(1) An engine absorbs heat at a temperature of 727 degrees Celsius and exhausts heat at a temperature of 527 degrees Celsius.

\[ T_H = (717 + 273) \text{ K} = 1000 \text{ K} \]
\[ T_C = (527 + 273) \text{ K} = 800 \text{ K} \]

(a) What is the maximum efficiency of the engine?

\[ \eta_{\text{max}} = \frac{\eta_{\text{carnot}}}{1 - \frac{T_C}{T_H}} = 1 - \frac{800 \text{ K}}{1000 \text{ K}} = 0.200 \]

(b) If the engine operates at a maximum possible efficiency, how much work does it perform for 2000 joules of heat input?

\[ \frac{W}{Q_H} = 0.200 = \frac{W}{2000 \text{ J}} \]
\[ W = 400 \text{ J} \]

(2) An air conditioner absorbs heat inside a building at 72 degrees Celsius and exhausts it outside at 95 degrees Celsius.

\[ T_C = (72 + 273) \text{ K} = 345 \text{ K} \]
\[ T_H = (85 + 273) \text{ K} = 368 \text{ K} \]

(c) What is the maximum possible coefficient of performance of the air conditioner?

\[ (\text{coeff of perf})_{\text{max}} = \frac{\text{coeff of perf}_{\text{carnot}}}{T_H - T_C} = \frac{T_C}{T_H - T_C} = \frac{345 \text{ K}}{368 \text{ K} - 345 \text{ K}} \]
\[ = 1.5 \]

(d) If the air conditioner operates at maximum possible coefficient of performance, using 1000W of electric power, how much heat does it remove from the building in one minute?

\[ \text{coeff of perf} = \frac{|Q_C|}{|W|} \]
\[ |W| = P \times t = (1000 \text{ W})(60 \text{ s}) \]
\[ = 6 \times 10^4 \text{ J} \]

\[ 15 = \frac{|Q_C|}{6 \times 10^4 \text{ J}} \]
\[ |Q_C| = 9 \times 10^5 \text{ J} \]