Name: KEY

Date:

Section C D F

The Masters School
Mr. Alex Rawson
Physics

Harmonic Motion 2

Pendulum Oscillations

1. Find the period and frequency of a 9.8 m long pendulum. (2 pts)

$T = 2\pi\sqrt{\frac{L}{g}}$ $\quad f = \frac{1}{T}$

$T = 2\pi\sqrt{\frac{9.8}{9.81}}$ $\quad f = \frac{1}{6.28}$

$T = 6.28\ s$ $\quad f = .159\ Hz$

2. A visitor to a lighthouse wishes to determine the height of the tower. The visitor ties a spool of thread to a small rock to make a simple pendulum, and then hangs the pendulum down a spiral staircase in the center of the tower. The period of oscillation is 9.49 s. What is the height of the tower? (2 pts)

isolate L

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

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

$\left(\frac{T}{2\pi}\right)^2 = \frac{L}{g}$

$g\left(\frac{T}{2\pi}\right)^2 = L$

$L = 9.81\left(\frac{9.49}{2\pi}\right)^2$

$L = 22.38\ m$

3. A 3 m long pendulum on the moon takes 8.511 seconds to complete 1 pendulum. What is the value of gravity on the moon? (2 pts)

isolate g

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

$\left(\frac{T}{2\pi}\right)^2 = \frac{L}{g}$

$g\left(\frac{T}{2\pi}\right)^2 = L$

$g = \frac{L}{\left(\frac{T}{2\pi}\right)^2}$

$g_{Moon} = \frac{3}{\left(\frac{8.511}{2\pi}\right)^2}$

$g_{Moon} = 1.635\ m/s^2$

Spring-Mass Oscillations

4. A spring with a spring constant of 1.8×10^2 N/m is attached to a 1.5 kg mass and then set in motion. (2 pts)

   a. What is the period of the mass-spring system?

$T = 2\pi\sqrt{\frac{m}{k}}$

$T = 2\pi\sqrt{\frac{1.5}{180}}$

$T = .57$ s

   b. What is the frequency of the vibration?

$f = \frac{1}{T} = \frac{1}{.57} = 1.74$ Hz

5. Two teenagers take a big F-350 truck joyriding around an off-road race course, with a combined weight of 2450 kg. A jump in the course sends the truck jumping and upon landing the shocks in the car oscillate for 1.1 seconds. Find the spring constant of the shocks in the truck. (2 pts)

$m = 2450$

$T = 1.1$ seconds

$T = 2\pi\sqrt{\frac{m}{k}}$

$\left(\frac{T}{2\pi}\right)^2 = \frac{m}{k}$

$k\left(\frac{T}{2\pi}\right)^2 = m$

$k = \frac{m}{\left(\frac{T}{2\pi}\right)^2}$

$k = \frac{2450}{\left(\frac{1.1}{2\pi}\right)^2}$

$k = 8.00 \times 10^4$ N/m

Assuming 4 shocks (there are actually 7, thanks Courtney + Julia)

$\frac{k}{4} = 2.00 \times 10^4$ N/m