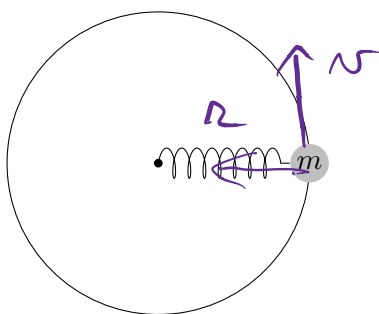


Physics 111-01: General Physics I—Mechanics and Thermodynamics
Test 2
October 25, 2017

Name: _____

All problems *must* begin with either a fundamental principle or with an equation from the equation sheet. If any question is unclear, please ask immediately. Be sure to show your work **clearly**. Partial credit may be given for work *if* it can be understood.

Problem 1: (20 pts.) A 0.0800 kg mass is attached to a spring with a spring constant of 5.00 N/m and a relaxed length of 0 m. The mass is on a horizontal frictionless table and is rotating around in a circle of radius 0.250 m.



$$k = 5.00 \text{ N/m}$$

$$r = 0.250 \text{ m}$$

$$m = 0.0800 \text{ kg}$$

$$F_s = -kx$$

a. (15 pts.) What is the velocity of the ball? $\sum F = ma$

$$-kr = m\left(-\frac{v^2}{r}\right)$$

$$v = \sqrt{\frac{kr^2}{m}}$$

$$v = \sqrt{\frac{(5.00 \text{ N/m})(0.250 \text{ m})^2}{0.0800 \text{ kg}}} = 1.98 \text{ m/s}$$

$$\sqrt{\frac{(\text{N/m}) \text{ m}^2}{\text{kg}}} = \sqrt{\frac{(\text{kg m/s}^2) \frac{1}{\text{m}} \cdot \text{m}^2}{\text{kg}}} = \text{m/s} \checkmark$$

b. (5 pts.) What is the period of the ball's motion?

$$T = \frac{2\pi r}{v} = \underline{0.795 \text{ s}}$$

(Note: Don't use $GMT^2 = 4\pi^2 r^3$!
 Irrelevant!)

Spring

x_R

Horizontal

$F_s = 0$ Relaxed

Horizontal \rightarrow

x

x_R

$F_s > 0$

Horizontal \leftarrow

x_R

$F_s < 0$

Hooke's Law: $F_s = -k(x - x_R)$

If $x_R = 0$,

$F_s = -kx$

Physics 111-01: General Physics I—Mechanics and Thermodynamics

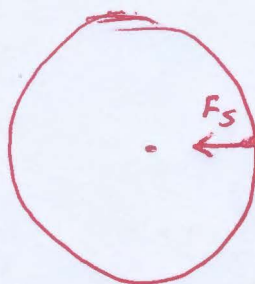
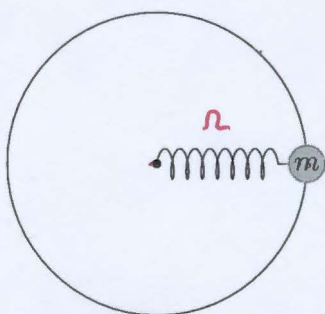
Test 2

October 25, 2017

Name: SOLUTIONS

All problems *must* begin with either a fundamental principle or with an equation from the equation sheet. If any question is unclear, please ask immediately. Be sure to show your work **clearly**. Partial credit may be given for work *if* it can be understood.

Problem 1: (20 pts.) A 0.0800 kg mass is attached to a spring with a spring constant of 5.00 N/m and a relaxed length of 0 m. The mass is on a horizontal frictionless table and is rotating around in a circle of radius 0.250 m.



a. (15 pts.) What is the velocity of the ball?

$$\begin{aligned} \Sigma F &= ma \\ -kr &= -m v^2 / r \\ v^2 &= \frac{kr^2}{m} \\ v &= \sqrt{\frac{k}{m}} r = \sqrt{\frac{5.00 \text{ N/m}}{0.080 \text{ kg}}} \cdot (0.25 \text{ m}) \\ v &= 1.98 \text{ m/s} \end{aligned}$$

b. (5 pts.) What is the period of the ball's motion?

$$T = \frac{2\pi r}{v} = \frac{2\pi (0.250 \text{ m})}{1.98 \text{ m/s}} = 0.795 \text{ s}$$