HW#4 **Internal Combustion Engines**

1) 10mg of n-octane fuel is being delivered to an engine. Calculate the *Total Surface Area*, the *Total number of droplets* and the *Time to evaporate* at 330K for the following fuel induction methods:

A) Carburetion giving 250μm droplet diameter.

B) Port Fuel Injection giving 30μm droplet diameter.

C) Direct Injector giving 10μm droplet diameter.

Assume that the relation ship between Evaporation time (t) and Droplet Diameter (d) is:

$$\mathbf{t = d^2 / k}$$

where **k** is 3 x 10 -7 m^2/s, (appropriate for n-octane fuel in an engine at 350K).

D) Which technique would give you the largest cylinder to cylinder fueling variation?

E) Which technique would give the least cycle to cycle AFR variation during a transient?

F) Which technique would you expect to give you the least overall Hydrocarbon Emissions?

2) One Cylinder of an automotive Engine may have the following parameters:

Bore = Stroke

Connecting Rod Length = 3 * Stroke

V_d = 400 cc

T_i = 320K

P_i = 1 atm

CR = 10

Φ= 1

η_v= 1

Fuel is C_8H_{18}

$$x_b = 1 - \exp\left[-a\left(\frac{\theta - \theta_o}{\Delta\theta}\right)^{m+1}\right]$$

The above Equation describes the fraction of Fuel Burned as a function of Crank Angle (θ). Using the following data:

Δθ= 28 deg (Burn Duration)

a = 5

m = 2

A) Determine what θ_0 must be to have a peak pressure at 8°atdc.

B) Plot P vs θ (from -180 to 180 deg) for the motored case (ie. no firing).

C) Plot P vs θ for the firing case on the same axis.

D) Plot P versus V for the motored and fired case on the same axis.

You can assume isentropic expansion/compression in the motored case, and IVC and EVO at BDC. Make whatever assumptions are necessary, and state them.