

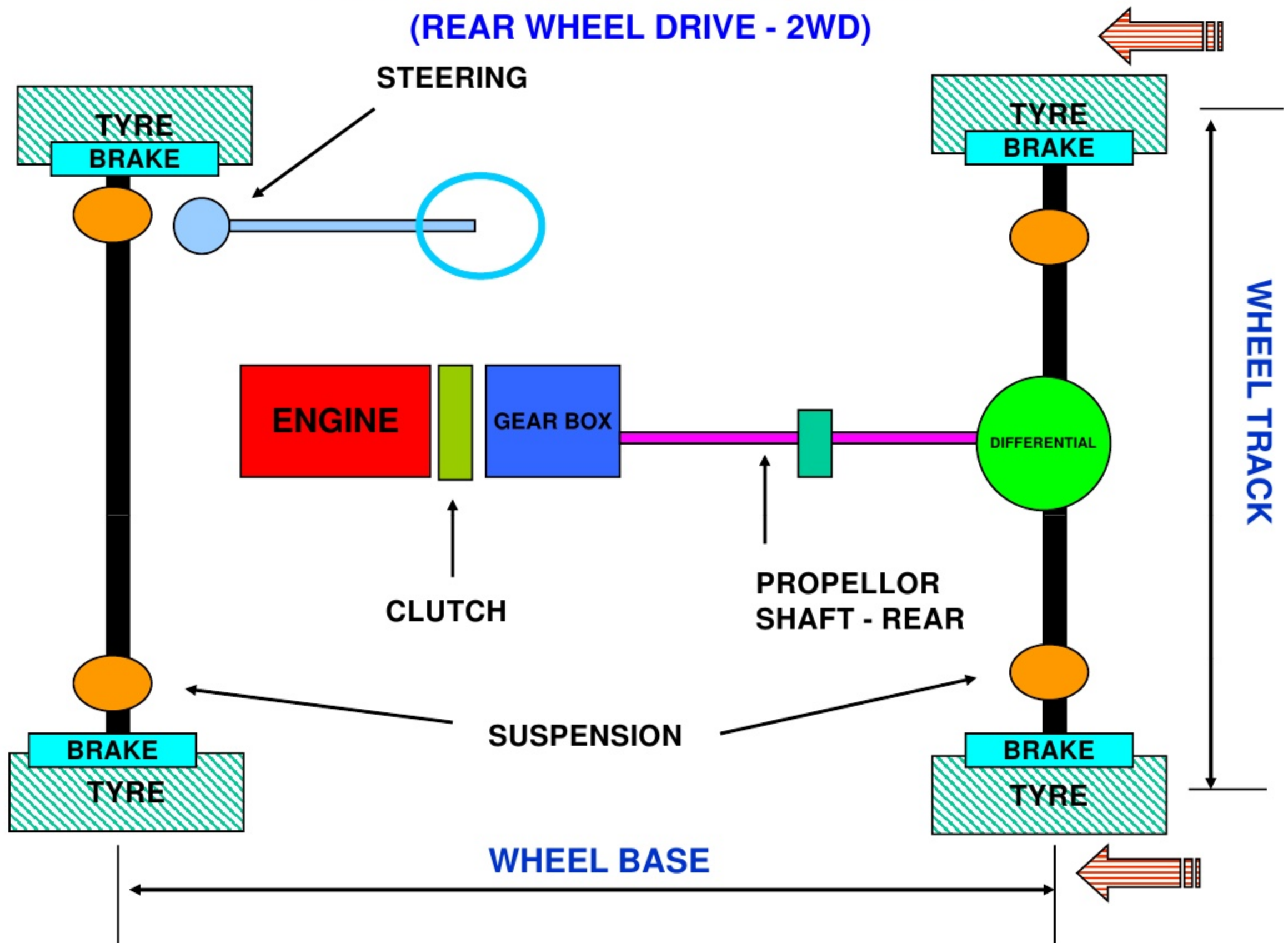
AUTOMOTIVE TECHNOLOGY

(BASICS)

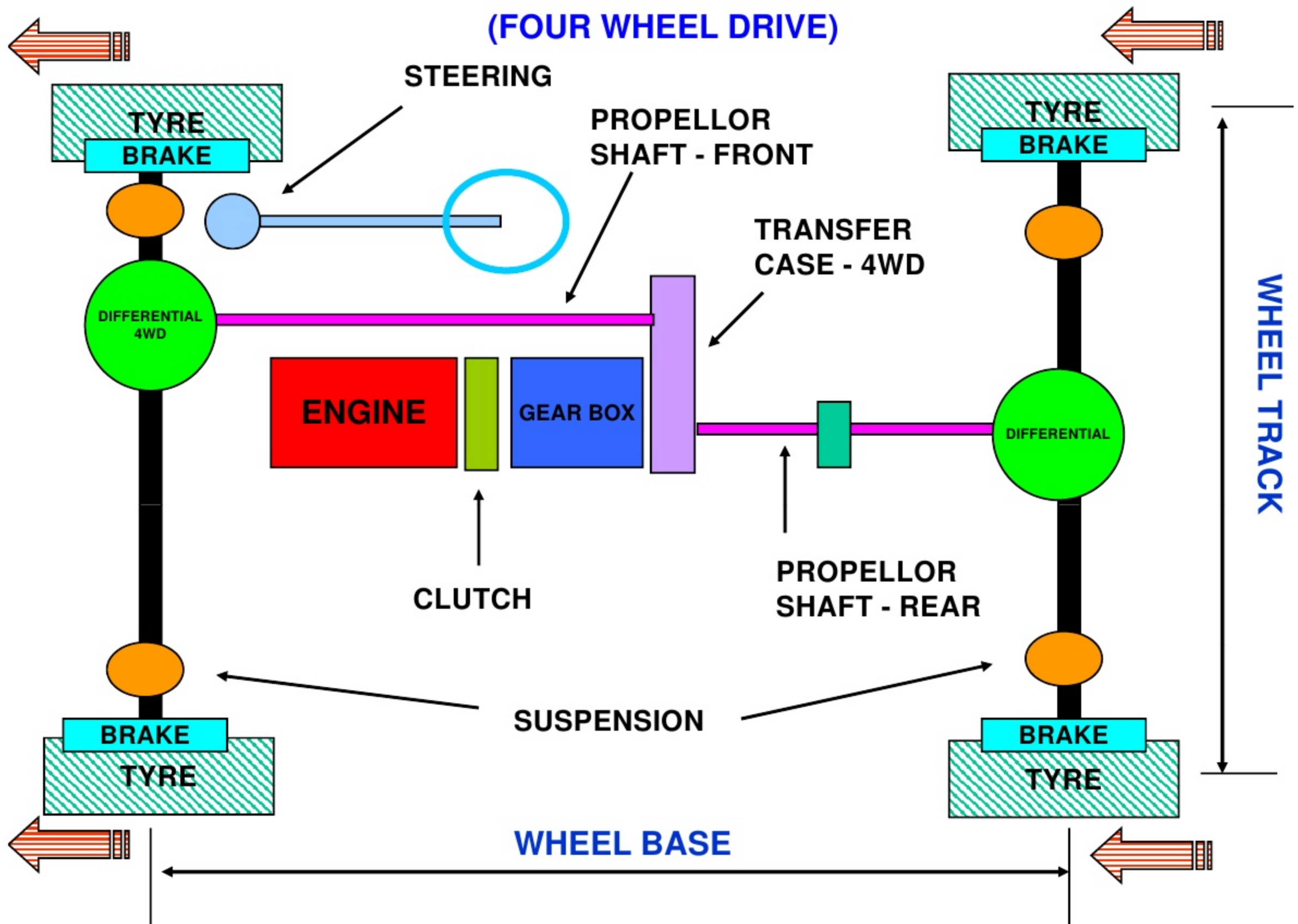
Feedback : spkingsley@live.in

ANATOMY OF AN AUTOMOBILE

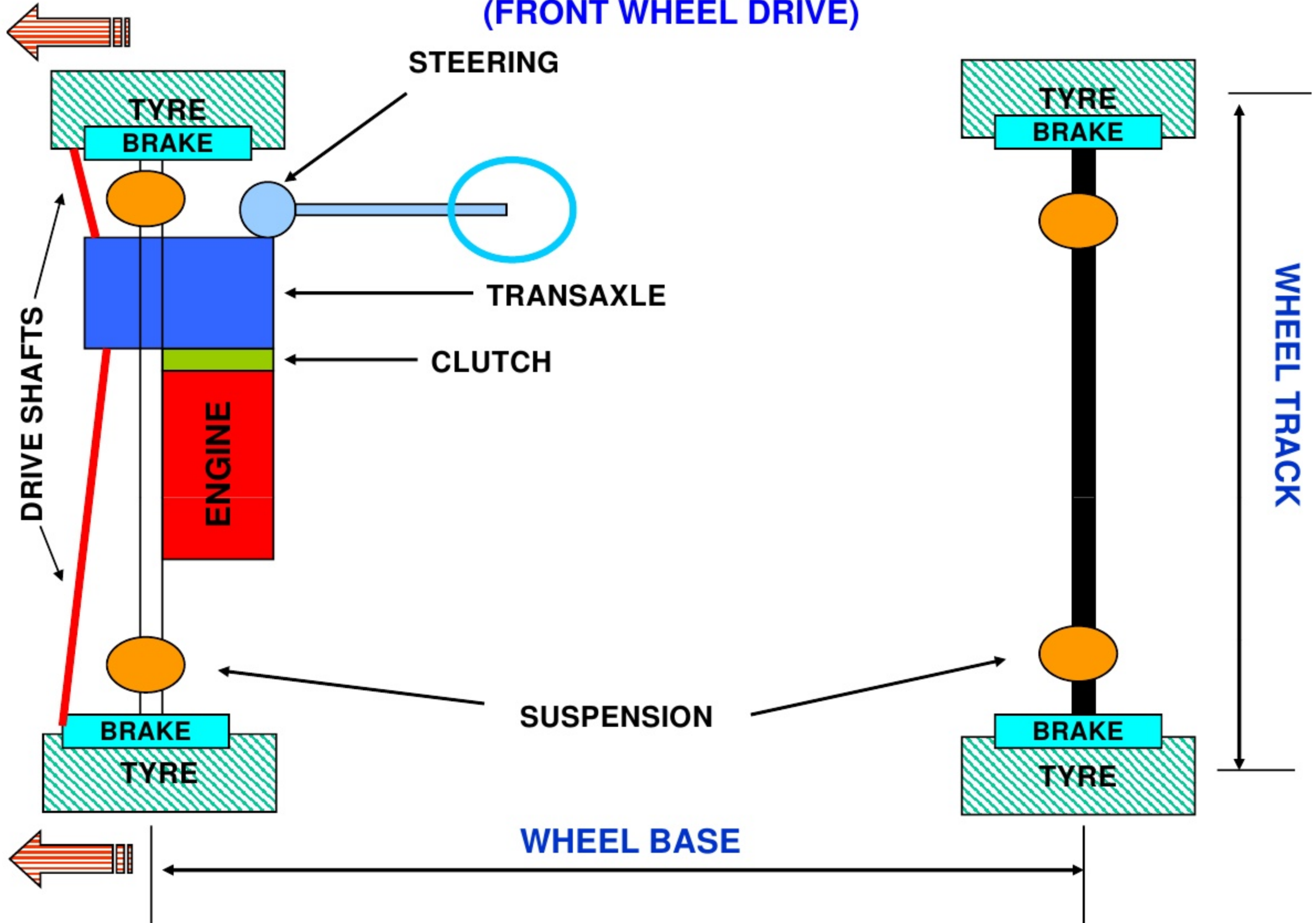
(REAR WHEEL DRIVE - 2WD)



ANATOMY OF AN AUTOMOBILE (FOUR WHEEL DRIVE)



ANATOMY OF AN AUTOMOBILE (FRONT WHEEL DRIVE)



SYSTEMS IN AN AUTOMOBILE

A. POWER TRAIN SYSTEM

- **POWER PLANT (POWER GENERATION - ENGINE)**

- **ENGINE**
- **FUEL SYSTEM**
- **INTAKE SYSTEM**
- **EXHAUST SYSTEM**
- **COOLING SYSTEM**

- **DRIVE LINE (POWER TRANSMISSION)**

- **CLUTCH**
- **GEAR BOX/TRANSMISSION**
- **TRANSFER CASE**
- **DIFFERENTIAL**
- **WHEELS/TYRES**

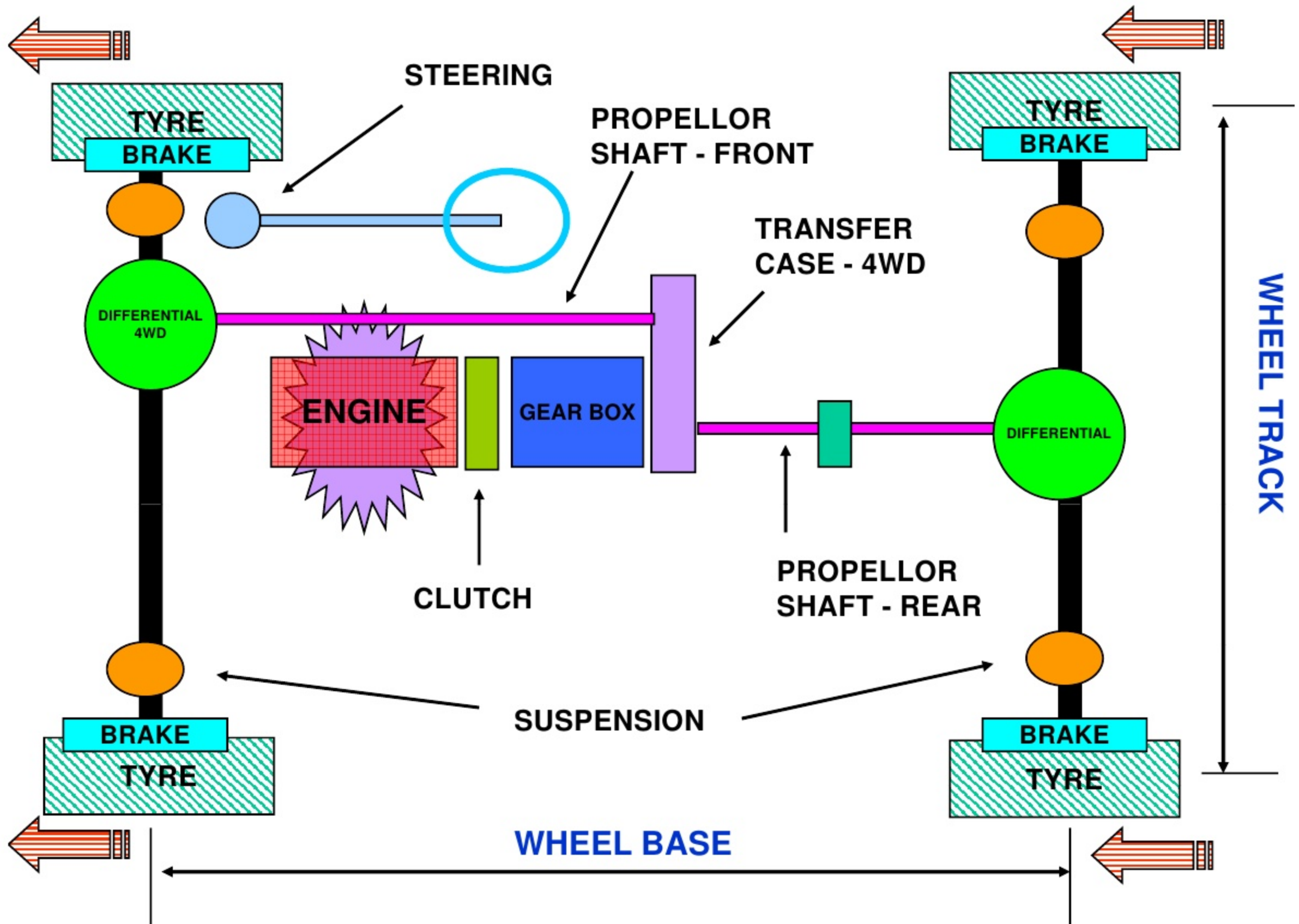
B. RUNNING SYSTEM

- **SUSPENSION**
- **STEERING**
- **BRAKING**

C. COMFORT SYSTEM

- **HVAC/AC/HEATER SYSTEM**
- **SEATING/UPHOLSTERY/FACIA/INSTRUMENTS**
- **AUDIO/VIDEO/GPS**

ANATOMY OF AN AUTOMOBILE - POWER PLANT



ENGINE

ENGINE IS THE HEART OF THE AUTOMOBILE

- IT GENERATES MOTIVE POWER FOR LOCOMOTION
- IT CONVERTS **CHEMICAL ENERGY** OF THE FUEL TO **MECHANICAL ENERGY**
- ENGINE DEVELOPS POWER & TORQUE

TORQUE : - Is the capacity to do work
Measured in **Kg-m , N-m , Lb-ft**

POWER : - How fast the work can be done
Measured in - **Horse Power, Kilo watt**

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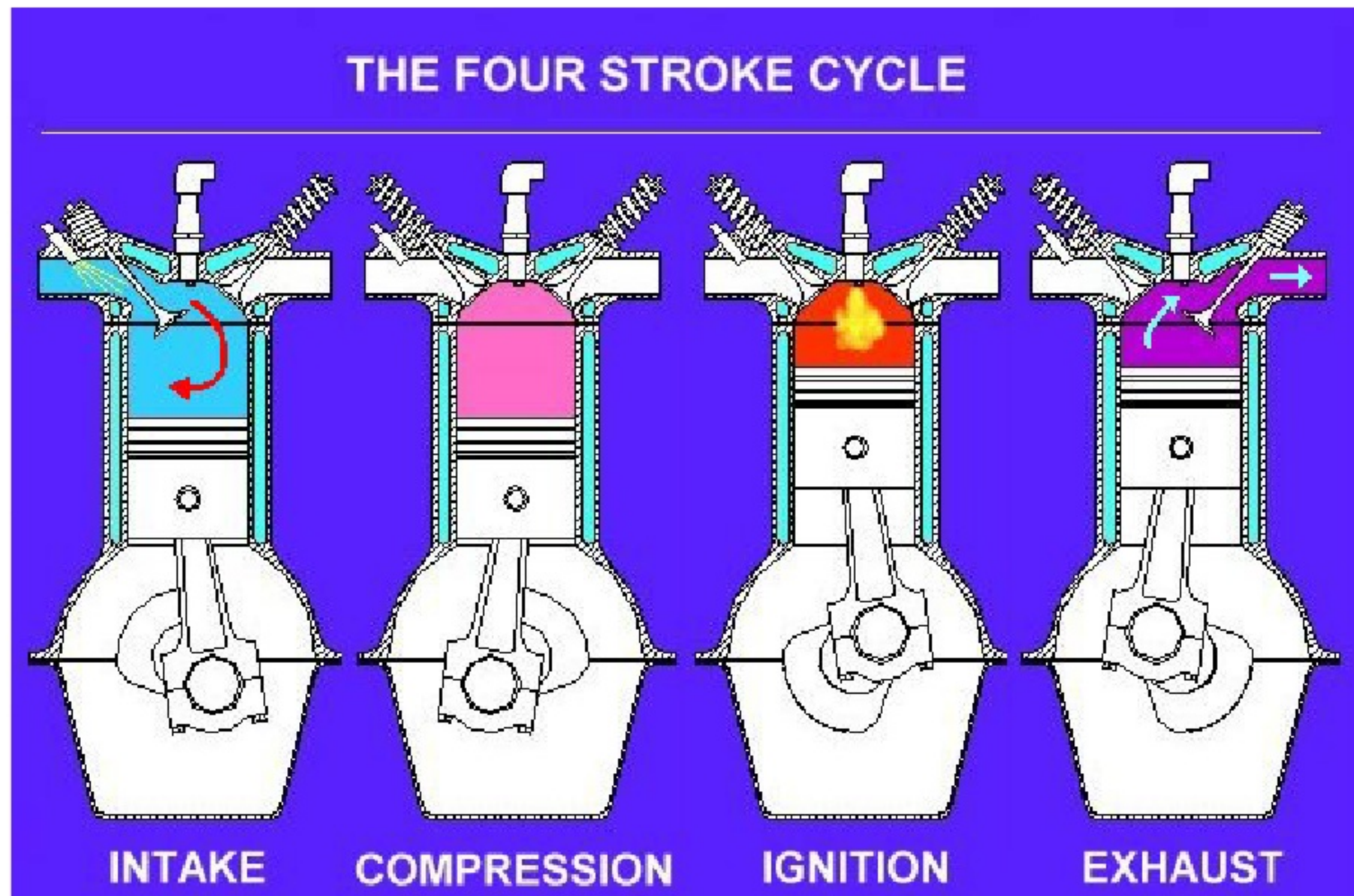
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ENGINE OPERATION - 4 STROKE



CLASSIFICATION OF ENGINES

ENGINES CAN BE CLASSIFIED IN MANY WAYS :

1. By Mechanical construction - **4 Stroke/2-Stroke**
2. By type of Ignition - **Compression Ignition/Spark Ignition**

COMPRESSION IGNITION ENGINES

- Basically **Diesel engines**
- Use diesel fuel
- Combustion is initiated by heat, on its own

SPARK IGNITION ENGINES

- Basically **Petrol engines, LPG engines, CNG engines**
- Use leaded or unleaded petrol, Alcohol, LPG or CNG
- Combustion is initiated by a spark from a spark plug

DIESEL ENGINE

DIESEL ENGINES ARE COMPRESSION IGNITION ENGINES & USE DIESEL FUEL

DIESEL ENGINES ARE BROADLY CLASSIFIED AS **DIRECT INJECTION (DI)** AND **INDIRECT INJECTION (IDI)**

DIRECT INJECTION ENGINE (DI)

ON DIRECT INJECTION DIESEL ENGINES, FUEL IS SPRAYED DIRECTLY ON TOP OF THE PISTON.

- Highly fuel efficient
- Noisy
- Easy cold starting ability

INDIRECT INJECTION ENGINE

ON INDIRECT INJECTION DIESEL ENGINES, FUEL IS SPRAYED ON TO A SEPERATE PRE-CHAMBER.

- Less fuel efficient
- Less Noisy/smooth
- Requires pre-heating for starting

PETROL/CNG/LPG ENGINES

PETROL ENGINES ARE SPARK IGNITION ENGINES & USE GASOLINE/CNG/LPG FUEL

PETROL ENGINES ARE BROADLY CLASSIFIED AS **CARBURATED** AND **FUEL INJECTED ENGINE**

CARBURETED ENGINE

ON CARBURETED ENGINE , THE PETROL & AIR ARE MIXED IN THE CARBURETER BEFORE BEING SENT IN TO THE ENGINE

FUEL INJECTED ENGINE

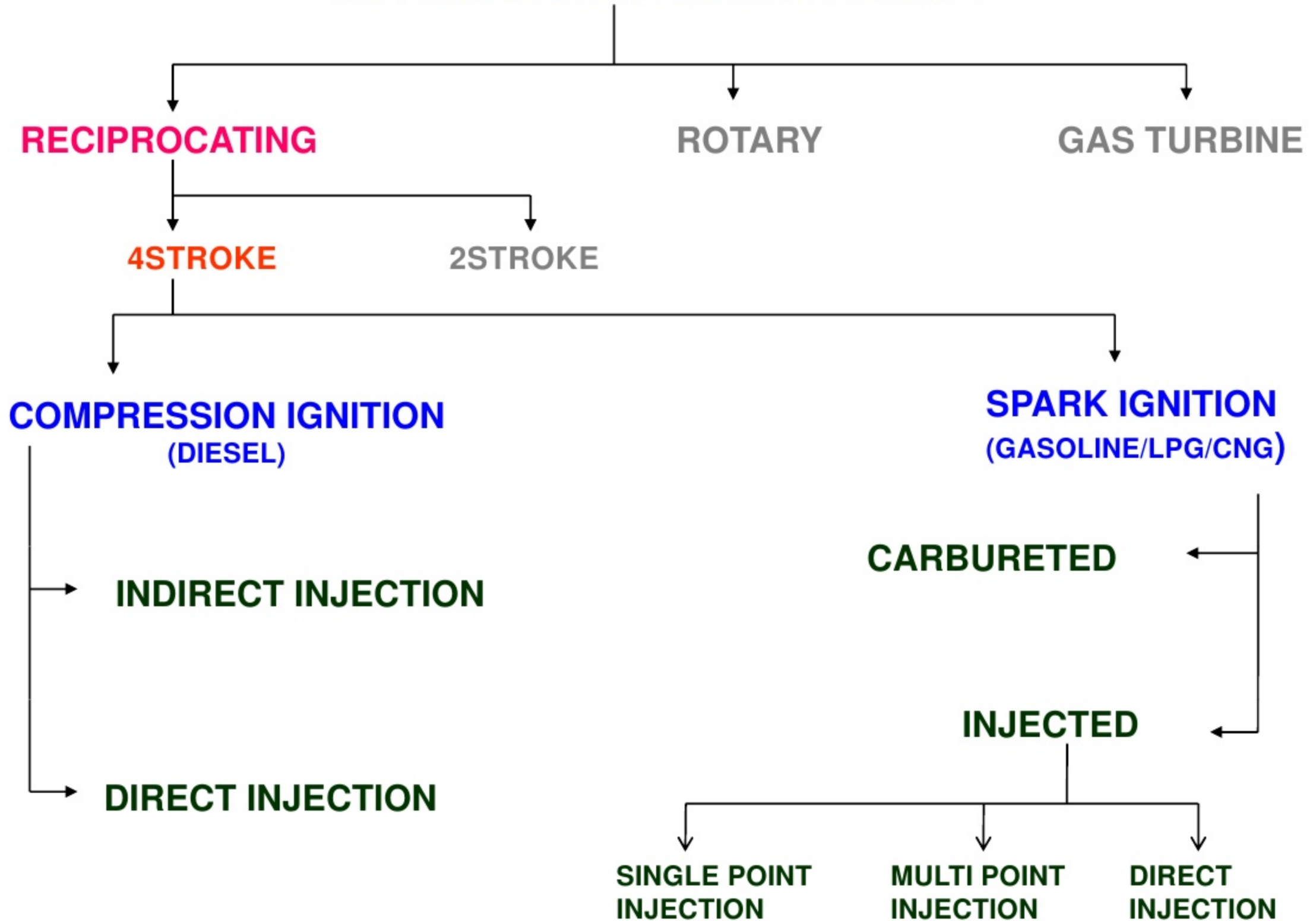
ON FUEL INJECTED ENGINES, THE PETROL IS INJECTED SEPERATELY AND THE PETROL AND AIR ARE MIXED INSIDE THE CYLINDER.

FUEL INJECTED ENGINES CAN BE FURTHER CLASSIFIED AS :

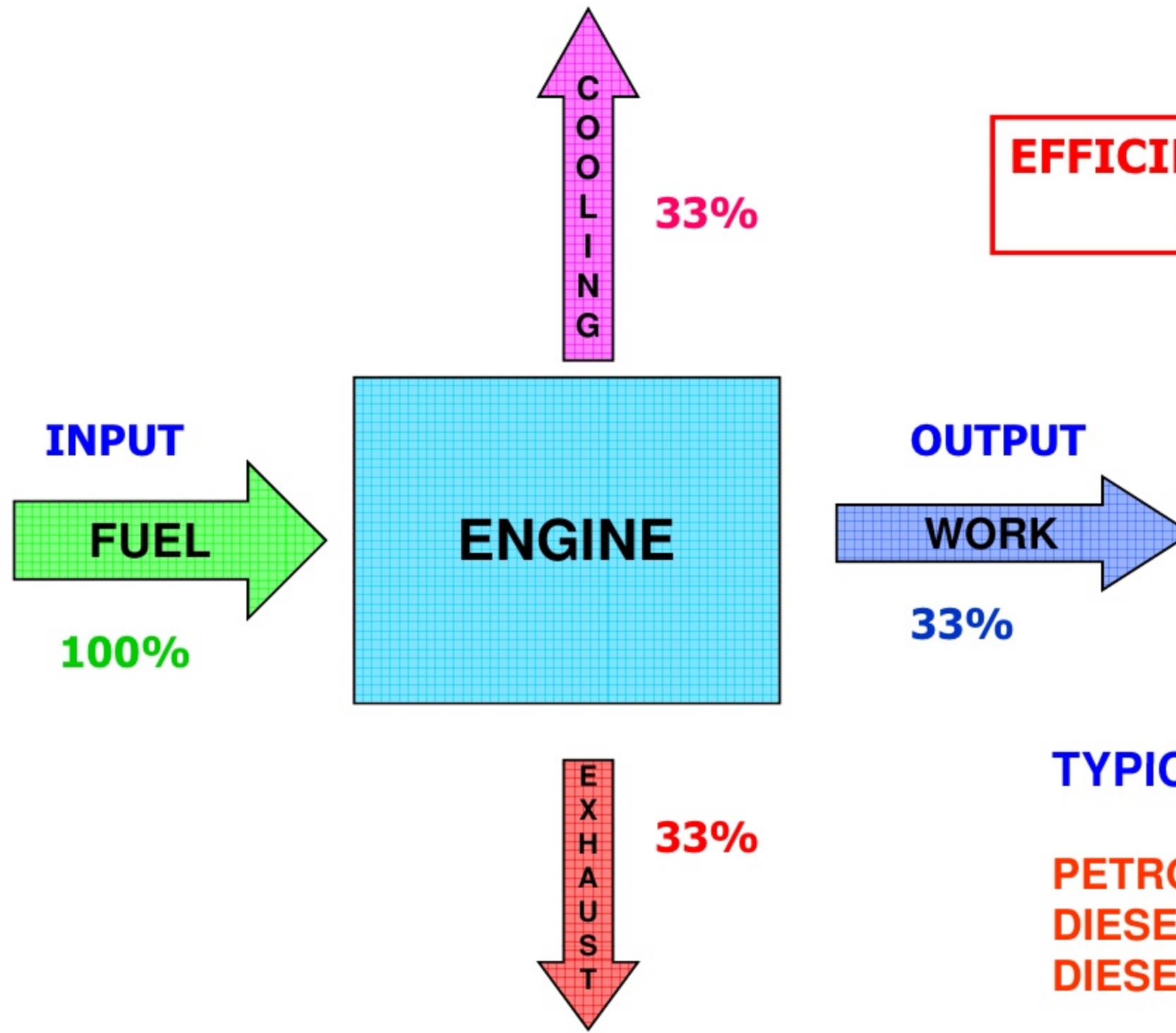
SINGLE/MULTI POINT FUEL INJECTION, Where the fuel is injected outside the cylinder

GASOLINE DIRECT INJECTION (GDI) , Where the fuel is injected directly in to the engine cylinder

INTERNAL COMBUSTION ENGINE



THERMAL EFFICIENCY



$$\text{EFFICIENCY} = \frac{\text{OUTPUT}}{\text{INPUT}} \%$$

TYPICAL EFFICIENCIES

PETROL - 25%
DIESEL IDI - 28-30%
DIESEL DI - 32-33%

FUEL EFFICIENCY

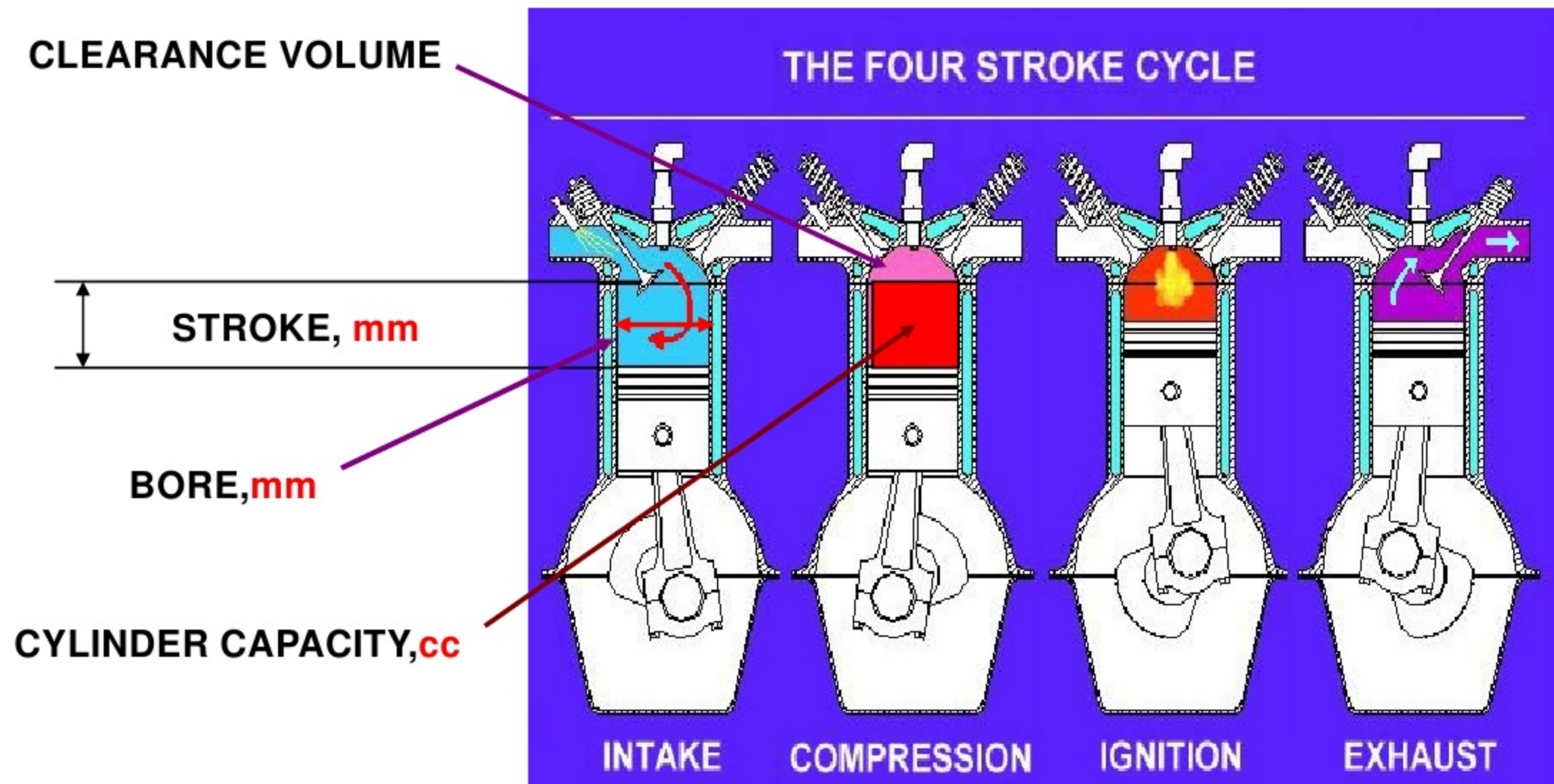
(FUEL CONSUMPTION)

**FUEL EFFICIENCY IS A COMBINATION OF ENGINE EFFICIENCY,
VEHICLE PARAMETERS & DRIVING PATTERN**

ENGINE EFFICIENCY
+
TRANSMISSION EFFICIENCY
(CLUTCH+GEARBOX+DIFFERENTIAL+ WHEELS + TYRES)
+
WEIGHT/LOAD/SPEED
+
AERODYNAMIC PARAMETERS
(DRAG - BODY SHAPE)
+
DRIVING PATTERN
(DRIVING STYLE & TRAFFIC CONDITIONS)

FUEL EFFICIENCY - Kms/Lit OR Lit/100 Kms

ENGINE PARAMETERS



ENGINE CAPACITY, cc = CYL. CAPACITY X No OF CYL

UNITS - cc - Cubic centimeter

- Lit - Liters = cc/1000

ENGINE PARAMETERS

BORE, mm : The diameter of the cylinder

STROKE, mm : The distance between top most point of piston travel to the bottommost point of piston movement

CAPACITY, cc : Also called displacement. The volume displaced by all pistons while moving from top to bottom. Also indicated in Liters.

CLEARANCE VOLUME : The volume available above piston, with the piston in top most point.

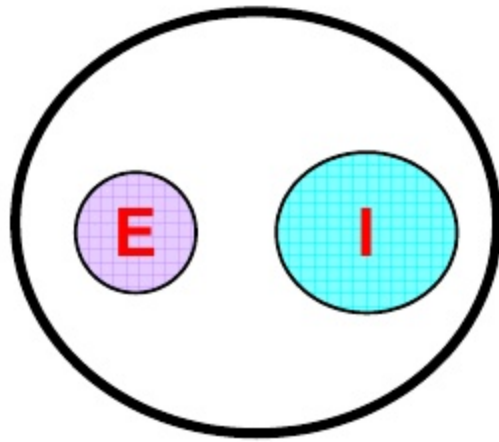
COMPRESSION RATIO : The ratio between the total volume to the clearance volume.

VALVE MECHANISM : The mechanism by which the valves are operated. It could be **push rod type or overhead camshaft type**

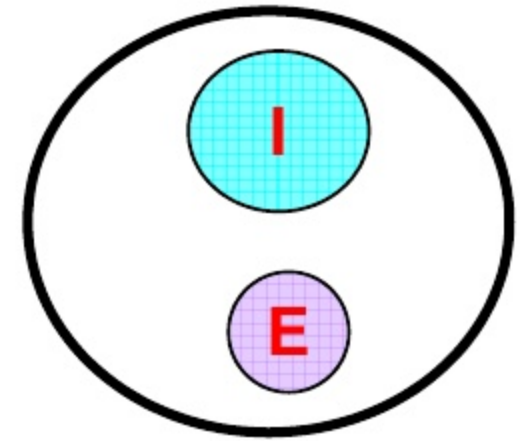
TIMING SYSTEM : The mechanism by which the camshaft & fuel injection pump are operated . It could be **gear driven, chain driven or belt driven.**

VALVE LAYOUTS

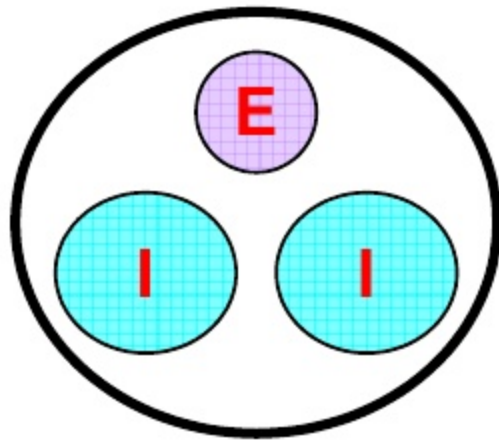
(NO. OF VALVES PER CYLINDER)



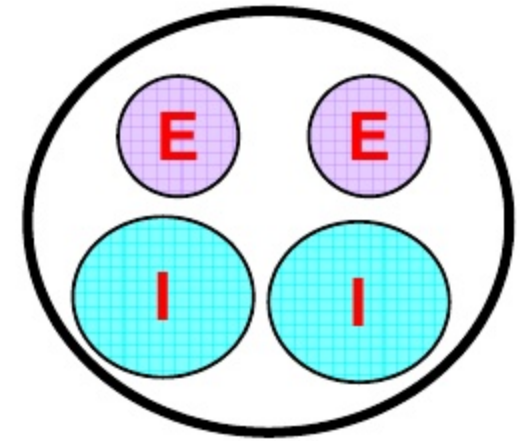
2 VALVES/CYL



2 VALVES/CYL



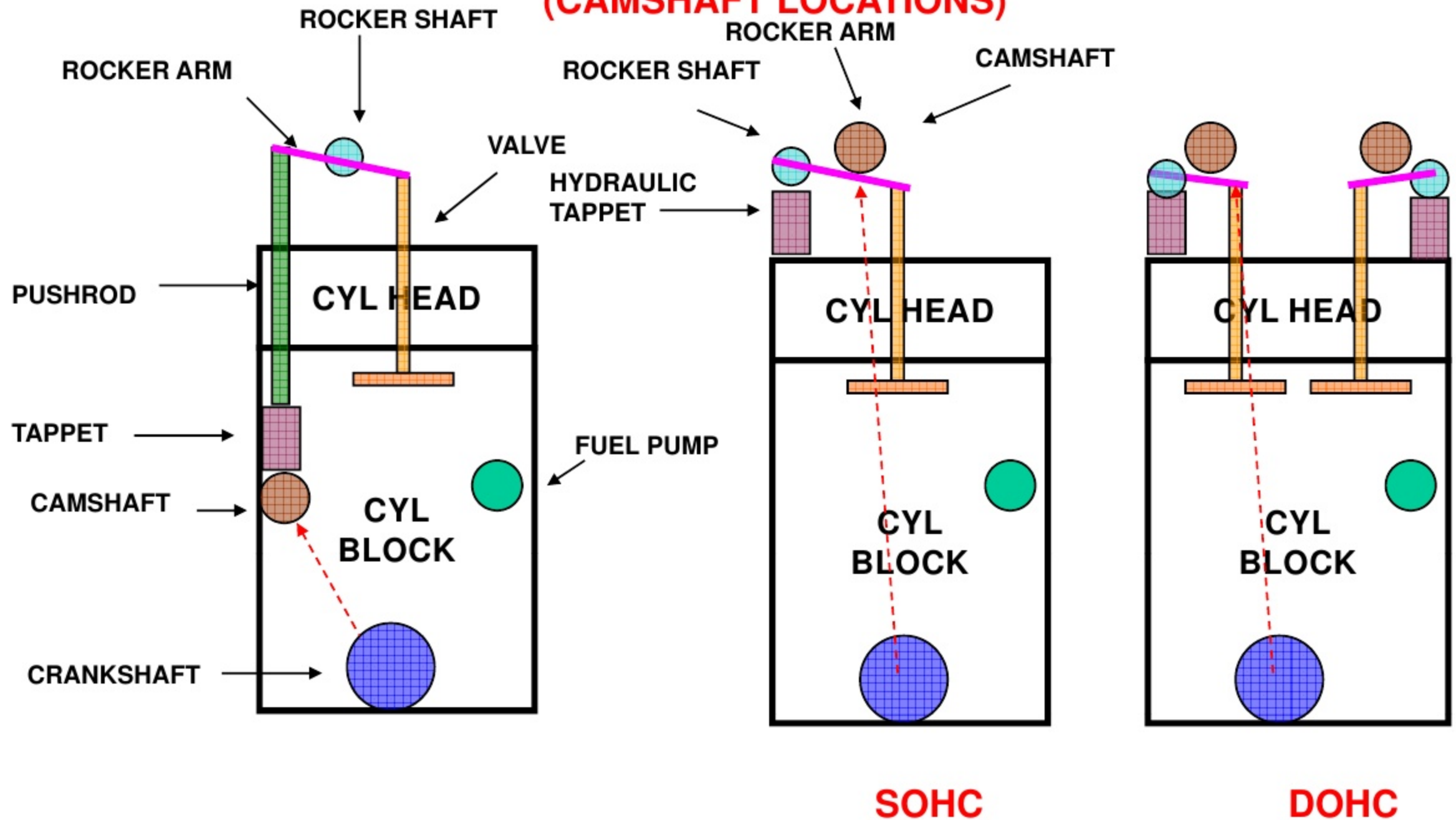
3 VALVES/CYL



4 VALVES/CYL

VALVE OPERATING MECHANISM

(CAMSHAFT LOCATIONS)

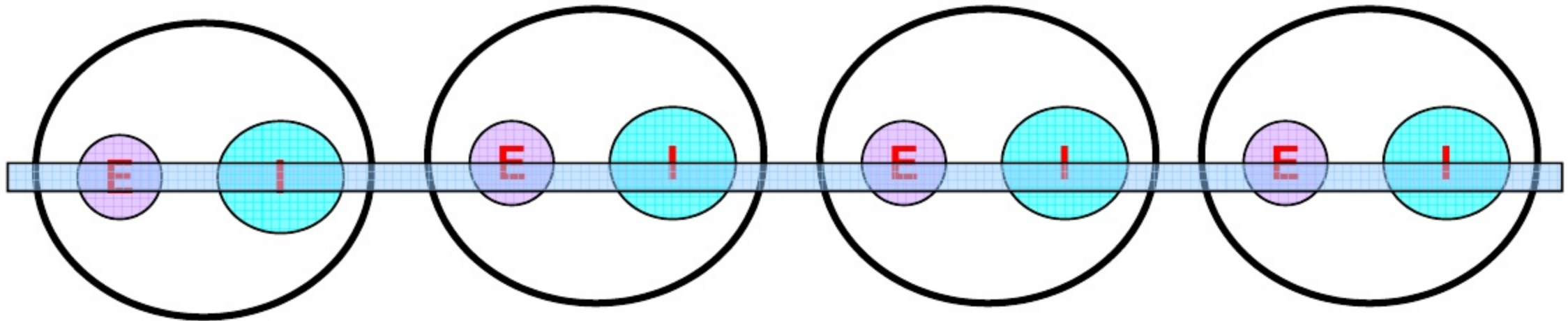


PUSH ROD ENGINE

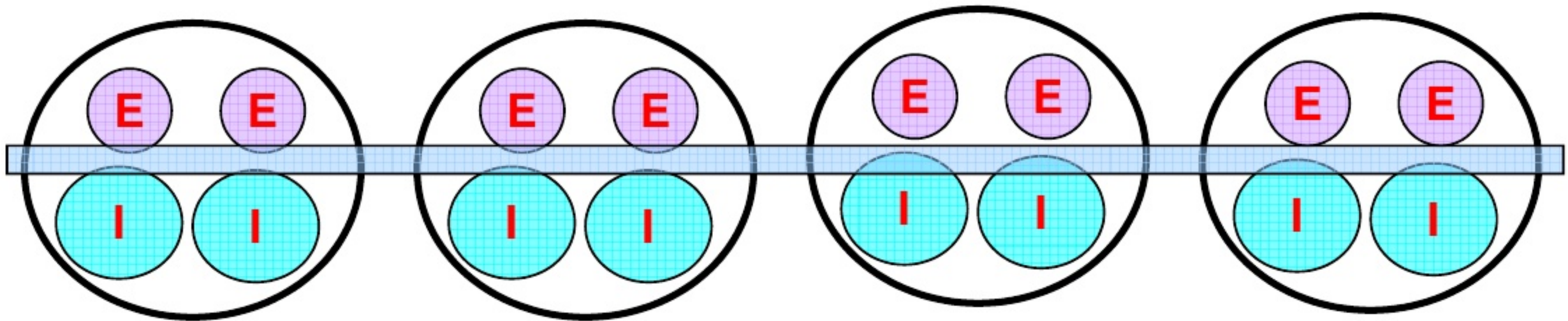
OVERHEAD CAM ENGINE

VALVE OPERATING MECHANISM

SINGLE OVERHEAD CAMSHAFT (SOHC)



2 VALVES/CYL , SOHC - VALVES OPERATED EITHER **DIRECTLY** OR THROUGH **ROCKERS**



4 VALVES/CYL , SOHC - VALVES OPERATED THROUGH **ROCKERS**