

Name Key

Do not plug in any numerical values until they are required to carry the analysis further.

#1 (20 Points) Consider an insulated room that has a uniform temperature, T . At some time, a 100 W light bulb and a 1500 W hair dryer are turned on. How much has the energy content of the room changed one minute after the light and hair dryer have been turned on? State any assumptions.

$$\Delta E = Q_{in, net} + W_{out, net}$$

$$\dot{E} = \dot{Q} + \dot{W} \quad \text{rate form}$$

$$\dot{Q} = 100 \text{ J/sec} + 1500 \text{ J/sec}$$

$$= 1600 \text{ J/sec} \quad \dot{W} = 0$$

$$\Delta E = Q_{in}, \quad Q_{in} = \dot{Q} \Delta t \quad (\text{Eq 2.37})$$

$$\text{So } \Delta E = \dot{Q} \Delta t$$

$$= 1600 \frac{\text{J}}{\text{sec}} \times 60 \text{ sec} =$$

$$960 \text{ kJ}$$

Write 1st law 5

\dot{Q} correct 5

$\Delta E = \dot{Q} \Delta t$ 5

All correct 5

