

EXAM-2 – v1

PHYS 201 (Spring 2005), 03/22/05

Name:

Lab-Sect. no.:

Signature:

*Duration: 75 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!*

No.	Points
1	
2	
3	
4	
5	
6	
Sum	

1.) *Multiple Choice*

(18 pts.)

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

- (a) Work is a vector quantity.  
TRUE                      FALSE
  
- (b) For conservative forces it is possible to define a corresponding potential energy.  
TRUE                      FALSE
  
- (c) The tangential speed of an extended object, which is rotating at constant angular speed, stays constant with increasing distance from the axis of rotation.  
TRUE                      FALSE
  
- (d) A net work done on an object results in a change of speed of that object.  
TRUE                      FALSE
  
- (e) The restoring force of an ideal spring is a nonconservative force.  
TRUE                      FALSE
  
- (f) In no external forces are acting on a 2-body system, the total momentum of the system is conserved.  
TRUE                      FALSE

2.) *Angular Kinematics*

(15 pts.)

A centrifuge is rotating about its center at an initial angular velocity of  $480\text{rad/s}$ . It then undergoes a constant deceleration of  $3\text{rad/s}^2$ .

- (a) What total angle (in *rad*) does the centrifuge turn through until it comes to rest?
- (b) How many total revolutions does the result in (a) correspond to?
- (c) How long does it take the centrifuge to come to rest?

3.) *Mechanical Energy*

(6+7 pts.)

A solid cylinder (radius  $0.4m$ ) is rolling from the top of a hill (height  $h_0=12m$ ) through a valley to the top of a second hill (height  $h_2=8m$ ), see figure below. The initial speed of the cylinder is  $2.4m/s$ . Neglect any friction forces.

- (a) What is the initial angular speed of the rotating cylinder?
- (b) What is the angular speed of the cylinder when it reaches the top of the second hill?

4.) *Linear Momentum*

(18 pts.)

A puck (mass  $m_1=0.4kg$ ) is sliding due east on a horizontal (frictionless) surface at a speed of  $1.8m/s$  before it collides with another puck (mass  $m_2=0.7kg$ ) which is originally at rest. After the collision, the first puck is moving with a speed of  $1.2m/s$  at an angle of  $50^\circ$  north of east.

- (a) Calculate the  $x$ - and  $y$ -component of the velocity of puck 2 after the collision.
- (b) At what angle with respect to due east does puck 2 emerge from the collision?
- (c) Is the kinetic energy conserved in the collision (calculation required)?

5.) *Simple Harmonic Motion*

(18 pts.)

A block (mass  $0.5\text{kg}$ ) is attached to a horizontal spring, on a horizontal frictionless surface. A person pulls on the block stretching the spring with a force of  $2\text{N}$  and releases it from rest, resulting in a vibration of the block with a frequency of  $0.85\text{Hz}$ .

- (a) What is the spring constant?
- (b) By how much did the person stretch the spring relative to its relaxed position?
- (c) What is the maximal speed that the block reaches during its vibration?

6.) *Torque*

(18 pts.)

Two persons push at a rotating door (total length  $L=3m$ , mass  $80kg$ ) at the same time with forces  $F_1=20N$ ,  $F_2=65N$  at distances  $x_1=1.5m$ ,  $x_2=1m$ , respectively, from the center of the door, see figure below (the rotation axis of the door goes through its center, perpendicular to the paper plane).

- (a) What is the net torque on the door?
- (b) Assuming the door to be a thin rectangular sheet, what is its moment of inertia with respect to its rotation axis?
- (c) What is the net angular acceleration of the door?