Define : i) Mechanical efficiency ii) Volumetric efficiency related to I.C. engine.

i) Mechanical Efficiency- It is the ratio of the power available at the engine crankshaft (bp) to the power developed in the engine cylinder (ip).

ii) Volumetric efficiency :- It is the ratio of the actual volume of the charge admitted into the cylinder to the swept volume of the piston .

## What are the effects of detonation in I.C. engine ?

Effects of detonation (1) Noise – As intensity of detonation increases, the sound intensity increases & it is harmful. (2) Mechanical damage – shock waves are so violent that it may cause mechanical damage like breaking of piston. It increases the rate of wear erosion of piston. (3) Pre-ignition – Due to local overheating of spark plug & this pre-ignition increases detonation. (4) Power output & efficiency decreases - Power output & thermal efficiency decreases due to abnormal combustion.

Represent wet compression and dry compression on

Dry Compression
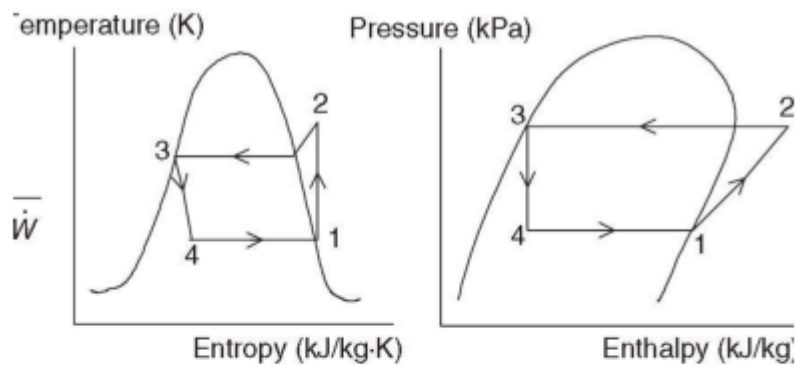
Wet Compression -
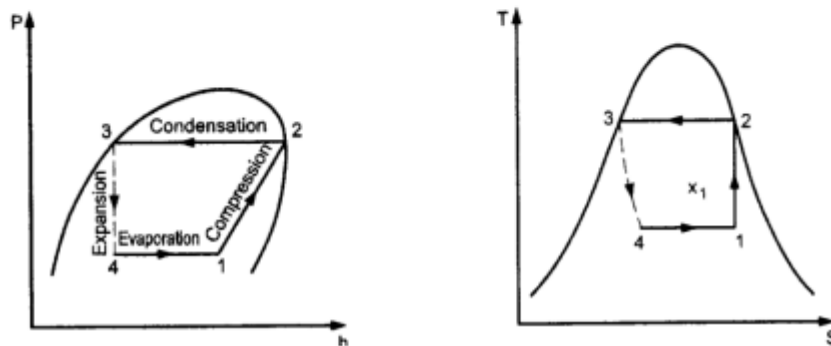
Explain with neat sketch working principle of Ram jet engine

Ramjet has no compressor as the entire compression depends upon compression. Function of supersonic & subsonic difference to convert the kinetic called the ram pressure.

State effects of pollutants in exhaust gases of petrol engine.

The major air pollutants emitted by petrol engines are CO_2, CO, HC, NO_x, SO_2, smoke & lead vapour.

Effect of CO:

Carbon monoxide combines with hemoglobin forming carboy hemoglobin, which reduces oxygen carrying capacity of blood.

1. This leads to laziness, exhaustion of body & headache. 2. Prolong exposure can even leads to death. 3. It also affects cardiovascular system, thereby causing heart problem

Effect of CO2: Causes respiratory disorder & suffocation.

What is supercharging ? State advantages of supercharging.

Superchargers are pressure boosting devices (compressors) which increase the pressure of the air before inletting it get into cylinder of the internal combustion engine, and the process of increasing the pressure OR forcing more air to get into engine is called as supercharging. This gives each intake cycle of the engine more oxygen, letting it burn more fuel and do more work, thus increasing power.

Draw turning moment diagram for four stroke petrol engine and explain it in brief.

Turning moment diagram of four stroke engine:
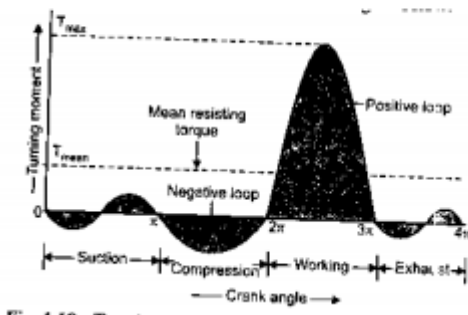
During suction stroke, negative loop is formed as pressure inside engine cylinder is less than atmospheric pressure. During compression stroke, work is done on gases therefore higher negative loop is formed. During expansion or power stroke, fuel burn & gases expand therefore large positive loop is formed & during this stroke we get work output. During exhaust stroke, work is done on the gas to expel it out of cylinder, hence negative loop is formed.

Explain working principle of simple vapour

Working of Simple Vapor absorption system: A Simple Vapor absorption system consists of evaporator, absorber, generator, condenser, expansion valve, pump & reducing valve. In this system ammonia is used as refrigerant and solution is used is aqua ammonia. Strong solution of aqua ammonia contains as much as ammonia as it can and weak solution contains less ammonia. The compressor of vapor compressor system is replaced by an absorber, generator, reducing valve and pump. The heat flow in the system at generator, and work is supplied to pump.

Explain construction and working of single stage reciprocating air compressor

In single stage reciprocating air compressor, the entire compression is carried out in a single cylinder. The opening & closing of a simple check valve (plate or spring valve) depends upon the difference in pressure, if mechanically operated valves are used for suction & discharge then their functioning is controlled by cams. The weight of air in the cylinder will be zero when the piston is at top dead centre. At this position, you have to neglect clearance volume.

Following observations were recorded during a trial on single cylinder four stroke oil engine

Q2 (a) Given,

$d = 15\,cm \quad l = 25\,cm \quad P_m = 7.35\,bar \quad N = 400\,r.p.m.$

$T = 225\,N\cdot m \quad m_f = 3\,kg/hr \quad C.V. = 44,200\,kJ/kg$

$$b.P. = 2\pi N T$$
$$= 2\pi \times \frac{400}{60} \times 225$$
$$= \underline{9428.57\,W} = \underline{\underline{9.429\,kW}} \quad — (2m)$$

$$I.P. = P_m \cdot L \cdot A \cdot \frac{N}{n} \qquad n = 2 \text{ for four stroke}$$
$$= 7.35 \times 10^5 \times (0.25) \times \frac{\pi}{4}(0.15)^2 \times \frac{400}{2 \times 60}$$
$$= \underline{10828.12\,W} = \underline{\underline{10.828\,kW}} \quad — (2m)$$

$$\eta_{mech} = \frac{b.P.}{I.P.} = \frac{9.429}{10.828} = \underline{\underline{87\%}} \quad — (1m)$$

$$\eta_{BTh} = \frac{b.P.}{m_f \times C.V.} = \frac{9.429}{\frac{3}{3600} \times 44,200} \quad — (1m)$$

$$= \underline{\underline{25.6\%}}$$

$$\eta_{Tith} = B.s.f.c. = \frac{m_f}{b.P.}$$
$$= \frac{3}{9.429}$$
$$= \underline{\underline{0.3182\,kg/kw\cdot hr}}$$
$$= \underline{\underline{318.2\,gm/kw\cdot hr}} \quad — (2m)$$

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