

Printed Name: _____

Section: 1 (8AM) 2 (9AM)

Problem 1	/ 25
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Total	/ 50

PHYSICS 221 EXAM 2

October 14, 2009

Do not open this booklet until instructed. The exam will end promptly at 50 minutes after the hour.

Instructions: When you are told to begin, check that this examination booklet contains all the numbered pages from 2 through 5.

Read each problem carefully so that you are certain what it is asking. Do not panic or be discouraged if you cannot do every part of every problem. If a part of a problem depends on a previous answer you have not obtained, define a symbol for it and proceed to maximize your credit. Keep moving to finish as much as you can!

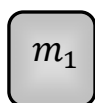
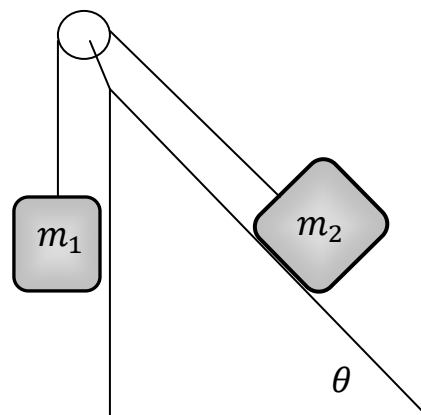
You must show your work. The purpose of this exam is to show how well you understood the material we have covered. You must include an adequate explanation, including correct equations where applicable, for full credit. Unless otherwise indicated, a number with no explanation will not get credit. **Show your answer's units**, and give an adequate number of significant digits. Completely numerical solutions showing no equations are not eligible for partial credit. Do not use scratch paper. Indicate any work on the back that you wish to be considered.

Box your answers.

This examination is administered under the Cadet Honor Code. All suspected violations must be reported appropriately. The seat next to you must be unoccupied. No talking is permitted during the examination, apart from questions to the instructor. **You may use a scientific calculator, but may not use "advanced features", including graphing, solving, or equation storage capabilities.** Any other electronic devices, including headphones, cell phones, PDAs, and MP3 players, may not be used during the exam in any way. You may use the equation sheet distributed with the exam. No other notes or textbooks may be open during the exam.

Problem 1: [25pt] Two blocks of mass $m_1 = 2.0$ kg and $m_2 = 6.0$ kg are connected by a rope of negligible mass, with m_2 sliding on a frictionless plane tilted upward at angle $\theta = 53^\circ$.

- (a) [5pt] Draw a free body diagram for each block, showing and labeling all forces acting on the block.



- (b) [5pt] Write Newton's Law for the motion of each block, relating the forces to the acceleration. You should have an equation for each block. For definiteness, take the acceleration to be positive if m_1 is accelerating upward.

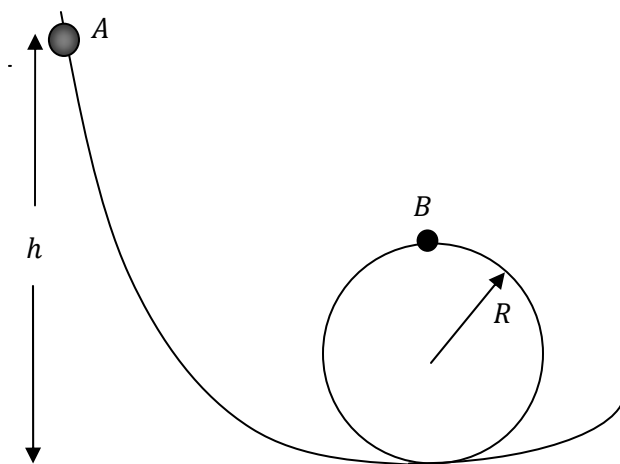
(c) [5pt] Determine the acceleration of the blocks. Clearly note whether block 1 is accelerating upward or downward.

(d) [5pt] Find the tension in the string.

(e) [5pt] Find the net power applied to mass m_1 by the forces acting on it at a time $t = 2.0$ s after the blocks are released from rest.

Problem 2: [25pt] A bead of mass m slides without friction around a wire bent into the shape shown. The bead is released from rest at point A , at a height $h = 4R$, where R is the radius of the loop.

This is a symbolic problem, and should not require the use of a calculator.



(a) [5pt] What is the bead's potential energy at each of the points A and B ? Express the results in terms of m , R and g . Assume the potential energy is zero on the dashed line at the bottom of the figure.

(b) [5pt] What is the bead's kinetic energy at point B ? Express the result in terms of m , R and g .

(c) [5pt] What is the bead's acceleration at point B ? Give the magnitude and direction. Express the result in terms of g .

(d) [5pt] What is the normal force on the bead at point B ? Is it up or down? Express the result in term of the weight mg of the bead.

(e) [5pt] Suppose there is friction in the system, so that when it is released from point A , it just makes it to point B and stops. How much work was done by friction along the wire? Express the result in terms of m , g , and R .