

Vibrations and Waves

Problem B**SIMPLE HARMONIC MOTION OF A SIMPLE PENDULUM
PROBLEM**

A simple pendulum with a length of 1.00 m would have a period of 13.3 s on Saturn's icy moon, Dione. Find the acceleration of gravity on Dione.

SOLUTION

Given: $L = 1.00 \text{ m}$ $T = 13.3 \text{ s}$

Unknown: $a_g = ?$

Choose the equation(s) or situation: Use the equation for the period of a simple pendulum and rearrange it to solve for g .

$$T = 2\pi \sqrt{\frac{L}{a_g}}$$

$$T^2 = \frac{4\pi^2 L}{a_g}$$

$$a_g = \frac{4\pi^2 L}{T^2} = \frac{4\pi^2 (1.00 \text{ m})}{(13.3 \text{ s})^2} = \boxed{0.223 \text{ m/s}^2}$$

ADDITIONAL PRACTICE

1. A simple pendulum with a length of $3.0 \times 10^{-1} \text{ m}$ would have a period of 1.16 s on Venus. Calculate the acceleration of gravity on Venus.
2. On Mars, a simple pendulum with a length of 65.0 cm would have a period of 2.62 s. Calculate the acceleration of gravity on Mars.
3. On Mercury, a simple pendulum with a length of 1.14 m would have a period of 3.55 s. What is the acceleration of gravity on Mercury?
4. A simple pendulum with a length of 50.0 cm would have a period of 2.99 s on Pluto. Calculate the acceleration of gravity on Pluto.
5. Find the length of a pendulum that oscillates with a frequency of 1.0 Hz.
6. Find the length of a pendulum that oscillates with a frequency of 0.50 Hz.
7. Find the length of a pendulum that oscillates with a frequency of 2.5 Hz.
8. Calculate the period and frequency of a 6.200 m long pendulum in Oslo, Norway, where $a_g = 9.819 \text{ m/s}^2$.
9. Calculate the period and frequency of a 2.500 m long pendulum in Quito, Ecuador, where $a_g = 9.780 \text{ m/s}^2$.
10. Calculate the period and frequency of a 3.120 m long pendulum in Cairo, Egypt, where $a_g = 9.793 \text{ m/s}^2$.