

JQ.2.34.Setup

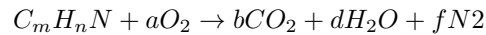
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(2.34) Polyacrylonitrile (C_3H_3N) burns to form vapor, carbon dioxide and nitrogen. The heat of formation of the polyacrylonitrile is 15.85 kcal/(g mol). Use data from Tables 2.1 and 2.2. Use specific heat values at 1000K.

- (a) Write the balanced chemical equation for the stoichiometric combustion in oxygen.
- (b) Determine the heat of combustion of the polyacrylonitrile.
- (c) write the balanced chemical equation for the stoichiometric combustion in air.
- (d) Determine the adiabatic flame temperature if the fuel burns stoichiometrically in air.

Setup

You've done all these steps in previous problems. For part (a):
balance the chemical reaction using elemental balances:



Find the stoichiometric coefficients a, b, & d.

Use equation 2.25 to express the heat of combustion in terms of the heats of formation

$$\Delta \tilde{h}_c = \left(\sum_i \nu_i \Delta \tilde{h}_{f,i}^\circ \right)_{React} - \left(\sum_j \nu_j \Delta \tilde{h}_{f,j}^\circ \right)_{Prod}$$

Assume that the reactants are at 25°C.

$$T_P = 25 + \frac{m_F}{m_T} \frac{\Delta h_c}{\bar{c}} = 25 + Y_F \frac{\Delta h_c}{\bar{c}}$$