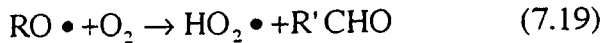
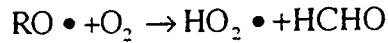


7.9



for $R'CHO$ to be $HCHO$, R' must be H so that

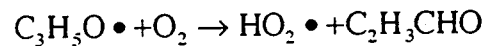
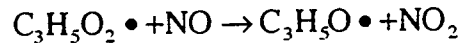
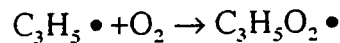
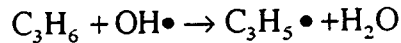


for the reaction to balance, $R = CH_3$

which says RH in (7.16) must be CH_4 (methane)

7.10 $RH = \text{propene} = CH_2=CH-CH_3 = C_3H_6$ so, $R = C_3H_5$

so the sequence of reactions (7.16) to (7.19) are:



The end product is acrolein, CH_2CHCHO .

7.11 U. S. Power plants:

$$\text{heat input} = 685 \times 10^6 \text{ tons} \times 2000 \frac{\text{lb}}{\text{ton}} \times 10,000 \frac{\text{Btu}}{\text{lb}} = 1.37 \times 10^{16} \text{ Btu}$$

$$\text{efficiency} = \frac{\text{output}}{\text{input}} = \frac{1400 \times 10^9 \text{ kWh} \times 3412 \text{ Btu/kWh}}{1.37 \times 10^{16} \text{ Btu}} = 0.349 \approx 35\%$$

At NSPS of 0.03 lb particulates per 10^6 Btu input, emissions would have been:

$$\text{emissions} = \frac{0.03 \text{ lb}}{10^6 \text{ Btu heat input}} \times 1.37 \times 10^{16} \text{ Btu in} \times \frac{1000 \text{ g}}{2.2 \text{ lb}} = 1.87 \times 10^{11} \text{ g}$$

$$\text{For comparison, } \frac{\text{emissions at NSPS}}{\text{actual emissions}} = \frac{1.87 \times 10^{11} \text{ g}}{0.39 \times 10^{12}} = 0.48 = 48\%$$

7.12 Derivation for the dry adiabatic lapse rate:

$$dQ = dU + dW \quad \text{where } dU = C_v dt \text{ and } dW = PdV$$

$$dQ = C_v dt + PdV \quad (1)$$

ideal gas law says $PV = nRT$

$$\text{so, } d(PV) = PdV + VdP = nRT$$

$$\text{or, } PdV = nRT - VdP$$

plugged into (1) gives: