Chapter 15 Problem 62

What rate will a pendulum clock run on the moon?

$g_{moon} = 1.63\ m/s^2$ $T_{earth} = 1\ hour$

$g_{earth} = 9.80\ m/s^2$

Find the time in hours for the moon clock to measure 1 hour.

Assume a simple pendulum

$$T = \frac{2\pi}{\omega} \quad + \quad \omega = \sqrt{\frac{g}{\ell}} \rightarrow T = 2\pi\sqrt{\frac{\ell}{g}}$$

$$T_{moon} = 2\pi\sqrt{\frac{\ell}{g_{moon}}}$$

$$T_{earth} = 2\pi\sqrt{\frac{\ell}{g_{earth}}}$$

$$\frac{T_{moon}}{T_{earth}} = \frac{2\pi\sqrt{\frac{\ell}{g_{moon}}}}{2\pi\sqrt{\frac{\ell}{g_{earth}}}} = \sqrt{\frac{\ell}{g_{moon}}}\cdot\sqrt{\frac{g_{earth}}{\ell}} = \sqrt{\frac{g_{earth}}{g_{moon}}}$$

Then for the same clock, to get the same oscillations to measure one hour on earth will have slower oscillations such that the time to go through the same motion with be

$$T_{moon} = T_{earth}\sqrt{\frac{g_{earth}}{g_{moon}}} = (1.00\,hr)\sqrt{\frac{9.80\,m/s^2}{1.63\,m/s^2}}$$

$\boxed{T_{moon} = 2.45\,hr}$

2.45 hr will pass before the hand on the clock will record 1 hr.