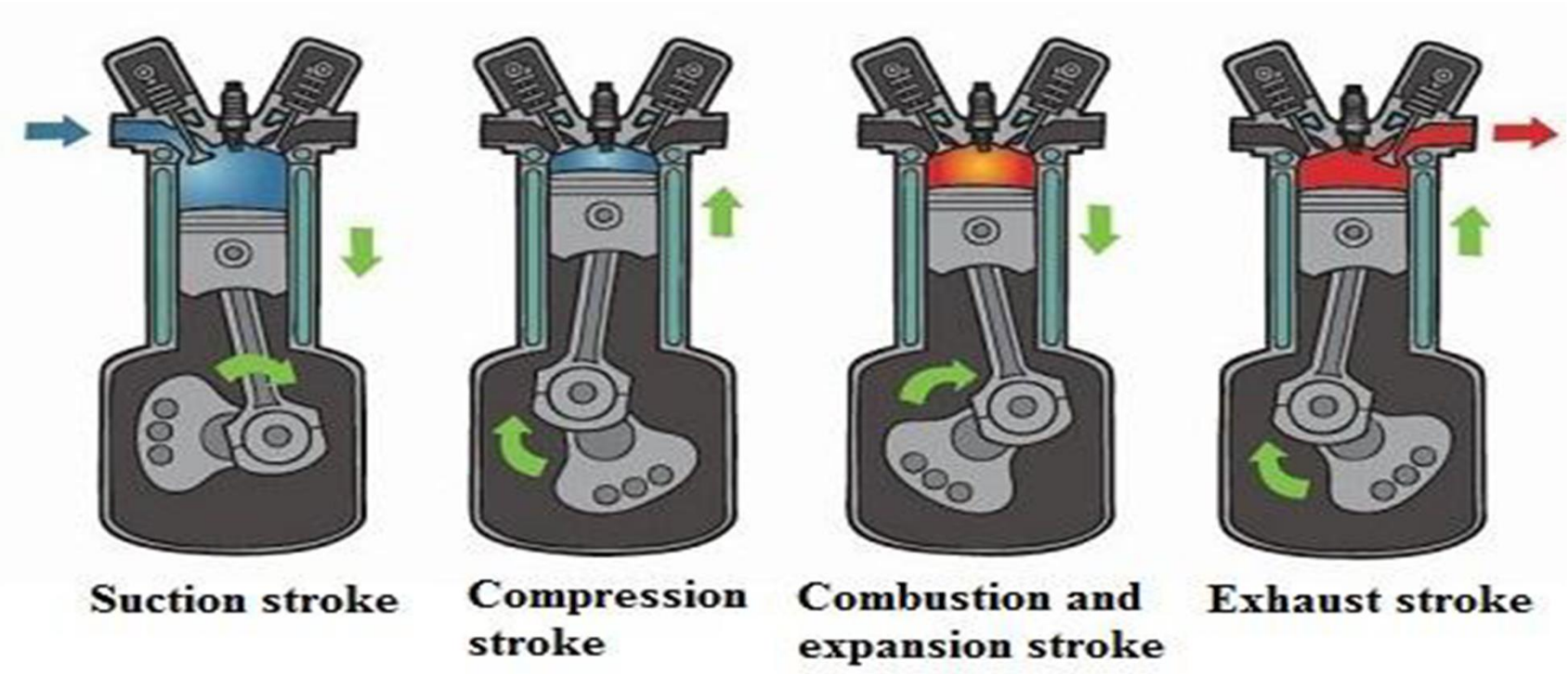
1.Suction Stroke - In this stroke the piston begins at top dead center (TDC) and ends at bottom dead center (BDC). Air and fuel mixture is drawn into cylinder during this stroke.

2.Compression- This stroke begins at B.D.C, or just at the end of the suction stroke, and ends at T.D.C. In this stroke the piston compresses the air-fuel mixture into clearance volume. Both the intake and exhaust valves are closed during this stroke. . At the end of compression stroke the air fuel mixture is ignited by spark plug and both valve remain closed during this stroke . Heat is added at constant volume .Chemical energy of fuel is converted into heat energy.

3.Expansion stroke : Also known as power stroke. After the compression the high pressure of the burnt gases force the piston. Piston moves from TDC to BDC due to products of combustion expand. Power is produced in this stroke .

4. **Exhaust**: During the *exhaust* stroke, the piston returns from B.D.C. to T.D.C. while the exhaust valve is open and inlet valve is closed . This action expels the spent product of combustion through the exhaust valve.

4-stroke SI Engine



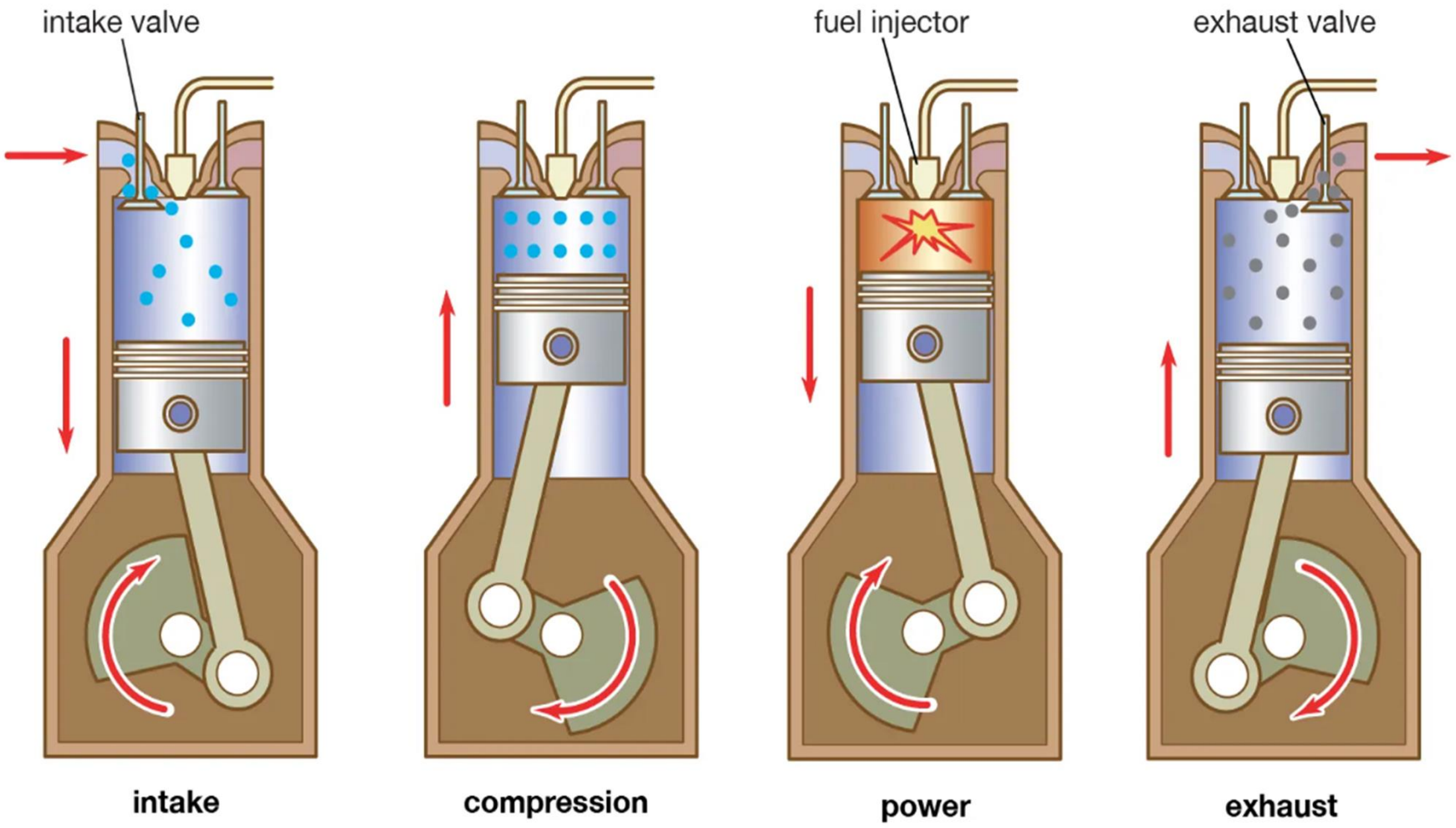
4-stroke CI engine

4-S CI engine operates on higher compression ratio.

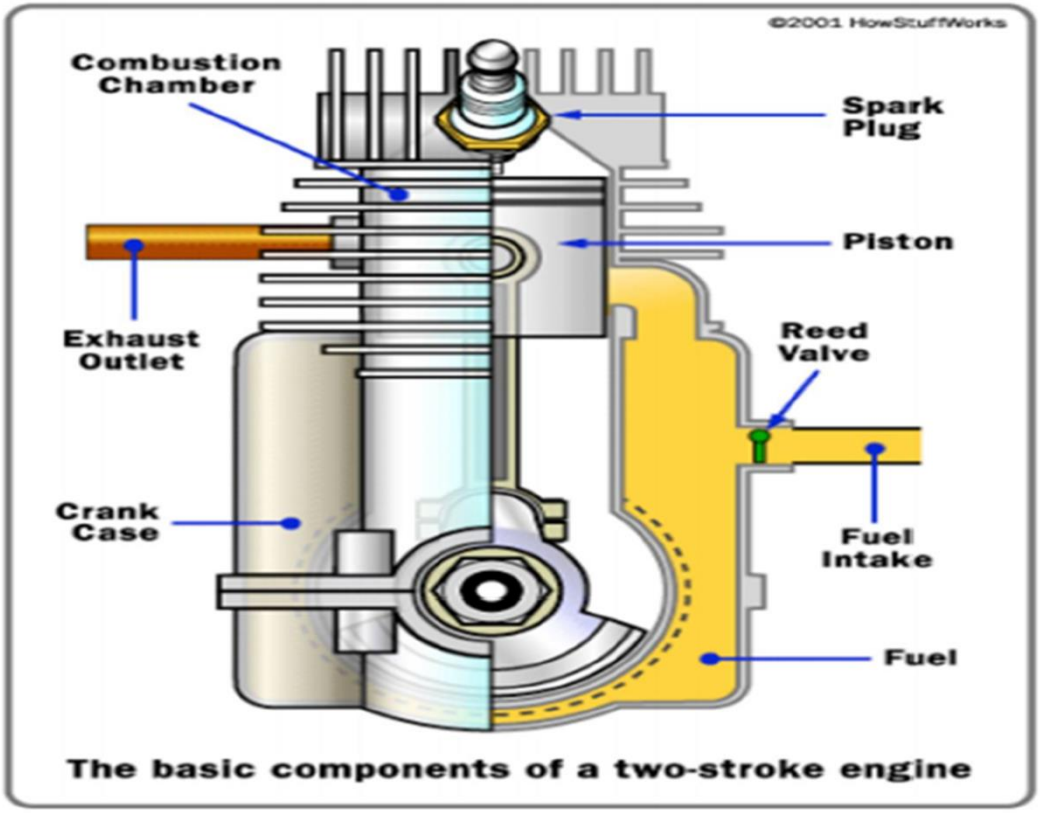
CI : 16 -20

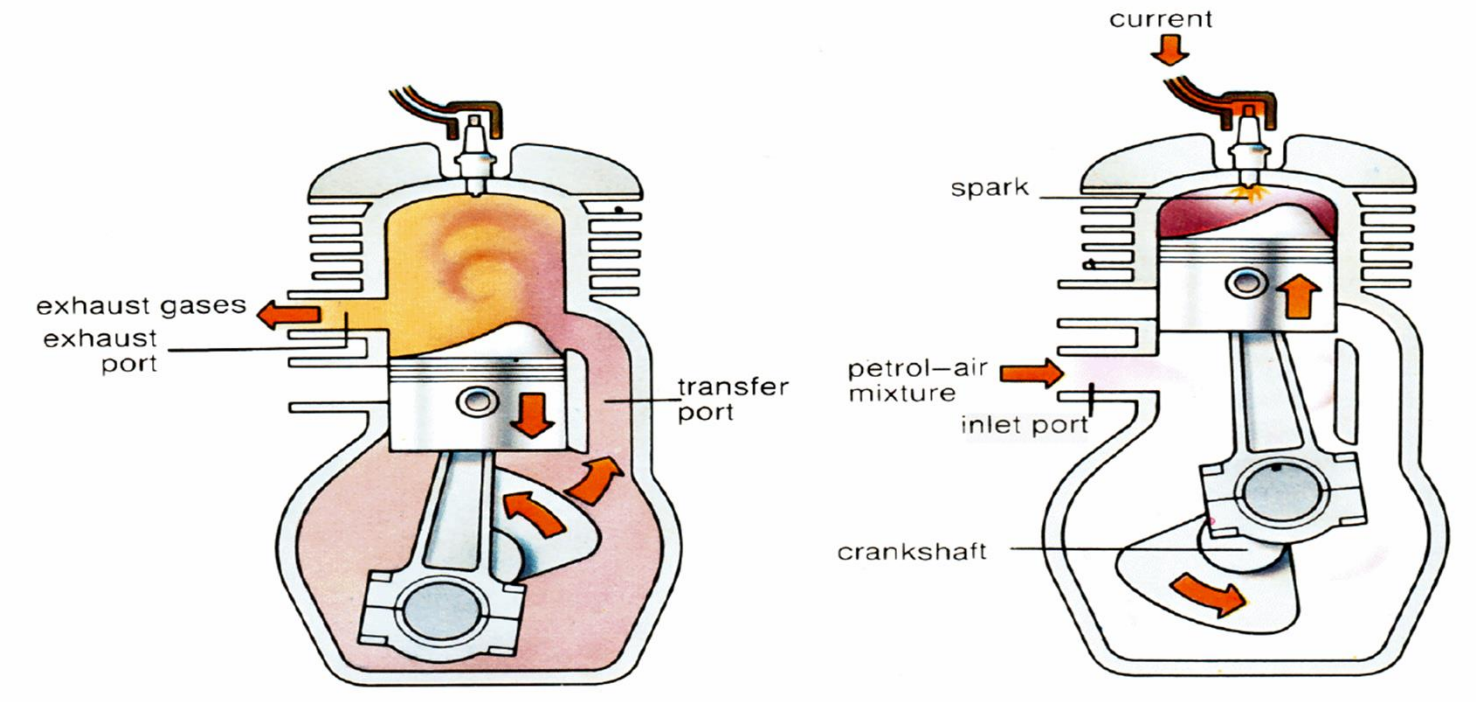
1. **Suction Stroke -** In this stroke the piston is moves from top dead center (TDC) to bottom dead center (BDC). Fresh Air comes into cylinder during this stroke.
2. **Compression Stroke -** In this stroke the piston is moves from bottom dead center (BDC) to top dead center (TDC). In this stroke the piston compresses the air into clearance volume. Both the intake and exhaust valves are closed during this stroke.
3. **Expansion stroke :** Also known as power stroke. Fuel injection start nearly at the end of compression stroke .Heat is added at constant pressure .After the injection of fuel is completed the products of combustion expand and both valve remain closed during this stroke. In this stroke the piston is moves from top dead center (TDC) to bottom dead center (BDC).
4. **Exhaust**: In this stroke the piston is moves from bottom dead center (BDC) to top dead center (TDC). . while the exhaust valve is open. This action expels the spent product of combustion through the exhaust valve.

4-stroke CI engine



2 Stroke Engine





No piston stroke for suction and exhaust operations
Suction is accomplished by air compressed in crankcase or by a blower
Induction of compressed air removes the products of combustion through exhaust ports
Transfer port is there to supply the fresh charge into combustion chamber

- Two-stroke engines do not have valves, which simplifies their construction and lowers their weight.
- Two-stroke engines fire once every revolution, while four stroke engines fire once every other revolution. This gives two-stroke engines a significant power boost.

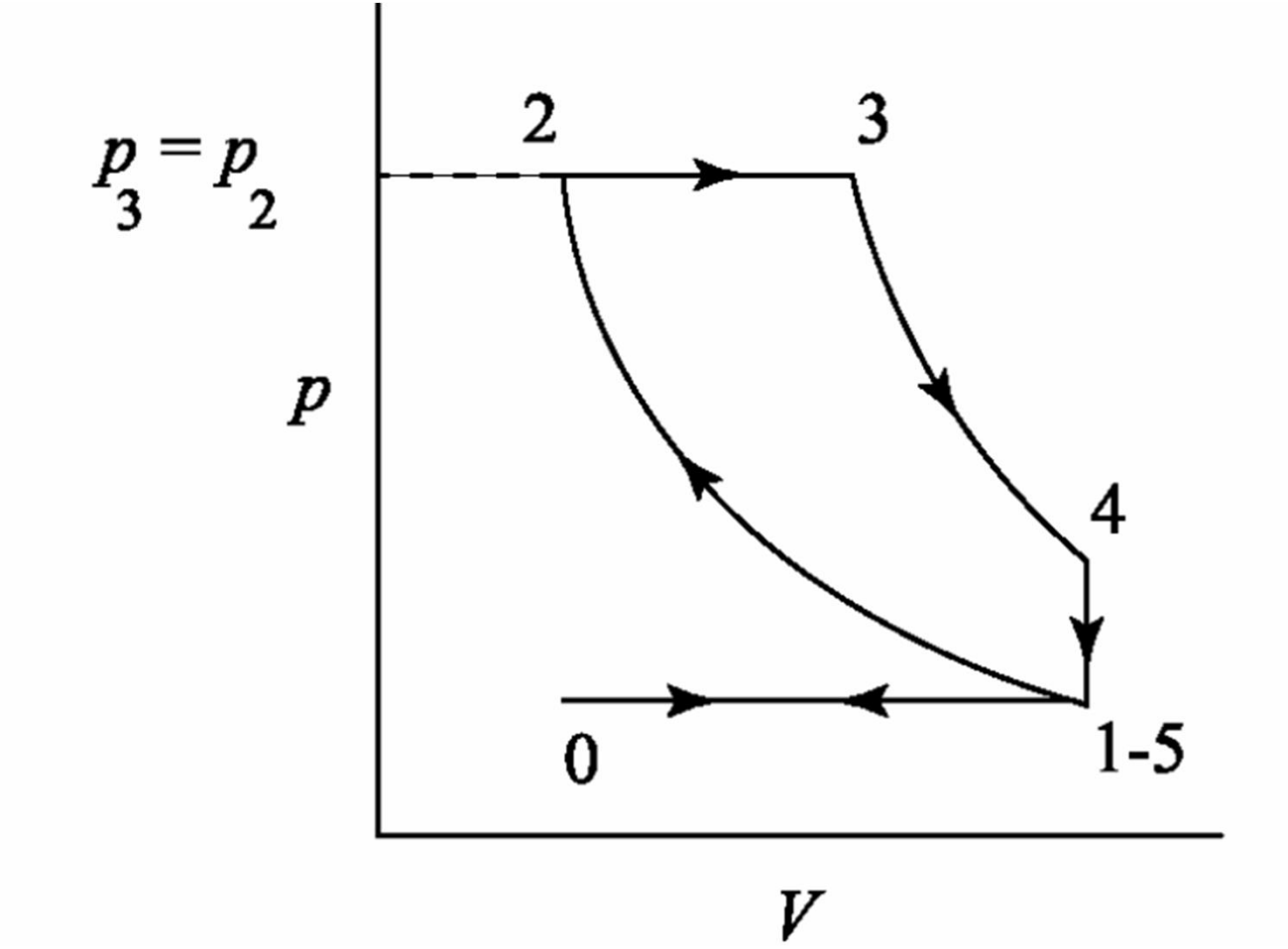
Difference b/w 2-S & 4-S Engine

Four stroke engine	Two stroke engine
1. One power stroke for every two revolutions of the crankshaft.	One power stroke for each revolution of the crankshaft.
2. There are inlet and exhaust valves in the engine.	There are inlet and exhaust ports instead of valves.
3. Crankcase is not fully closed and air tight.	Crankcase is fully closed and air tight.
4. Top of the piston compresses the charge.	Both sides of the piston compress the charge.
5. Size of the flywheel is comparatively larger.	Size of the flywheel is comparatively smaller.
6. Fuel is fully consumed.	Fuel is not fully consumed.
7. Weight of engine per hp is high.	Weight of engine per hp is comparatively low.
8. Thermal efficiency is high.	Thermal efficiency is comparatively low.
9. Removal or exhaust gases easy.	Removal of exhaust gases comparatively difficult.
10. Torque produced is even.	Torque produced is less even.
11. For a given weight, engine would give only half the power of two stroke	For same weight, two stroke engine gives twice the power that of four stroke engine.

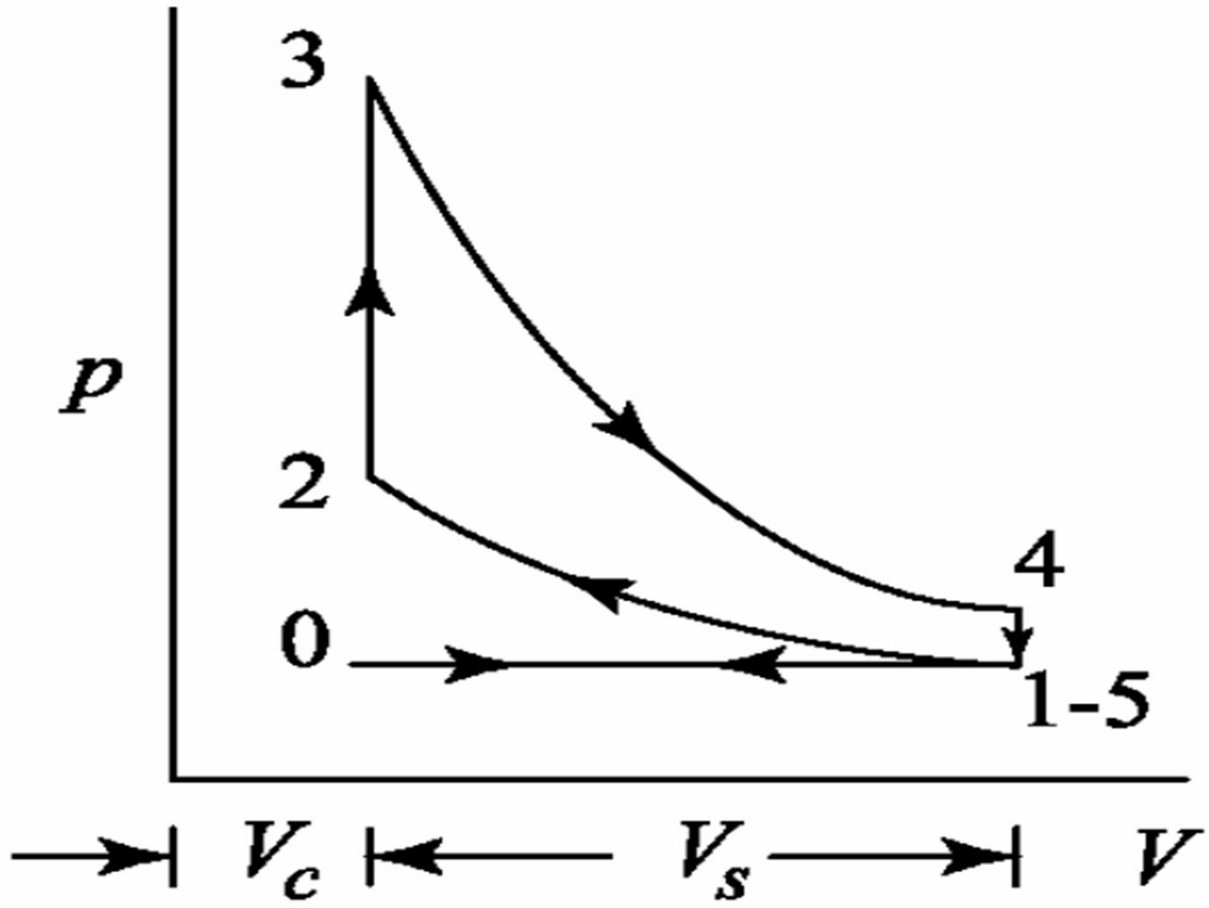
Comparison of SI and CI engine:

SI engine	CI engine
Working cycle is Otto cycle.	Working cycle is diesel cycle.
Petrol or gasoline or high octane fuel is used.	Diesel or high cetane fuel is used.
High self-ignition temperature.	Low self-ignition temperature.
Fuel and air introduced as a gaseous mixture in the suction stroke.	Fuel is injected directly into the combustion chamber at high pressure at the end of compression stroke.
Carburettor used to provide the mixture. Throttle controls the quantity of mixture introduced.	Injector and high pressure pump used to supply of fuel. Quantity of fuel regulated in pump.
Use of spark plug for ignition system	Self-ignition by the compression of air which increased the temperature required for combustion
Compression ratio is 6 to 10.5	Compression ratio is 14 to 22
Higher maximum RPM due to lower weight	Lower maximum RPM
Maximum efficiency lower due to lower compression ratio	Higher maximum efficiency due to higher compression ratio
Lighter	Heavier due to higher pressures

P-V (indicator) diagram: 4-stroke CI engine



P-V diagram: 4-stroke SI engine



p-V (indicator) diagram: 2-stroke SI engine