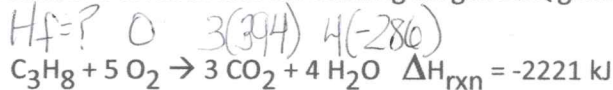


LONG ANSWER

(f) $(2265 \text{ kJ}) \left(\frac{43.55}{100} \right) = 986.4 \text{ kJ} = 986,400 \text{ J}$
 $986,400 \text{ J} = mc\Delta T = (3558 \text{ g}) \left(4.184 \frac{\text{J}}{\text{g}^\circ\text{C}} \right) (T_f - 25^\circ\text{C})$
 $T_f = 91.3^\circ\text{C}$

Propane, C_3H_8 , is used in plumber's torches and for cooking on gas BBQ grills. The equation is



	ΔH_f		ΔH_f
H_2O	-286 kJ	CO_2	-394 kJ

a) What is the ΔH_f value for C_3H_8 ?
 $\Delta H_{\text{rxn}} = -2221 \text{ kJ} = \sum H_f(\text{products}) - \sum H_f(\text{reactants})$
 $-2221 = (3 \cdot -394) + (4 \cdot -286) - (1 H_f + 0)$
 Solve for $H_f \rightarrow H_f = -105 \text{ kJ}$

b) Write the equation for the formation of C_3H_8 .
 $3 \text{C}(s) + 4 \text{H}_2(g) \rightarrow \text{C}_3\text{H}_8 \quad \Delta H_f = -105 \text{ kJ}$

c) Is the reaction in part (b) above, exothermic or endothermic? Explain your reasoning.
 exothermic b/c $\Delta H < 0$

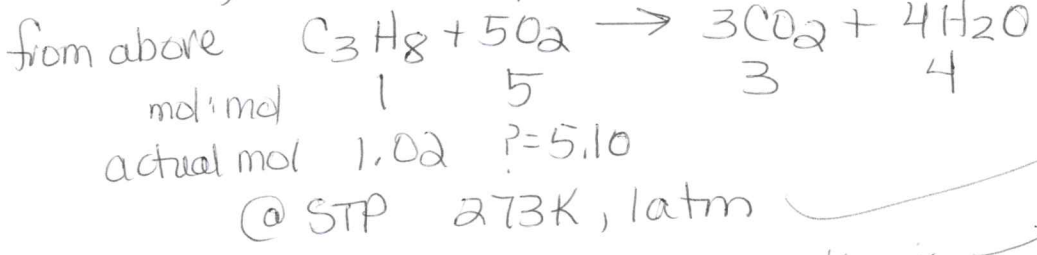
d) Calculate the volume of air at STP that is needed to burn completely 45.0 grams of propane. Assume that air is 21.0 percent O_2 by volume.

e) If 45.0 grams of C_3H_8 were combusted, how much heat energy was produced?
 from (d) $n = 1.02 \text{ mol } \text{C}_3\text{H}_8 \quad (2221 \frac{\text{kJ}}{\text{mol}}) (1.02 \text{ mol}) = 2265 \text{ kJ released}$

f) Assuming an 43.55% efficiency in the transfer of heat from the reaction in part (e), what would the final temperature be of 3558 grams of water in a pot on the grill at 25.0°C were heated with the 45.0 grams of propane from part (e)?
 see above

d) $\frac{45.0 \text{ g}}{\text{mm}} = \text{moles } \text{C}_3\text{H}_8 \quad \frac{45.0 \text{ g}}{44.10 \text{ g/mol}} = 1.02 \text{ mol } \text{C}_3\text{H}_8$

2 ways to solve for liters $\text{O}_2(g)$
 1) stoichiometry and $PV = nRT$



$PV = nRT$
 $(1 \text{ atm})(V) = (5.10)(0.0821)$
 $V = 114.3 \text{ L } \text{O}_2(g)$

or @ STP
 $22.4 \text{ L} = \frac{V}{1 \text{ mol}} = \frac{V}{5.10 \text{ mol}} \quad V = 114.2 \text{ L } \text{O}_2(g)$
 this is volume of O_2 (NOT AIR!)

then for volume of air $\frac{21}{100} = \frac{114.3}{x} \quad x = 544.3 \text{ L air}$