AS – 568 High Temperature Gas Dynamics
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Supplementary Exercise – 5
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1. (a) Find the explosion limits curve of the system given below:

Reaction	A_k(mol,cm3,s)	m_k(T in K)	E_k(kcal/mol)
(i) H + O2 → O + OH	1.91e14	0.0	16.44
(ii) O + H2 → H + OH	5.08e4	2.67	6.292
(iii) OH + H2 → H2O + H	2.16e8	1.51	3.43
(iv) O + H2O → OH + OH	2.97e6	2.02	13.4
(v) H2 + M → H + H + M	4.57e19	-1.4	105.1
(vi) H + OH + M → H2O + M	4.5e22	-2.0	0.00
(vii) any radical → surface quench eg.: OH + S → quenched at wall	5.0e5	0.5	0.00

(b) Estimate the ignition time (defined as the time when 1% of product concentration is formed) for a case on the line and a case slightly into the explosive region.

2. Consider the above mechanism with (a) reaction 2 being in PE and (b) QS approx for O in reactions 1&2. Find the explosion limit(s) for the system at 3 atm. Explain the differences with problem 1(a) and the current two cases.

3. In assignment 1, problem 2, find the blowout characteristic (flow rate at which system blows out) of the burner for various ϕ values for adiabatic conditions, and compare the same for non-adiabatic conditions. Interpret the results.

4. In assignment 1, problem 3, what is the effect on the plot, if (i) Tin is increased by 200K, or (ii) Pin is decreased by 0.1 atm. Interpret the results.