Physics 2305 3 April, 2000
Quiz 12—Form A

1. Which of the following must produce simple harmonic motion?

A) a force proportional to x^{-2}
B) a force proportional to $-x$
C) a first-order differential equation in x
D) any differential equation in x

2. Mars has a mass of 6.4×10^{23} kg and a radius of 3397 km. What is the gravitational acceleration at its surface?

A) 3.7 m/s^2 C) 9.8 m/s^2
B) 5.5 m/s^2 D) 15 m/s^2

Useful equations and constants:

$F = G\, m_1 m_2 / r^2$ $F = ma$
$\omega = 2\,\pi\, f = 2\,\pi\, /\, T$
$T = 2\pi\, (m/k)^{1/2}$ $T = 2\pi\, (l/g)^{1/2}$
$T = 2\pi\, (I/mgh)^{1/2}$ $T = 2\pi\, (I/\kappa)^{1/2}$
$g = 9.80$ m/s^2 $G = 6.67 \times 10^{-11}$ N m^2 kg^{-2}

Physics 2305 3 April, 2000
Quiz 12—Form B

1. A torsion pendulum consists of a solid disk of mass 2.0 kg and radius 10 cm. For a solid disk, $I = \frac{1}{2} m r^2$. If the pendulum oscillates with a period of 0.5 seconds, what is κ?

A) 0.8 N m/rad
B) 1.6 N m/rad
C) 3.2 N m/rad
D) 320 N m/rad

2. What are the units of the gravitational constant G?

A) kg m s^{-2}
B) m s^{-2}
C) m^2 kg^{-1} s^{-1}
D) m^3 kg^{-1} s^{-2}

Useful equations and constants:

$F = G\, m_1 m_2 / r^2$ $\quad F = ma$
$\omega = 2\pi f = 2\pi / T$
$T = 2\pi\, (m/k)^{1/2}$ $\quad T = 2\pi\, (l/g)^{1/2}$
$T = 2\pi\, (I/mgh)^{1/2}$ $\quad T = 2\pi\, (I/\kappa)^{1/2}$
$g = 9.80$ m/s^2 $\quad G = 6.67 \times 10^{-11}$ N m^2 kg^{-2}

Physics 2305 3 April, 2000
Quiz 12—Form C

1. A physical pendulum consists of a long thin rod suspended from one end ($I = (1/3)\ m\ l^2$). What is its period of oscillation on the surface of the Earth if its length is 25 cm?

A) 0.41 s
B) 0.58 s
C) 0.82 s
D) 1.00 s

2. NASA engineers are developing a soft lander of mass 440 kg for Europa (mass 4.80×10^{22} kg, radius 1.57×10^{6} m). To hover over the Europan surface, what must its maximum engine thrust be?

A) 1.30 N
B) 572 N
C) 2290 N
D) 4310 N

(Apologies to Lockheed-Martin for not using pounds!)

Useful equations and constants:

$F = G\ m_1 m_2 / r^2$ $\quad F = ma$
$\omega = 2\ \pi\ f = 2\ \pi\ /\ T$
$T = 2\pi\ (m/k)^{1/2}$ $\quad T = 2\pi\ (l/g)^{1/2}$
$T = 2\pi\ (I/mgh)^{1/2}$ $\quad T = 2\pi\ (I/\kappa)^{1/2}$
$g = 9.80$ m/s^2 $\quad G = 6.67 \times 10^{-11}$ N m^2 kg^{-2}