Assignment # 6

Thermodynamics-IV

Chapter 20: The Second Law of Thermodynamics

Important Concepts and Formulas:

$$H = kA\frac{T_H - T_C}{L}$$

Thermal efficiency of an engine $e = \dfrac{W}{Q_H}$

Coefficient of performance; $K = \dfrac{Q_C}{W}$

$$\Delta S = \int_1^2 \frac{dQ}{T}$$

Question 1:

A diesel engine performs 2200 J of mechanical work and discards 4300 J of heat each cycle.

    (a) How much heat must be supplied to the engine in each cycle?
    (b) What is the thermal efficiency of the engine?

Question 2:

A room air conditioner has a coefficient of performance of 2.9 on a hot day and uses 850 W of electrical power.

    (a) How many joules of heat does the air conditioner remove from the room in one minute?
    (b) How many joules of heat does the air conditioner deliver to the hot outside air in one minute?
    (c) Explain why your answers to parts (a) and (b) are not the same.

Question 3:

A person who has skin of surface area 1.85 m² and temperature 30.0° C is resting in an insulated room where the ambient air temperature is 20.0° C. In this state, a person gets rid of excess heat by radiation. By how much does the person change the entropy of the air in this room each second?

Question 4:

Suppose 1.00 kg of water at 100°C is placed in thermal contact with 1 kg of water at 0°C. What is the total change in entropy? Assume that the specific heat of water is constant at 4190 J/kg.K over this temperature range.

Question 5:

What do you think about the entropy of universe, is it increasing, decreasing? Justify your statement with the help of suitable mathematical equation.