Assignment 3

Thermodynamics I

Chapter 17: Temperature and Heat

Important Formulas and Concepts:

Difference between heat and temperature

Thermal equilibrium

Temperature scales and their conversion formulas

$\Delta L = \alpha L_0 \Delta T$

Stefan-Boltzmann law $H = Ae\sigma T^4$

Question 1:

(a) Let us suppose we have three bodies A, B and C, all of these bodies having different temperature. When they connected with each other then temperature of all these bodies become equal after certain period of time, explain the concept on the basis of heat flow.
(b) Why is a hot, humid day in the tropics generally more uncomfortable for human beings than a hot, dry day in the desert?
(c) Earth isn't in thermal equilibrium with the sun (which has a surface temperature of 5800 K). But why aren't the two bodies (Earth and Sun) in thermal equilibrium?

Question 2:

(a) Calculate the one temperature at which Fahrenheit and Celsius thermometers agree with each other.
(b) Calculate the one temperature at which Fahrenheit and Kelvin thermometers agree with each other.

Queston3:

(a) The Humber Bridge in England has the world's longest single span, 1410 m. Calculate the change in length of the steel deck of the span when the temperature increases from -5°C to 18.0°C.
(b) A copper cylinder is initially at what temperature will its volume be 0.150% larger than it is at 20.0°C?
(c) Prove that β=3α, and write the reason that why one coefficient of expansion is thrice of other?

Question 4:

In an effort to stay awake for an all-night study session, a student makes a cup of coffee by first placing a 200-W electric immersion heater in 0.320 kg of water.

(a) How much heat must be added to the water to raise its temperature from 20.0°C 80.0°C? (5 Points)
(b) How much time is required? Assume that all of the heater's power goes into heating the water.

Question 5:

The basal metabolic rate is the rate at which energy is produced in the body when a person is at rest. A 75-kg (165-lb) person of height 1.83 m (6 ft) has a body surface area of approximately 2.0 m^2. What is the net amount of heat this person could radiate per second into a room at 18°C (about 65°F) if his skin's surface temperature is 30°C?