

MIDTERM EXAM-3

PHYS 201 (Spring 2014), 03/31/14

Name:

Lab-Sect. no.:

Signature:

In taking this exam you confirm to adhere to the Aggie Honor Code:
"An Aggie does not lie, cheat, steal or tolerate those who do."

Duration: 50 minutes

Show all your work for full/partial credit!

Include the correct units in your final answers for full credit!

Unless otherwise stated, quote your results in SI units!

1.) *Multiple Choice*

(18 pts.)

For each statement below, circle the correct answer (TRUE or FALSE, no reasoning required).

- (a) If a solid disk is rotating at constant angular velocity, different points on the disk generally have different tangential speeds.
TRUE FALSE
- (b) If a solid cylinder is rolling without slipping at constant speed, its rotational kinetic energy is larger than its translational kinetic energy.
TRUE FALSE
- (c) When a solid cylinder and a hoop roll down the same hill, both starting from rest, the cylinder will reach the bottom first.
TRUE FALSE
- (d) The moment of inertia of a rigid object depends on the axis about which the object is rotating.
TRUE FALSE
- (e) Torque is a scalar quantity.
TRUE FALSE
- (f) In simple harmonic motion, the total mechanical energy [$E = 0.5(kx^2 + mv^2)$] is conserved even though x and v vary with time.
TRUE FALSE

No.	Points
1	
2	
3	
4	
5	
Sum	

2.) *Rotational Energy and Dynamics*

(10+8+5 pts.)

A massless string is wrapped around the outer rim of a solid disk (mass 70 kg , radius 30 cm) which is fixed in place but is free to rotate about its center, see sketch below. A package of mass 25 kg is attached to the end of the string and released from rest, 4.5 m above the ground.

- (a) What is the speed of the package just before it hits the ground?
- (b) What is the acceleration of the package and the angular acceleration of the disk?
- (c) What is the net torque on the disk?

3.) *Angular Momentum*

(12+3 pts.)

A small wooden turntable (mass 3 g) is rotating in the horizontal plane about its center at 2 revolutions per second. A big bumble bee (mass 0.8 g) lands vertically on the edge of the turntable (assume the bee's velocity just prior to landing to be zero).

- (a) Calculate the angular speed of turntable plus bee after landing.
- (b) Do you expect energy to be dissipated in the process? (no calculation required)
- yes no

4.) *Equilibrium*

(8+16 pts.)

A scales (a uniform bar of length 60 cm and mass $M=0.5\text{ kg}$) is loaded with a mass $m_1=2\text{ kg}$ at 20 cm to the left of the pivot point, and an unkown mass m_2 at 35 cm to the right of the pivot point (see sketch below). The bar is in equilibrium.

- (a) Draw the free body diagram of the bar.
- (b) Find the the unkown mass.

5.) *Simple Harmonic Motion*

(20 pts.)

On a frictionless horizontal surface, a block (mass 2.5 kg) is attached to an ideal spring and performs simple harmonic motion with a frequency of 0.8 Hz .

- (a) Find the spring constant.
- (b) If the amplitude of the motion is 15 cm , what is the maximal speed reached by the block?