14.59. **Model:** Assume a small angle oscillation of the pendulum so that it has simple harmonic motion.
Solve: **(a)** At the equator, the period of the pendulum is

$$T_{\text{equator}} = 2\pi\sqrt{\frac{1.000\ \text{m}}{9.78\ \text{m/s}^2}} = 2.009\ \text{s}$$

The time for 100 oscillations is 200.9 s.
(b) At the north pole, the period is

$$T_{\text{pole}} = 2\pi\sqrt{\frac{1.000\ \text{m}}{9.83\ \text{m/s}^2}} = 2.004\ \text{s}$$

The time for 100 oscillations is 200.4 s.
(c) The difference between the two answers is 0.5 s, and this difference is quite measurable with a hand-operated stopwatch.
(d) The period on the top of the mountain is 2.010 s. The acceleration due to gravity can be calculated by rearranging the formula for the period:

$$g_{\text{mountain}} = L\left(\frac{2\pi}{T_{\text{mountain}}}\right)^2 = (1.000\ \text{m})\left(\frac{2\pi}{2.010\ \text{s}}\right)^2 = 9.77\ \text{m/s}^2$$

Assess: This last result is reasonable because g decreases with altitude.