

Problem 1.3

Determine the kelvin temperature for each of the following:

- (a) human body temperature
- (b) the boiling point of water (at the standard pressure of 1 atm);
- (c) the coldest day you can remember;
- (d) the boiling point of liquid nitrogen (-196°C);
- (e) the melting point of lead (327°C).

Solution

Part (a)

The normal human body temperature is 98.6°F . Convert this to Celsius.

$$\begin{aligned} (^{\circ}\text{C}) &= \frac{5}{9}[(^{\circ}\text{F}) - 32] \\ &= \frac{5}{9}(98.6 - 32) \\ &= 37.0 \end{aligned}$$

Then convert it to kelvin.

$$\begin{aligned} (\text{K}) &= (^{\circ}\text{C}) + 273.15 \\ &= 37.0 + 273.15 \\ &\approx 310.2 \end{aligned}$$

The normal human body temperature is about 310.2 K.

Part (b)

The boiling point of water (at the standard pressure of 1 atm) is 100°C . Convert this to kelvin.

$$\begin{aligned} (\text{K}) &= (^{\circ}\text{C}) + 273.15 \\ &= 100 + 273.15 \\ &\approx 373 \end{aligned}$$

The boiling point of water (at the standard pressure of 1 atm) is about 373 K.

Part (c)

The coldest day I can remember was 5°F. Convert this to Celsius.

$$\begin{aligned} (^{\circ}\text{C}) &= \frac{5}{9}[(^{\circ}\text{F}) - 32] \\ &= \frac{5}{9}(5 - 32) \\ &= -15 \end{aligned}$$

Then convert it to kelvin.

$$\begin{aligned} (\text{K}) &= (^{\circ}\text{C}) + 273.15 \\ &= -15 + 273.15 \\ &\approx 258 \end{aligned}$$

The coldest day I can remember was about 258 K.

Part (d)

Convert the given Celsius temperature (-196°C) to kelvin.

$$\begin{aligned} (\text{K}) &= (^{\circ}\text{C}) + 273.15 \\ &= -196 + 273.15 \\ &\approx 77 \end{aligned}$$

Therefore, the boiling point of liquid nitrogen is about 77 K.

Part (e)

Convert the given Celsius temperature (327°C) to kelvin.

$$\begin{aligned} (\text{K}) &= (^{\circ}\text{C}) + 273.15 \\ &= 327 + 273.15 \\ &\approx 600 \end{aligned}$$

Therefore, the melting point of lead is about 600 K.