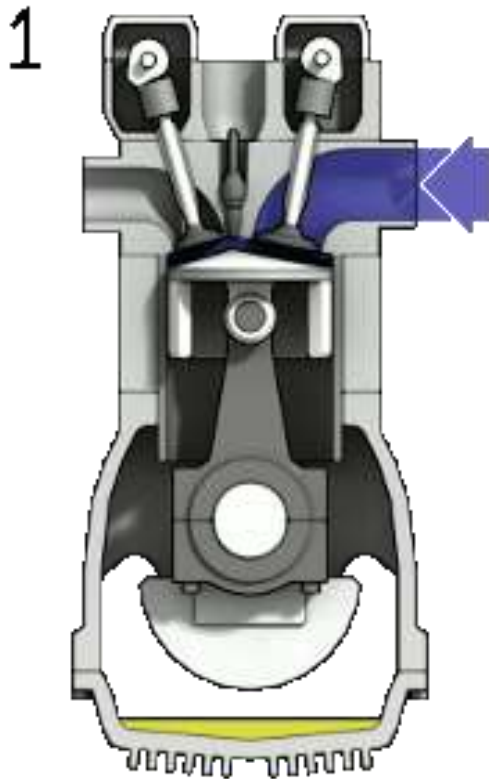


IC ENGINES



Presented by,
Yuvaraja MM
M Tech in Renewable energy
NMIT, Bengaluru.

HEAT ENGINE

A **heat engine** is a system that converts **heat** or thermal energy to mechanical energy, which can then be used to do mechanical work

TYPE OF ENGINE

Heat engine classification can be done into two types.
They are:

- 1) External Combustion Engine (EC Engine)
- 2) Internal Combustion Engine (IC Engine)

EC ENGINE

External combustion engines are those in which combustion takes place outside the engines. Heat produced during external combustion is used for inducing useful mechanical motion in the cylinder of the engine.

Ex: *Steam Engine, Steam Turbine, Closed cycle gas turbine.*

IC ENGINE

Internal combustion engine are those in which combustion takes place within the engine. Chemical energy of the fuel is converted to thermal energy and thermal energy is converted to mechanical energy.

Ex: *Gasoline Engine, Diesel Engine, Wankel Engine, Open cycle Gas Turbine*

Classifications of IC engines

Based on Application :

1. Automotive: (i) Car (ii) Truck/Bus
2. Light Aircraft
3. Marine: (i) Outboard (ii) Inboard (iii) Ship
4. Power Generation: (i) Portable (Domestic) (ii) Fixed (Peak Power)
5. Agricultural: (i) Tractors (ii) Pump sets
6. Earthmoving: (i) Dumpers

Based on Engine design:

1. Reciprocating

- (a) Single Cylinder

- (b) Multi-cylinder

 - (I) In-line

 - (ii) V

 - (iii) Radial

 - (iv) Opposed Cylinder

 - (v) Opposed Piston

(a) 2. Rotary:

- (a) Single Rotor

- (b) Multi-rotor

Operating Cycle:

- Carnot cycle
- Otto (For the Conventional SI Engine)
- Diesel (For the Ideal Diesel Engine)
- Dual (For the Actual Diesel Engine)

Working Cycle (Strokes) :

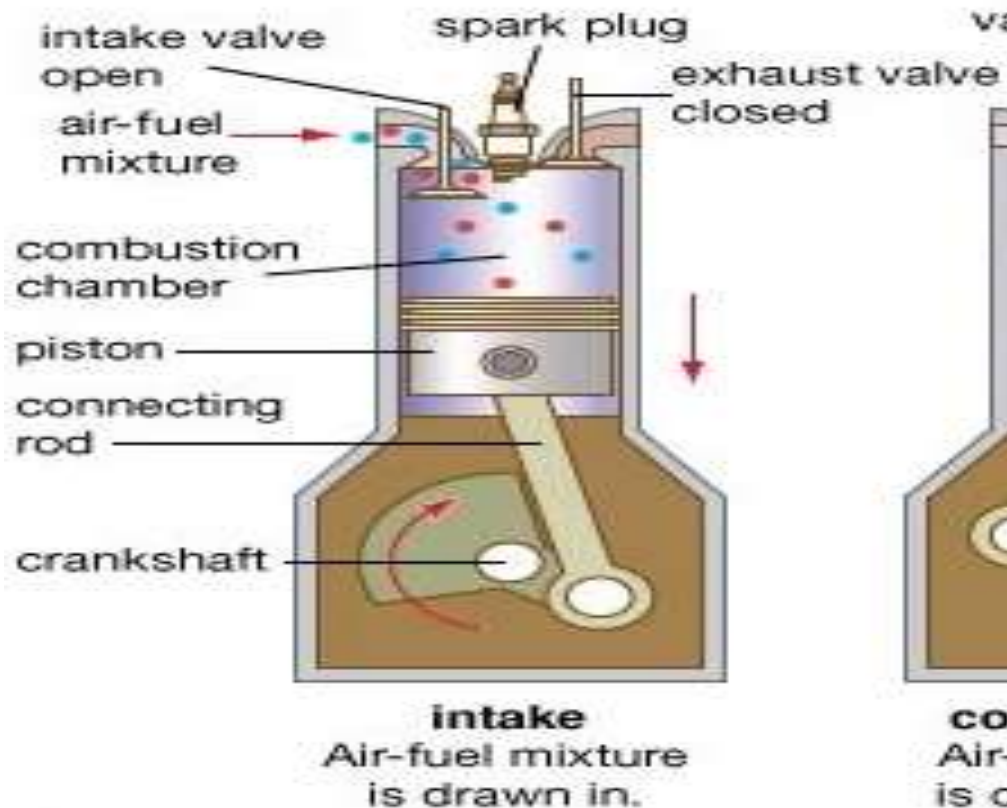
1. Four Stroke Cycle
2. Two Stroke Cycle

Working Process of 4-stroke engine

A **four-stroke engine** is an internal combustion (IC) engine in which the piston completes four separate strokes while turning a crankshaft. A stroke refers to the full travel of the piston along the cylinder, in either direction. The four separate strokes are termed:

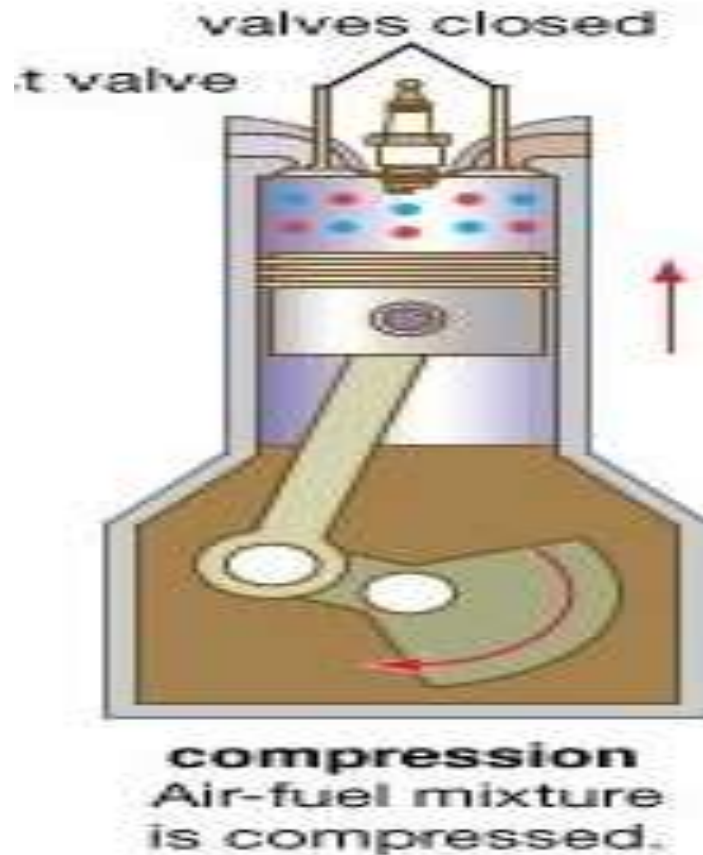
- Intake(suction) stroke
- Compression stroke
- Power (working) stroke
- Exhaust stroke

Intake Stroke



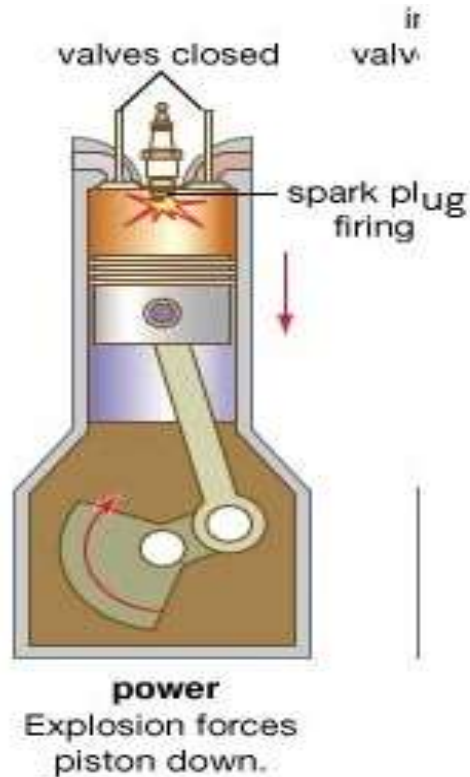
Intake: This stroke of the piston begins at top dead center (T.D.C.) and ends at bottom dead center (B.D.C.). In this stroke the intake valve must be in the open position while the piston pulls an air-fuel mixture into the cylinder by producing vacuum pressure into the cylinder through its downward motion.

Compression stroke



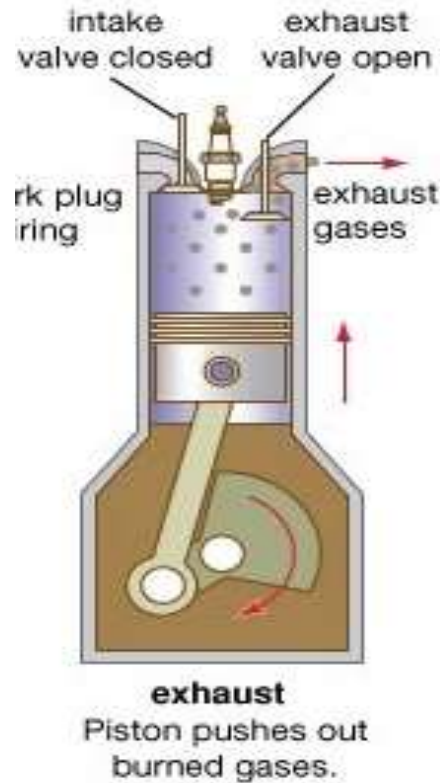
Compression: This stroke begins at B.D.C, or just at the end of the suction stroke, and ends at T.D.C. In this stroke the piston compresses the air-fuel mixture in preparation for ignition during the power stroke (below). Both the intake and exhaust valves are closed during this stage.

Working stroke



Power: This is the start of the second revolution of the four stroke cycle. At this point the crankshaft has completed a full 360 degree revolution. While the piston is at T.D.C. (the end of the compression stroke) the compressed air-fuel mixture is ignited by a **spark plug** (in a gasoline engine) or by heat generated by high compression (diesel engines), forcefully returning the piston to B.D.C. This stroke produces mechanical work from the engine to turn the crankshaft.

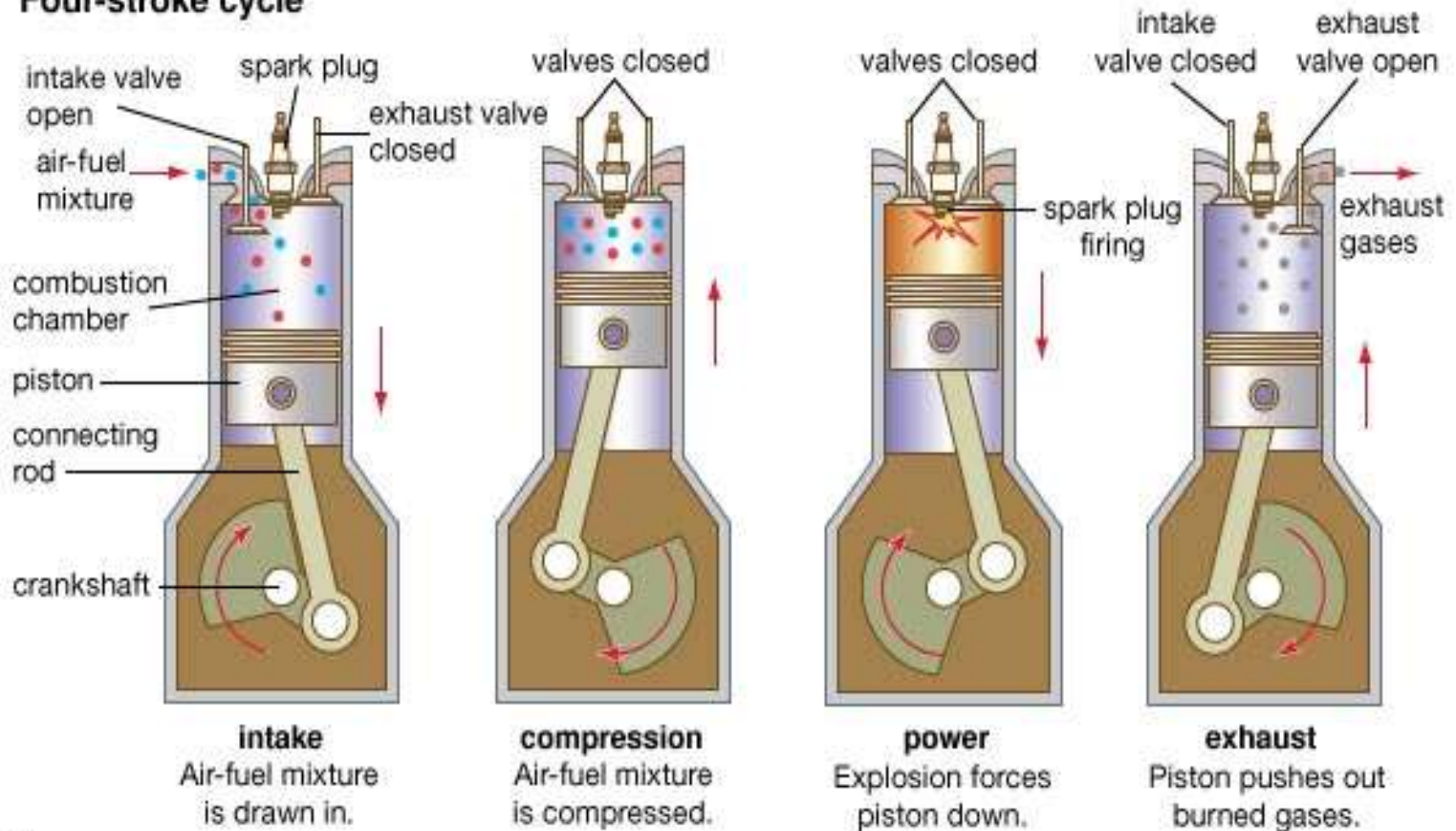
Exhaust stroke



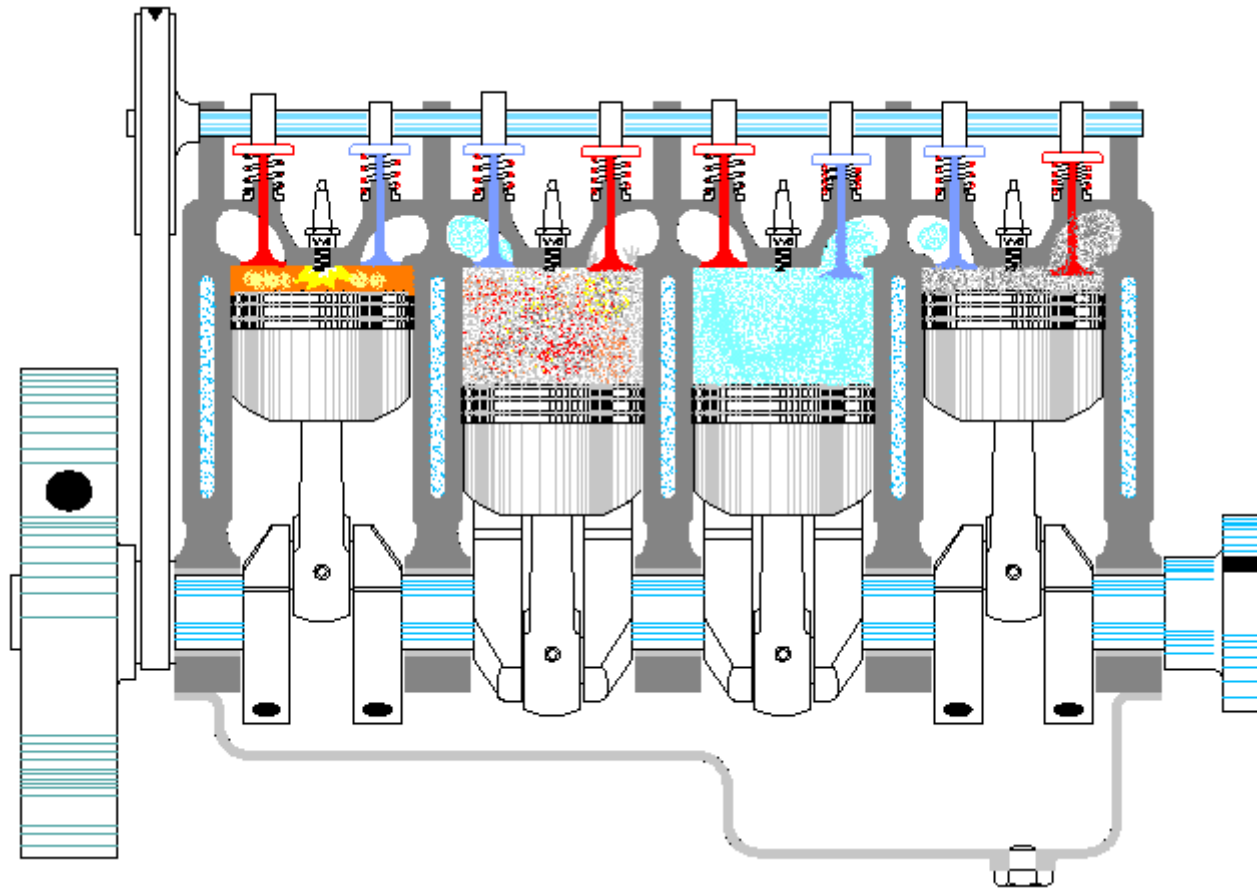
Exhaust: During the *exhaust* stroke, the piston once again returns from B.D.C. to T.D.C. while the exhaust valve is open. This action expels the spent air-fuel mixture through the exhaust valve.

Working Process of 4-stroke engine

Four-stroke cycle



Animation of 4stroke engine



Applications of IC Engines

I.C. engines have many applications, including:

- Road vehicles(e.g. scooter , motorcycle , buses etc.)
- Aircraft
- Motorboats
- Small machines, such as lawn mowers, chainsaws and portable engine-generators

Advantages of IC engine

- An internal combustion engine is compact and lighter.
- An internal combustion engine can be started immediately.
- An internal combustion engine is quite safe to use.
- An internal combustion engine has higher efficiency than external combustion engine.

Thank you....