Weather and Climate Practice Problems:

1. A storm system is approximately 20 km from a weather radar station, which contains a transmitter and a receiver. Determine the time that elapses from when a transmitter generates a pulse of electromagnetic radiation to when the receiver detects a reflected pulse/signal from the storm.

(0.13 milliseconds)

2. A weather radar station is detecting the position of a storm. A reflected signal is detected by the receiver 0.62 milliseconds after the transmitter created it. Determine the distance the storm is from the weather station.

(93 kilometres)

3. The average solar irradiance near the surface of the earth in a part of Ontario on a cloudy day is approximately 250 Watts/metre$^2$ during the summer months. A solar panel, whose length is 600 cm and width is 180 cm is placed outdoors and is approximately 26.0% efficient (that is, for every 1 metre$^2$ of solar panel and 100 Watts of solar power incident on the solar panel, only 26 Watts is converted into electrical power for the home). Determine the amount of electrical power that is created by the solar generation system for a home.

(702 Watts)

4. A home requires 1500 watts of power (in the summer) to operate an air conditioning unit. The average solar irradiance near the surface of the earth in the southern US is 400 Watts/metre$^2$ during the summer months. The solar panel has an efficiency of 31.0%. Determine the minimum size of solar panel required to meet the power demands of the air conditioning unit for this home.

(12.1 m$^2$)

5. A fluid has a thermal coefficient of expansion of 90.0x10^{-6} per deg C. During an experiment, the fluid’s initial volume is 2.30x10^2 ml and its initial temperature is 20.0 deg C. After 5 minutes of warming, the fluid has a final temperature of 25.5 deg C and has expanded, climbing up a glass rod by a height of 6.0 cm. The tube has an overall length of 30.0 cm. What volume of fluid can the tube hold in total?

(0.57 ml)

6. During an experiment, the fluid’s initial volume is 300 ml and its initial temperature is 10.0 deg C. After 5 minutes of warming, the fluid has a final temperature of 12.3 deg C and has expanded, climbing up a glass rod by a height of 3.0 cm. The tube has an overall length of 10.0 cm and can hold 6 ml of water. What is the thermal coefficient of expansion for this fluid?