

HW#3 Internal Combustion Engines

1) The following exhaust composition was measured on the Engines Lab Port Fuel Injection automotive 1.8L naturally aspirated engine. H₂O was condensed out of the gasses prior to measurement. What was the Air/Fuel ratio?

CO: 0.9%

CO₂: 15%

O₂: 1.9%

2) For an engine similar to that in question #1, what are reasonable values for the following:

η_c ?

η_{mech} (max)?

Compression Ratio?

BMEP?

Maximum BSFC?

Based on your estimation of Compression Ratio, calculate η_t (theoretical).

What is a reasonable number for η_t (actual)?

3) A car rolling at speed S (m/s) will have a rolling resistance of:

$$P_r = (C_r M_v g + \frac{1}{2} \rho_a C_d A S^2) S$$

Where P_r is the power required to keep the vehicle rolling

C_r is the coefficient of rolling resistance (~.0135)

M_v is the vehicle mass (use 1400 kg)

g is the gravitational constant (m/s)

ρ_a is the density of air at standard conditions (kg/m³)

C_d is the aerodynamic drag coefficient (use 0.37)

A is the frontal area of the vehicle (use 2.5 m²)

Given your estimation of maximum BSFC above, what should the cars fuel mileage (km/liter) be at a steady speed of 100 km/h, (assuming this is the optimum point for BSFC)?