

## Exercise 1.34

(a) The temperature on a warm summer day is 87 °F. What is the temperature in °C? (b) Many scientific data are reported at 25 °C. What is this temperature in kelvins and in degrees Fahrenheit? (c) Suppose that a recipe calls for an oven temperature of 400 °F. Convert this temperature to degrees Celsius and to kelvins. (d) Liquid nitrogen boils at 77 K. Convert this temperature to degrees Fahrenheit and to degrees Celsius.

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### Solution

#### Part (a)

Use the formula to convert from Fahrenheit to Celsius temperature scales.

$$\begin{aligned}\text{°C} &= \frac{5}{9}(\text{°F} - 32) \\ &= \frac{5}{9}(87 - 32) \\ &\approx 31^\circ\end{aligned}$$

87 °F is about 31 °C.

#### Part (b)

Use the formula to convert from Celsius to Fahrenheit temperature scales.

$$\begin{aligned}\text{°F} &= \frac{9}{5}(\text{°C}) + 32 \\ &= \frac{9}{5}(25) + 32 \\ &= 77^\circ\end{aligned}$$

25 °C is 77 °F. Use the formula to convert from Celsius to Kelvin temperature scales.

$$\begin{aligned}\text{K} &= \text{°C} + 273.15 \\ &= 25 + 273.15 \\ &\approx 298\end{aligned}$$

25 °C is about 298 K.

**Part (c)**

Use the formula to convert from Fahrenheit to Celsius temperature scales.

$$\begin{aligned}\text{°C} &= \frac{5}{9}(\text{°F} - 32) \\ &= \frac{5}{9}(400 - 32) \\ &\approx 204^\circ\end{aligned}$$

400 °F is about 204 °C. Use the formula to convert from Celsius to Kelvin temperature scales.

$$\begin{aligned}\text{K} &= \text{°C} + 273.15 && (1) \\ &= \frac{5}{9}(400 - 32) + 273.15 \\ &\approx 478\end{aligned}$$

400 °F is about 478 K.

**Part (d)**

Solve equation (1) for °C.

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

77 K is about -196 °C. Use the formula to convert from Celsius to Fahrenheit temperature scales.

$$\begin{aligned}\text{°F} &= \frac{9}{5}(\text{°C}) + 32 \\ &= \frac{9}{5}(-196^\circ) + 32 \\ &\approx -321^\circ\end{aligned}$$

77 K is about -321 °F.