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DEPARTMENT OF AUTOMOBILE ENGINEERING

23GET102 – BASIC CIVIL MECHANICAL ENGINEERING

I YEAR / I SEMESTER

UNIT 4 – IC ENGINES AND POWER PLANT ENGINEERING

Topic : Internal Combustion Engines

Automobile

"A self-propelled passenger vehicle that usually has four wheels and an internal-combustion engine, used for land transport."

The world's first automobile, designed by Karl Benz

The Benz Patent-Motorwagen N 1, the first car in the world, was built by German engineer and inventor Karl Benz

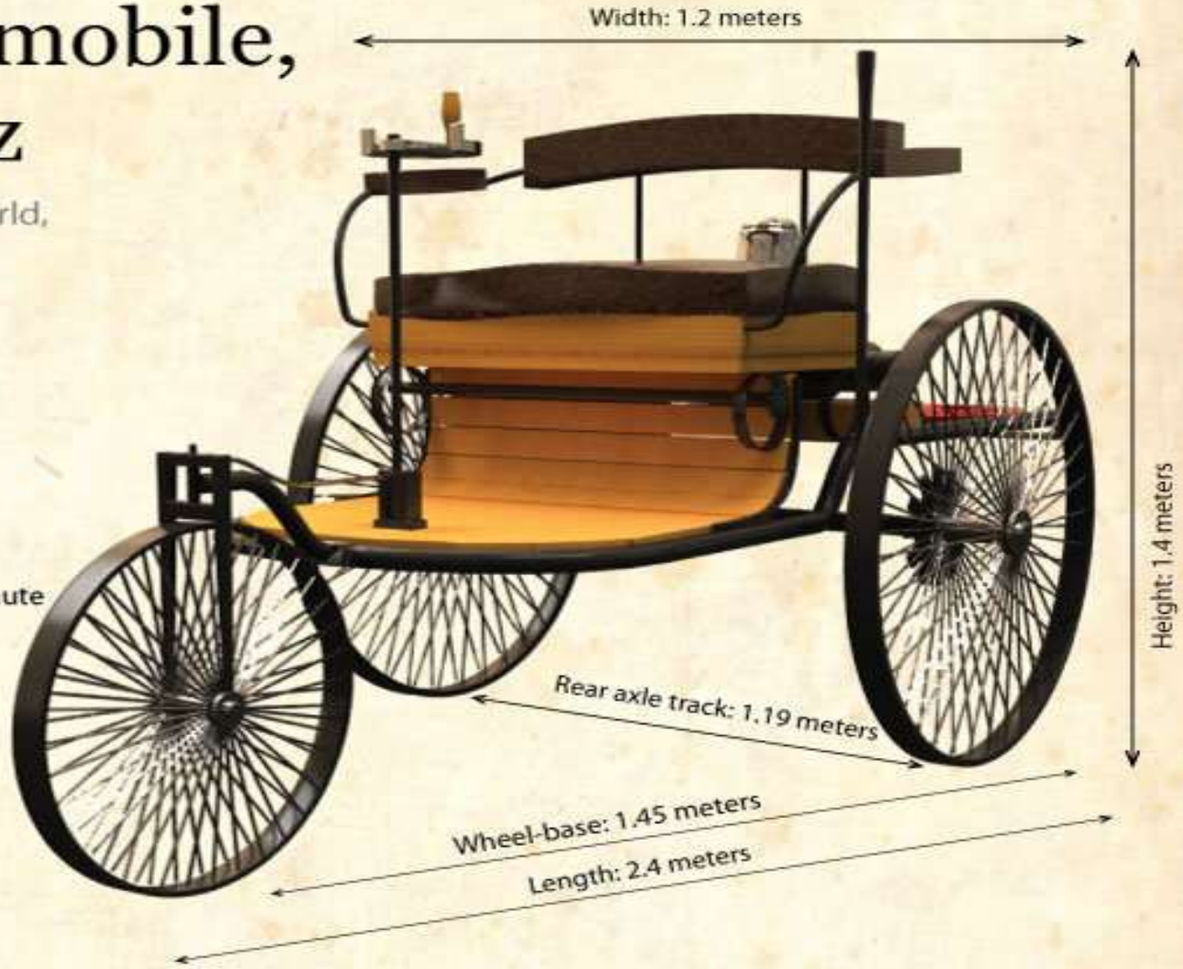
Specifications

- Weight: 265 kilograms
- Maximum speed: 16 kilometers per hour

ENGINE

- Engine type: Four-stroke, carburetor
- Water-cooled engine
- Number of cylinders: One
- Engine volume: 954 cm³
- Power: 0.9. horsepower at 400 revolutions per minute

1906. Karl Benz donates his car to the German Museum in Munich, Germany. 1936. Three copies of the Karl Benz car are built for the Mercedes-Benz Museum, the Museum of Technology in Vienna and the Transport Museum in Dresden



Design timeline

- 1885 — Designing the vehicle and building the first operational model
- January 29, 1886 — Patent application filed
- July 3, 1886 — First public demonstration
- November 2, 1886 — Karl Benz receives the patent

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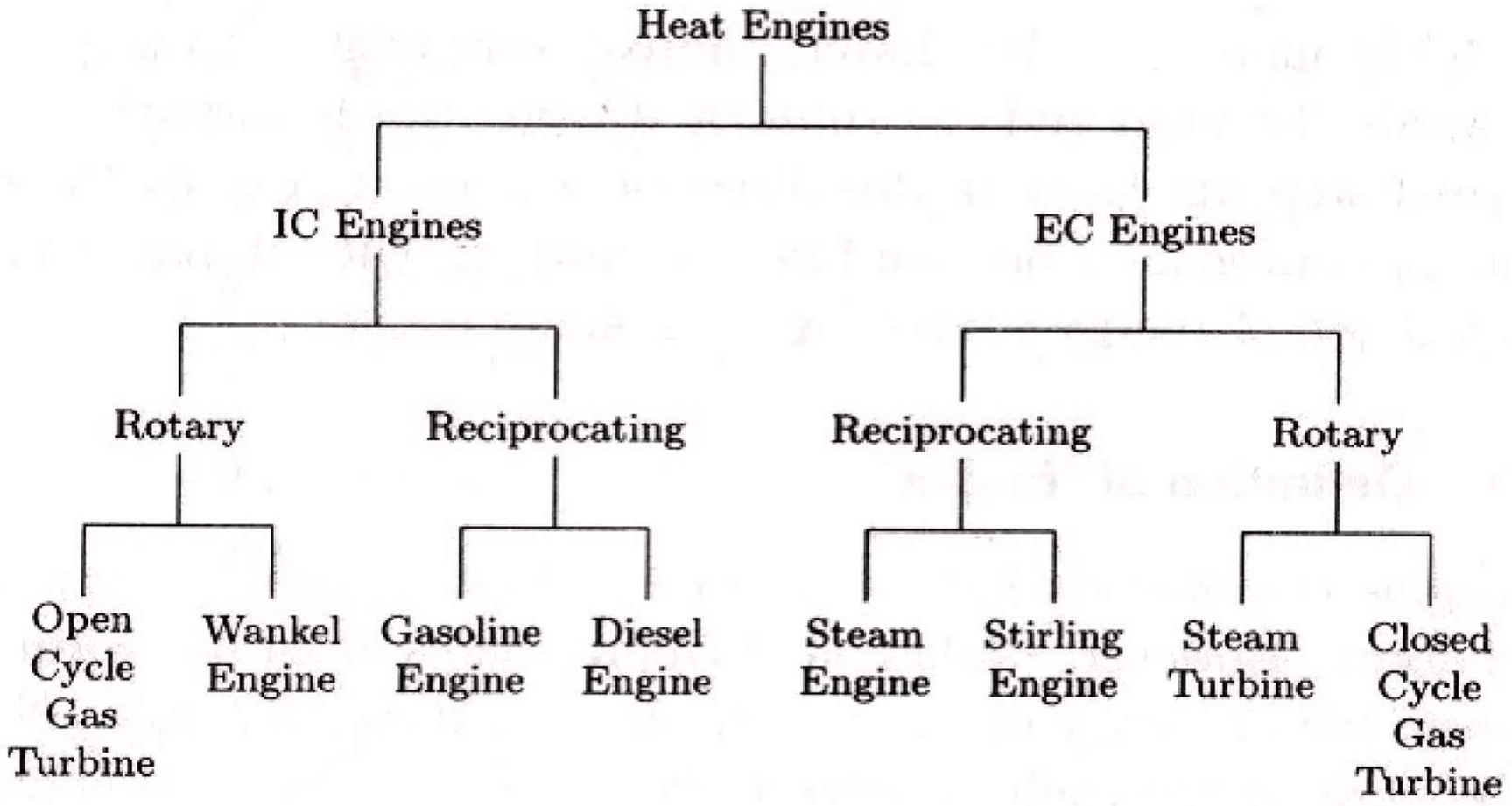
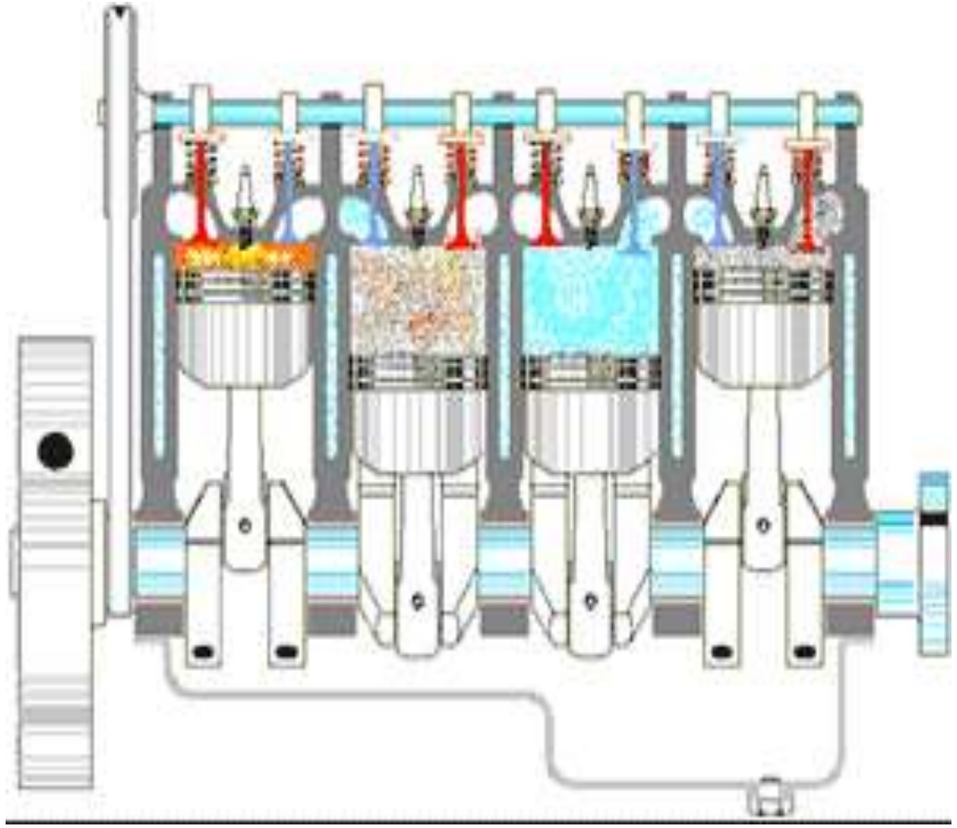
Classification



IC Engines

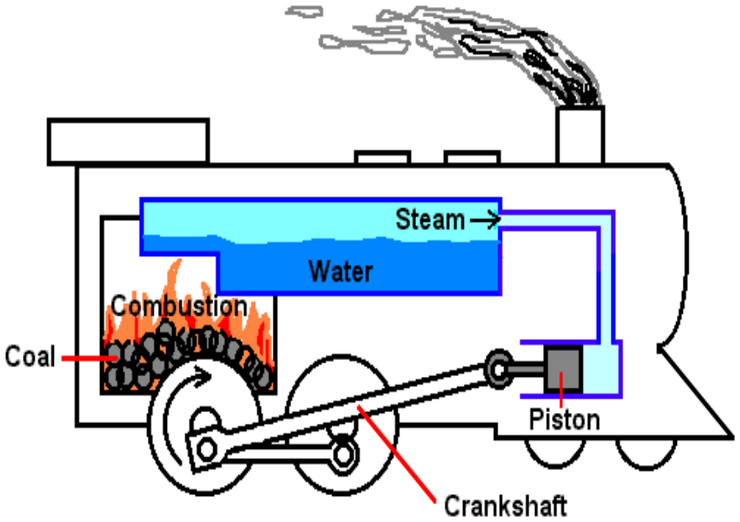
DT-Ideate

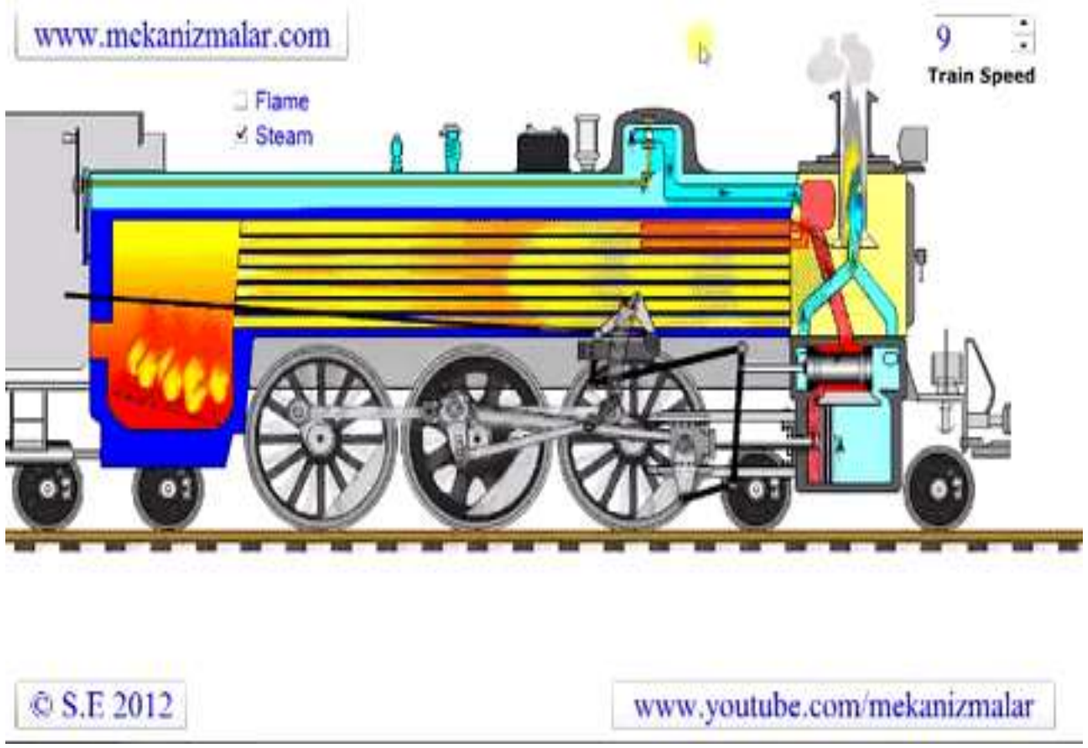


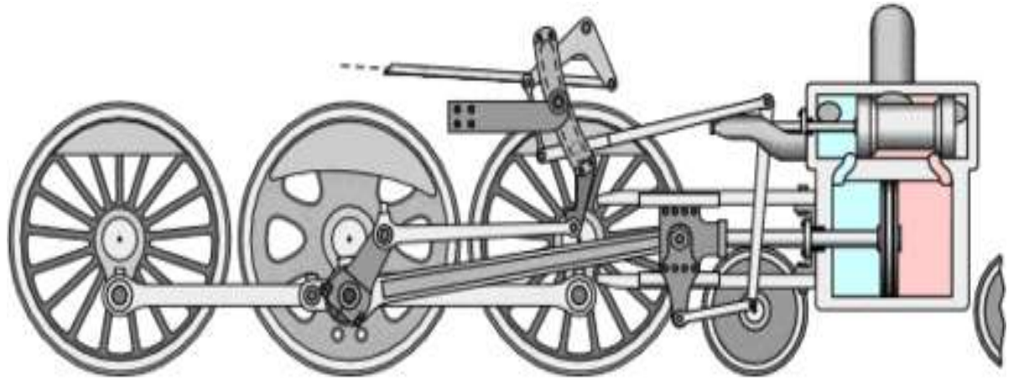
- Heat Engine is a machine which converts heat energy supplied to it into mechanical work.
- Heat energy is supplied to the engine by burning the fuel.

EC Engines

DT-Ideate







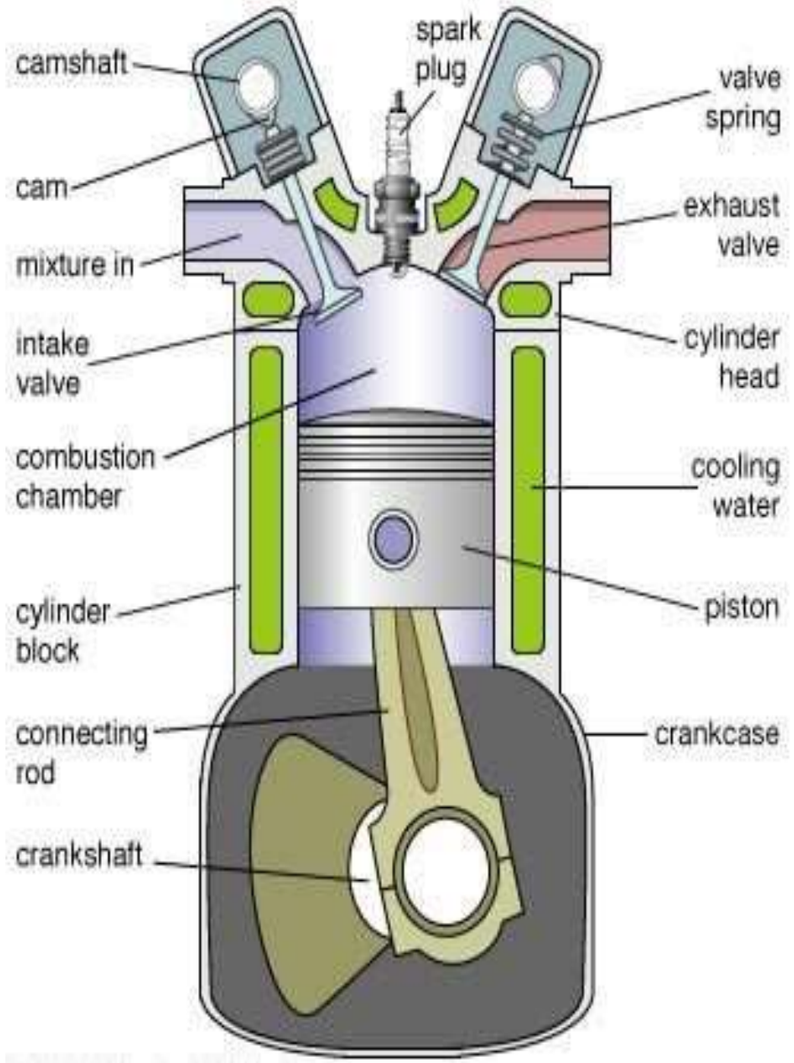
Why IC Engines?

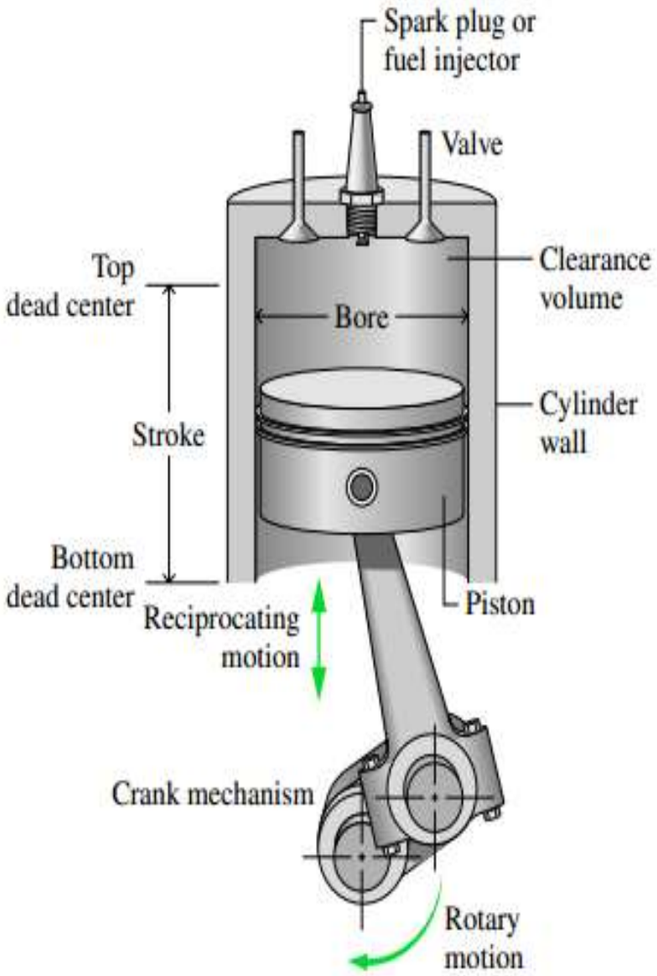
DT-Ideate

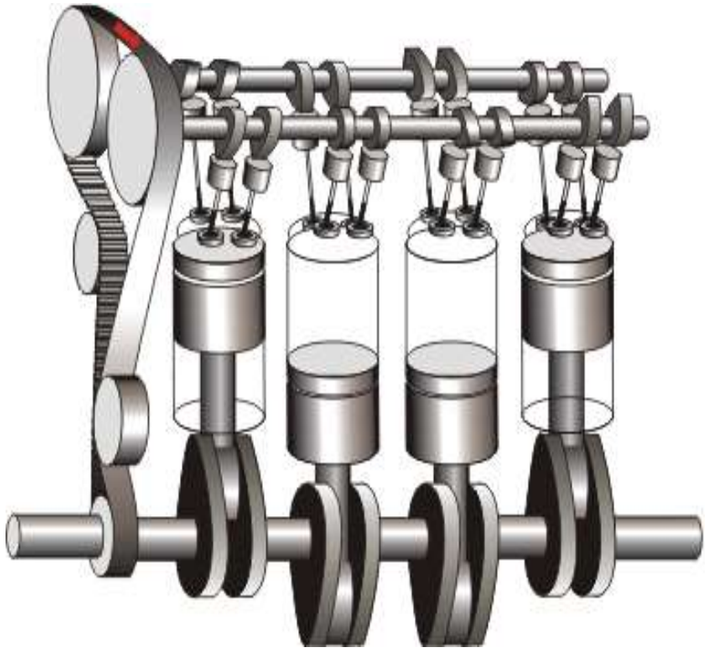
Aspect	IC Engines (Internal Combustion)	Non-IC Engines
Definition	Fuel is burnt **inside** the engine cylinder, and combustion gases act directly on piston/turbine.	Power is produced **without internal combustion** (external combustion, electrical, fuel cells, renewables).
Examples	Petrol engine, Diesel engine, Gasoline engine, Gas turbine.	Steam engine, Steam turbine, Stirling engine, Electric motor, Hydrogen fuel cell, Wind turbine.
Working Medium	Hot combustion gases from fuel.	Steam, compressed air, electricity, hydrogen, water, wind, solar energy.
Energy Conversion	Chemical energy → Heat → Mechanical.	Heat/Electrical/Renewable → Mechanical/Electrical.
Efficiency	25–40% (higher with turbocharging & modern tech).	Steam turbine (30–45%), Electric motors (85–95%), Fuel cells (60–70%).

Components of an Engine

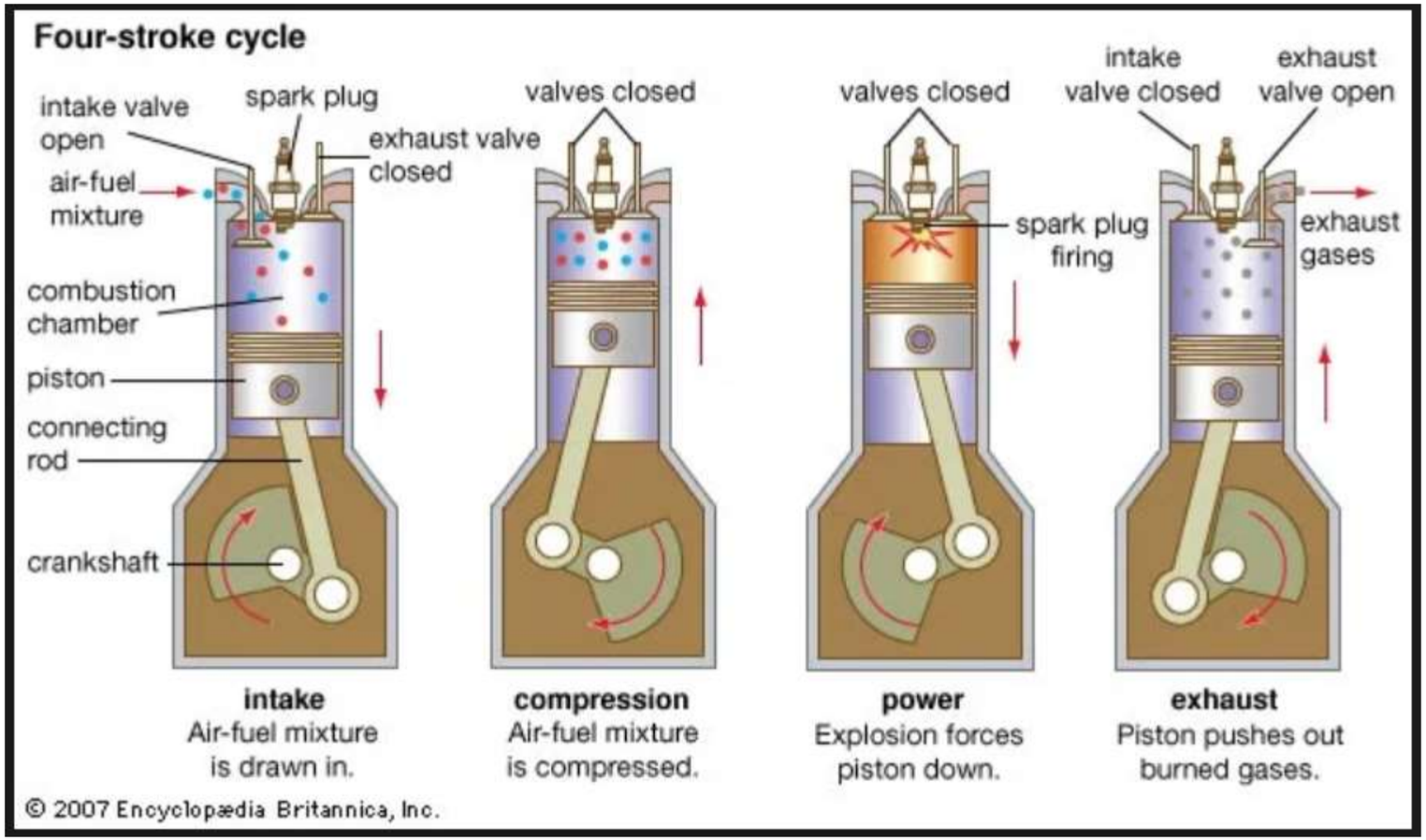
DT-Define







4 Stroke Engine



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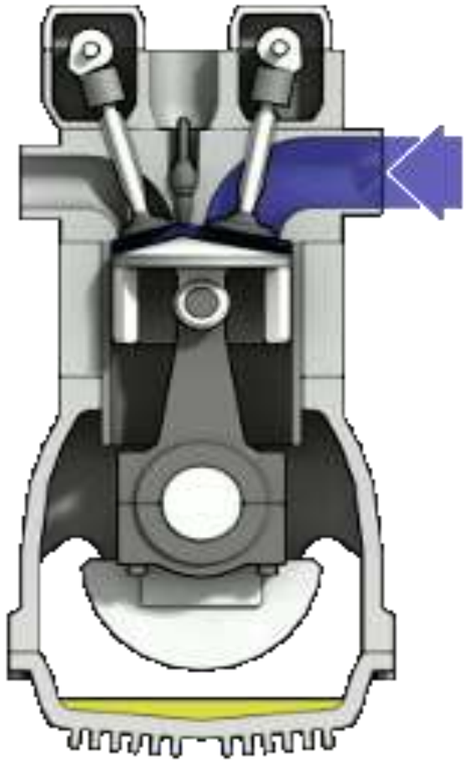
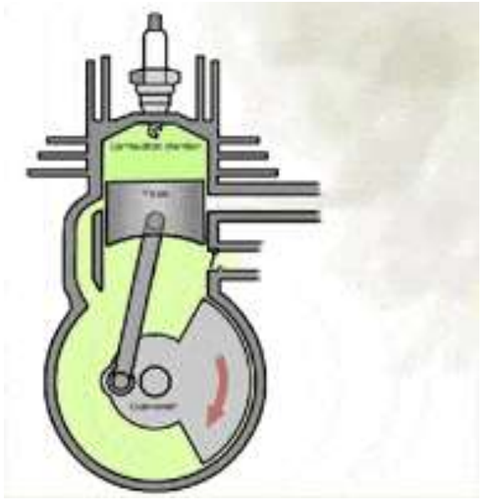
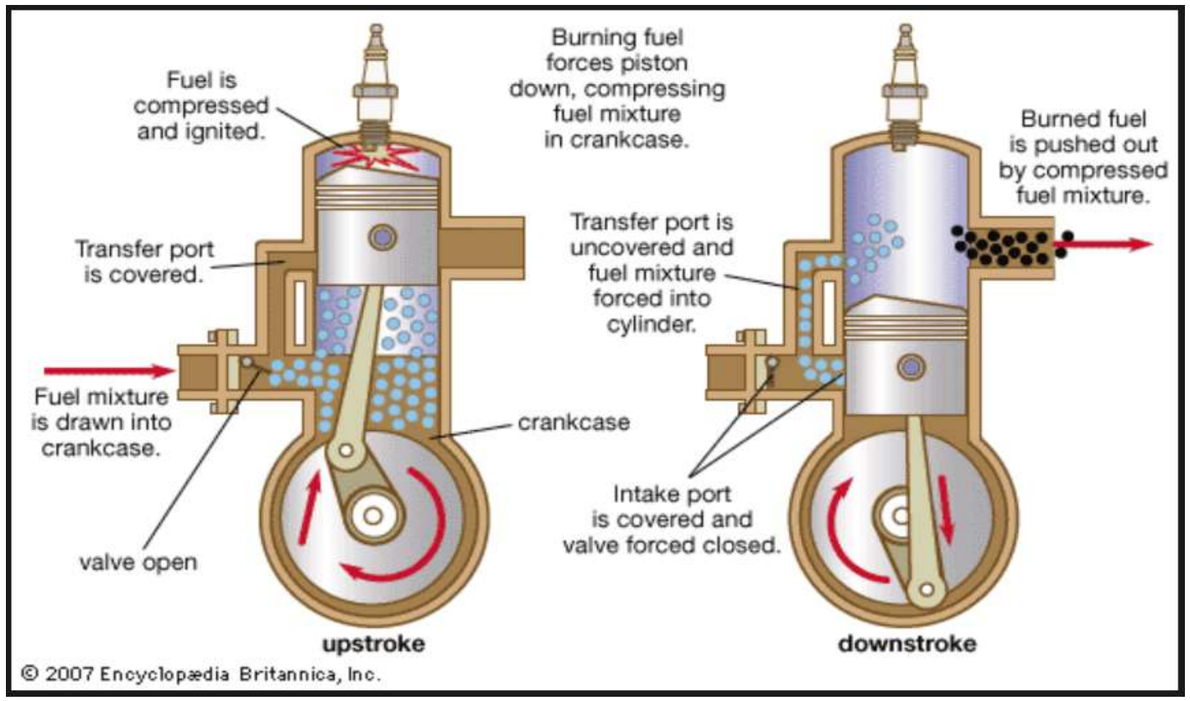


This process, which takes **two complete rotations** of the **crankshaft**, is fundamental to how most **modern automobiles**, motorcycles, and other **machines generate power** from fuel.

2 Stroke Engine





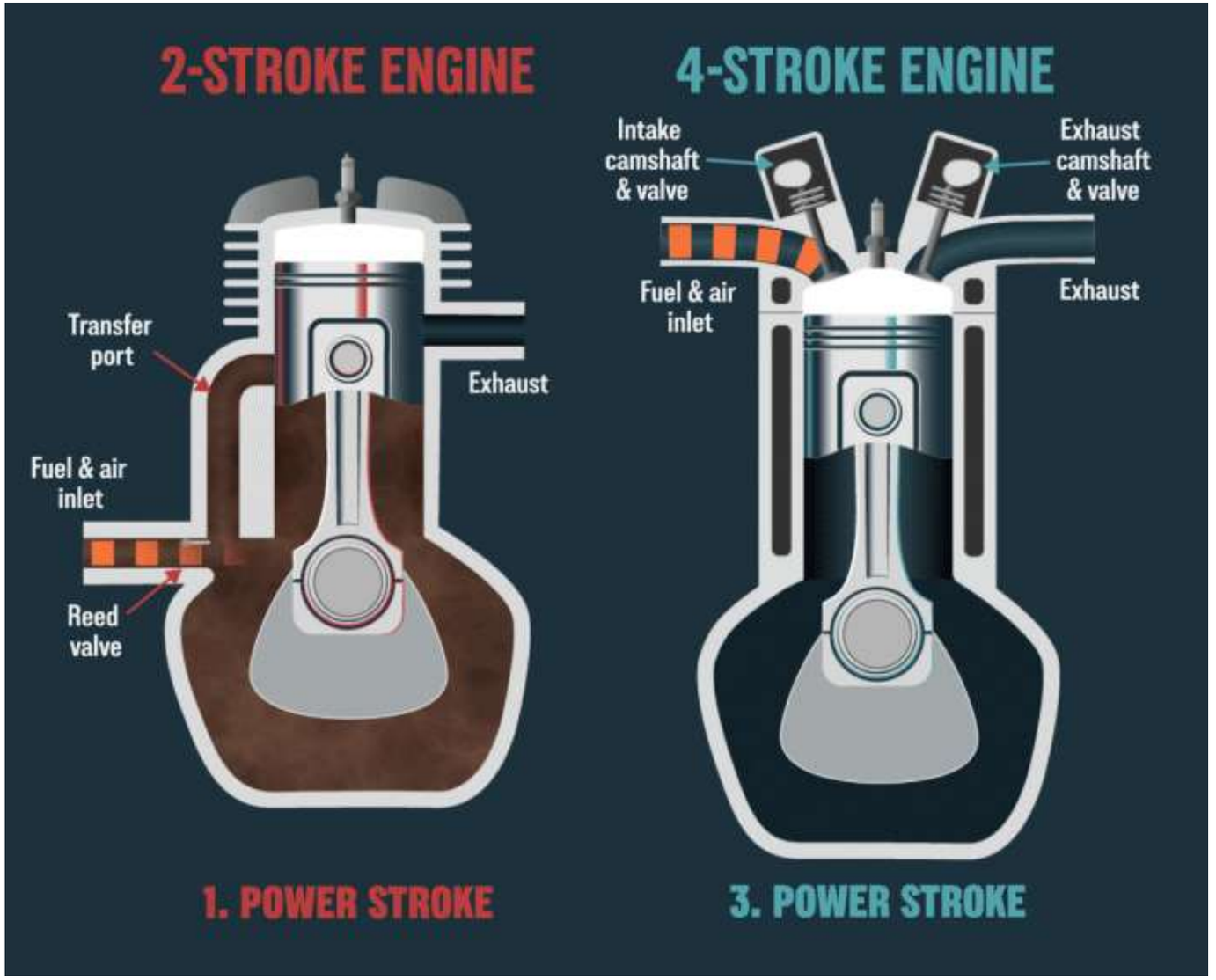
Down Stroke

- ✓ The piston moves from the top (TDC) to the bottom (BDC).
- ✓ Fresh air-fuel mixture enters the combustion chamber from the crankcase.
- ✓ The crankshaft rotates 180° during this stroke.

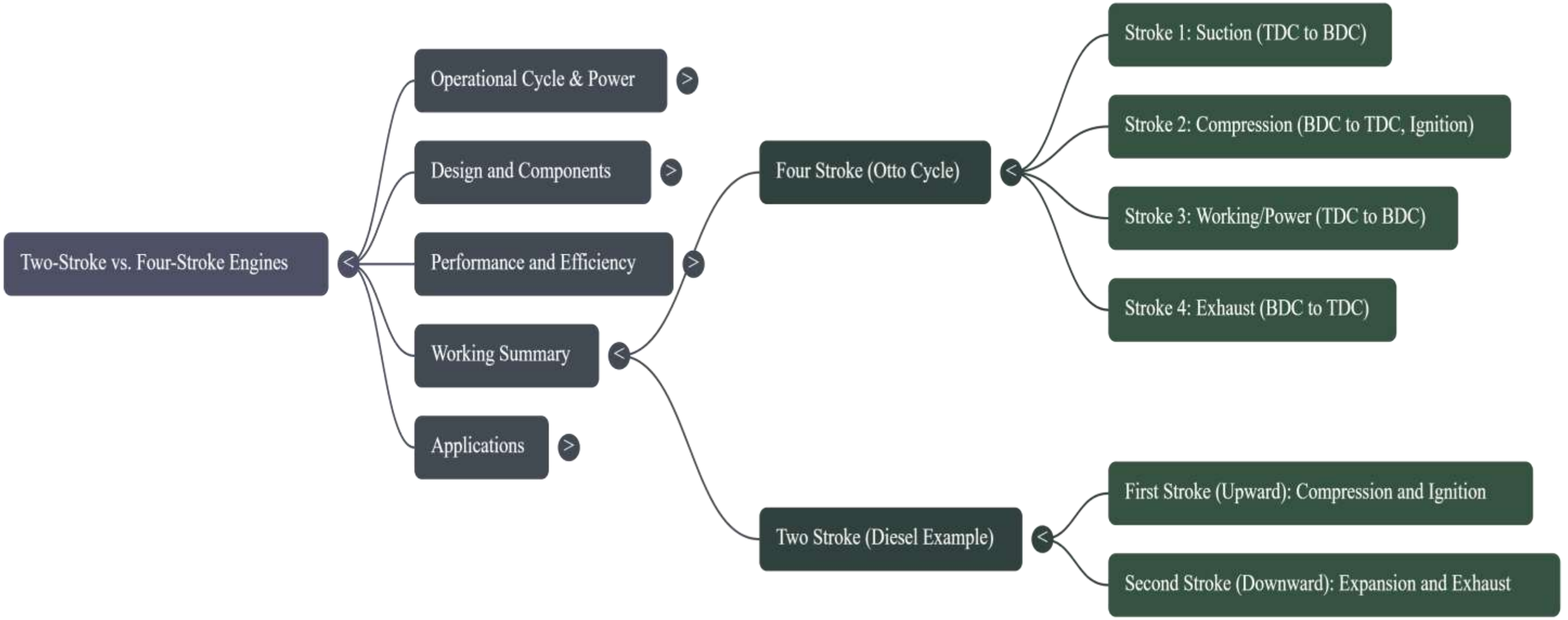
Up Stroke

- ✓ The piston moves from the bottom (BDC) to the top (TDC).
- ✓ The mixture gets compressed and is ignited by the spark plug, pushing the piston down.
- ✓ The inlet port opens and draws mixture into the crankcase.
- ✓ The crankshaft rotates another 180°.

Difference


2-STROKE ENGINE
4-STROKE ENGINE
Intake camshaft & valve
Exhaust camshaft & valve
Transfer port
Exhaust
Fuel & air inlet
Exhaust
Fuel & air inlet
Reed valve
1. POWER STROKE
3. POWER STROKE

Mind map


Two-Stroke vs. Four-Stroke Engines
Operational Cycle & Power
Design and Components
Performance and Efficiency
Working Summary
Applications
Four Stroke (Otto Cycle)
Stroke 1: Suction (TDC to BDC)
Stroke 2: Compression (BDC to TDC, Ignition)
Stroke 3: Working/Power (TDC to BDC)
Stroke 4: Exhaust (BDC to TDC)
Two Stroke (Diesel Example)
First Stroke (Upward): Compression and Ignition
Second Stroke (Downward): Expansion and Exhaust

Questionnaire

1. What is the primary distinction between an Internal Combustion (IC) Engine and an External Combustion (EC) Engine?
2. During the compression stroke of a four-stroke petrol engine, what is the status of the inlet and exhaust valves?
3. What is compressed inside the cylinder during the compression stroke of a standard four-stroke diesel engine?
4. n a two-stroke engine as depicted in the source material, what components replace the function of conventional inlet and outlet valves?