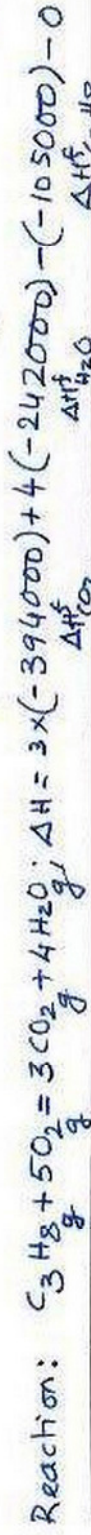


What is the adiabatic flame temperature when propane (C_3H_8) at 300K is burnt with stoichiometric amount (to give CO_2 and H_2O) of pure oxygen at 300K? Take 1 Nm³ blast air as the basis. Present your results as fully populated mass and heat balance tables.

Method I: Heat Balance: Sensible heats of all materials is given as $H_T - H_{298} = \int_{298}^T \phi \cdot dT$



Input	Details	kJ	Output	Details	kJ
$O_2, 298K$	$(1 Nm^3 = \frac{1000}{22.4} \times \frac{273}{298} = 40.9 \text{ mol}) \times 0$	0	CO_2, T_f	$24.54 \times (61.0 T_f - 30500)$	
$C_3H_8, 298K$	$\frac{40.9}{5} = 8.180 \text{ mol}$	0	H_2O, g, T_f	$(H_{T_f} - H_{298})$ $32.72 \times (47.4 T_f - 22200)$	
Rxn. Heat ($-\Delta H_{298}$)	$\frac{40.9}{5} [3 \times 394000 + 4 \times 242000] - 105000 = 0$		Losses	adiabatic	0

Sign change here.

Method II: Enthalpy Balance: Enthalpy in = Enthalpy out (for adiabatic process)

Enthalpy of elements at 298K = 0. Compounds have enthalpy ($= \Delta H_f^\circ$) at 298K.

Input	Details	kJ	Output	Details	kJ
$O_2, 298$	element	0	CO_2	$(H_{298} + (H_{T_f} - H_{298})) \cdot n_{CO_2}$ $= 24.54 \times (-394000 + 61.0 T_f - 30500)$	
$C_3H_8, 298$	$(0 + \Delta H_{298}^\circ) \cdot n = 8.18 \times (-105000)$		H_2O, g	$(H_{298} + (H_{T_f} - H_{298})) \cdot n_{H_2O}$ $= 32.72 \times (-242000 + 47.4 T_f - 22200)$	

- Two methods are identical, except how one does the counting.
- Engineers normally prefer Method I.