1) Dermatologists often remove small precancerous skin lesions by freezing them quickly with liquid nitrogen, which has a temperature of 77K. What is this temperature on the a) Celsius and b) Fahrenheit scales?

2) A simple pendulum consists of a ball connected to one end of a thin brass wire (The coefficient of linear expansion for brass is \( \alpha = 19 \times 10^{-6} \, ^\circ C^{-1} \).) The period of the pendulum in 2.0000 s. The temperature rises by 140\(^\circ\)C, and the length of the wire increases. Determine the period of the heated pendulum.

3) When you drink cold water, your body must expend metabolic energy in order to maintain normal body temperature (37\(^\circ\)C) by warming the water in your stomach. Could drinking ice water substitute for exercise as a way to burn calories? Suppose you expend 430 kcal during a brisk hour-long walk. How many liters of ice water (0\(^\circ\)C) would you have to drink in order to use up 430 kcal of metabolic energy? For comparison, the stomach can hold about 1 liter.

4) Suppose that the 20 gallon steel gas tank in your car is completely filled when the temperature is 17\(^\circ\)C. How many gallons will spill out when the temperature rises to 35\(^\circ\)C? (The coefficient of volume expansion for steel is \( \beta = 36 \times 10^{-6} \, ^\circ C^{-1} \) and the coefficient of volume expansion for gasoline is \( \beta = 950 \times 10^{-6} \, ^\circ C^{-1} \).)

\[
\begin{align*}
1) \quad &^\circ C = k \times 273 = 77 - 273 = [-196 \, ^\circ C] \\
&^\circ F = \frac{9}{5} \times (-196) + 32 = -221 \, ^\circ F
\end{align*}
\]

\[
2) \quad l_0 = \frac{9T^2}{4\pi^2} = \frac{(9.8) \pi^2}{4 \pi^2} = 0.9929 m
\]

\[
\Delta l = \alpha l_0 \Delta T \\
= (19 \times 10^{-6}) (0.9929) (140) = 0.0026 m
\]

\[
l = 0.9929 m + 0.0026 m = 0.9955 m
\]

\[
T = 2\pi \sqrt{\frac{l}{g}} = 2\pi \left( \frac{0.9955}{7.8} \right)^{1/2} = 2.0026 s
\]
\[ 8) \quad \Delta V = V_0 \delta \Delta T \]

\[
\Delta V_s = (20 \text{ gal}) (3.6 \times 10^{-6}) (18) \\
= 0.0130 \text{ gal/} \\
\]

\[
\Delta V_{\text{gar}} = (20 \text{ gal/}) (950 \times 10^{-6} \text{ C}^{-1}) (18 \text{ C}) \\
= 0.342 \text{ gal/} \\
\]

\[
\text{Gas spill/dl} = 0.342 \text{ gal/} - 0.013 \text{ gal/} \\
\]

\[
= [0.329 \text{ gal/}] \\
\]