Revised August 2006

AP WORKED ANSWERS

1995, 2

Points 1, 4, 2, 2

(a) $C_3H_{8(g)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(l)}$

(b) Moles of $C_3H_8 = \frac{10.0}{44} = 0.227$ mols

From ratio (1:5)

Moles of $O_2 = 5 \times 0.227 = 1.13$ mols

$$V = \frac{(n)(R)(T)}{(P)} = \frac{(1.13)(0.0821)(303)}{1} = 28.1 \text{ L}$$

28.1 L of O_2 is 21% of the volume of air needed

so 100% of the volume of air = $\left(\frac{28.1}{21}\right)(100)$

= **<u>134 L</u>**

(c) Using $\Delta H = [H_{f\ Products}] - [H_{f\ Reactants}]$

$-2220.1 = [3(-393.5) + 4(-285.3)] - [(H_f\ C_3H_8) + 5(0)]$

(Oxygen is an element that has a standard enthalpy of formation = 0)

$\Delta H_{f\ Propane}$ = **<u>-101.6 kJ</u>**

Alternative methods via Hess's Cycle OR algebraic manipulation of equations.

(d) Since 1 mole of propane (44g) produces 2220.1 kJ of energy (standard enthalpy of combustion) in an exothermic reaction, 30g of propane evolves (gives off/releases)

$\left(\frac{30}{44}\right)(2220.1) = 1513.7$ kJ of energy

Converting to J by multiplying kJ by 1000 gives the energy transferred to the water.

(1513.7 kJ) (1000) = 1513700 J

Then apply;

$q = m\ c\ \Delta T$

$= 1513700 = (8000)\ (4.18)\ \Delta T$

ΔT = **<u>45 K</u>**