

PROBLEM 1.50

First convert temperatures from °C to K by rearranging Eq. 1.17 to solve for temperature in K

$$T(^{\circ}\text{C}) = T(\text{K}) - 273.15 \rightarrow T(\text{K}) = T(^{\circ}\text{C}) + 273.15$$

For summer: $T_{\text{summer}}(\text{K}) = 19.5^{\circ}\text{C} + 273.15 = 292.65 \text{ K}$

For winter: $T_{\text{winter}}(\text{K}) = -4.9^{\circ}\text{C} + 273.15 = 268.25 \text{ K}$

Next apply Eq. 1.16 to solve for temperatures in °R

$$T(^{\circ}\text{R}) = 1.8T(\text{K})$$

For summer: $T_{\text{summer}}(^{\circ}\text{R}) = (1.8)(292.65 \text{ K}) = \underline{526.77^{\circ}\text{R}}$ ←

For winter: $T_{\text{winter}}(^{\circ}\text{R}) = (1.8)(268.25 \text{ K}) = \underline{482.85^{\circ}\text{R}}$ ←

Finally, apply Eq. 1.18 to solve for temperatures in °F

$$T(^{\circ}\text{F}) = T(^{\circ}\text{R}) - 459.67$$

For summer: $T_{\text{summer}}(^{\circ}\text{F}) = 526.77^{\circ}\text{R} - 459.67 = \underline{67.10^{\circ}\text{F}}$ ←

For winter: $T_{\text{winter}}(^{\circ}\text{F}) = 482.85^{\circ}\text{R} - 459.67 = \underline{23.18^{\circ}\text{F}}$ ←

PROBLEM 1.51

Use the following equations to convert from °F to °C and then to K

$$T(^{\circ}\text{F}) = 1.8 \times T(^{\circ}\text{C}) + 32 \quad (1.19)$$

$$\Rightarrow T(^{\circ}\text{C}) = \frac{T(^{\circ}\text{F})}{1.8} - \frac{32}{1.8} = \frac{T(^{\circ}\text{F})}{1.8} - 17.78$$

$$T(^{\circ}\text{C}) = T(\text{K}) - 273.15 \quad (1.17)$$

$$\Rightarrow T(\text{K}) = T(^{\circ}\text{C}) + 273.15$$

(a) 86°F

$$T(^{\circ}\text{C}) = \frac{86}{1.8} - 17.78 = 30^{\circ}\text{C}$$

$$T(\text{K}) = 30 + 273.15 = 303.15 \text{ K}$$

(b) -22°F

$$T(^{\circ}\text{C}) = \frac{-22}{1.8} - 17.78 = -30^{\circ}\text{C}$$

$$T(\text{K}) = -30 + 273.15 = 243.15 \text{ K}$$

(c) 50°F

$$T(^{\circ}\text{C}) = \frac{50}{1.8} - 17.78 = 10^{\circ}\text{C}$$

$$T(\text{K}) = 10 + 273.15 = 283.15 \text{ K}$$

(d) -40°F

$$T(^{\circ}\text{C}) = \frac{-40}{1.8} - 17.78 = -40^{\circ}\text{C}$$

$$T(\text{K}) = -40 + 273.15 = 233.15 \text{ K}$$

(e) 32°F

$$T(^{\circ}\text{C}) = \frac{32}{1.8} - 17.78 = 0^{\circ}\text{C}$$

$$T(\text{K}) = 0 + 273.15 = 273.15 \text{ K}$$

(f) -459.67°F

$$T(^{\circ}\text{C}) = \frac{-459.67}{1.8} - 17.78 = -273.15^{\circ}\text{C}$$

$$T(\text{K}) = -273.15 + 273.15 = 0 \text{ K}$$