

Exercise 1.41

Use of the British thermal unit (Btu) is common in some types of engineering work. A Btu is the amount of heat required to raise the temperature of 1 lb of water by 1 °F. Calculate the number of joules in a Btu.

Solution

A calorie is the amount of heat required to raise the temperature of 1 gram of water by 1 °C. Also, note that there are 1.8 degrees Fahrenheit for every degree Celsius.

$$\frac{4.184 \text{ J}}{1 \text{ cal}} \times \frac{1 \text{ cal}}{1 \text{ g} \cdot ^\circ\text{C}} \times \frac{453.59 \text{ g}}{1 \text{ lb}} \times \frac{1 \text{ }^\circ\text{C}}{\frac{9}{5} \text{ }^\circ\text{F}} \times \frac{1 \text{ lb} \cdot ^\circ\text{F}}{1 \text{ Btu}} \approx 1054 \frac{\text{J}}{\text{Btu}}$$