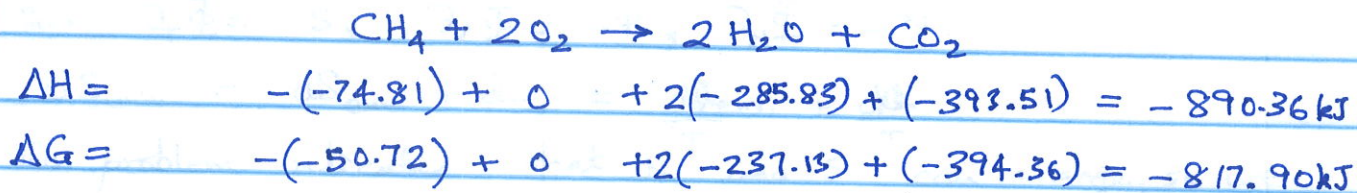5.5) (a) Since the reaction takes place at room temperature and pressure, we use values for liquid water (for instance).

$$CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$$

$$\Delta H = -(-74.81) + 0 \quad +2(-285.83) + (-393.51) = -890.36 \text{ kJ}$$

$$\Delta G = -(-50.72) + 0 \quad +2(-237.13) + (-394.36) = -817.90 \text{ kJ}$$

(b) Per mole, the electrical work $= -\Delta G = 817.9 \text{ kJ}$.

(c) The waste heat produced $= -\Delta H + \Delta G = 72.46 \text{ kJ}$

(d) Voltage $= \dfrac{-\Delta G}{(8)(1.6 \times 10^{-19} \text{ C})(6.02 \times 10^{23})} = 1.061 \text{ V}$.