

PHYSICS 218 Exam 2

Fall, 2006 STEPS

*Do not fill out the information
below until instructed to do so!*

Name: _____

Signature: _____

Student ID: _____

E-mail: _____

Section Number: _____

- No calculators are allowed in the test.
- Be sure to put a box around your final answers and clearly indicate your work to your grader.
- **All work must be shown to get credit for the answer marked. If the answer marked does not obviously follow from the shown work, even if the answer is correct, you will not get credit for the answer.**
- Clearly erase any unwanted marks. No credit will be given if we can't figure out which answer you are choosing, or which answer you want us to consider.
- Partial credit can be given only if your work is clearly explained and labeled.

Put your initials here after reading the above instructions:

Mathematical expressions:

If $f(x) = kx^n$

$$\frac{df(x)}{dx} = nkx^{n-1}$$

$$\int f(x)dx = \frac{1}{n+1} kx^{n+1} + C$$

$$\int_a^b f(x)dx = \frac{1}{n+1} kb^{n+1} - \frac{1}{n+1} ka^{n+1}$$

For grader use only:

Problem 1 (30) _____

Problem 2 (40) _____

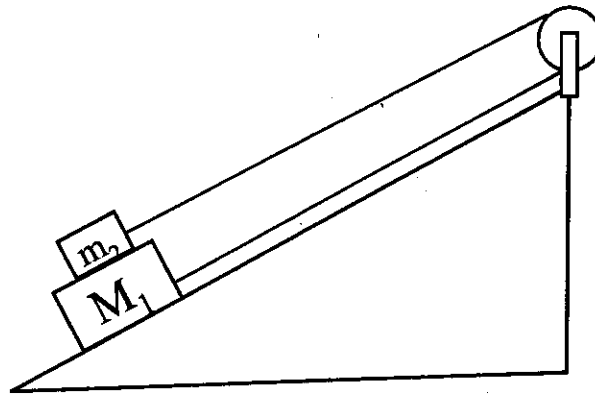
Problem 3 (30) _____

Total (100) _____

Problem 1: (30 points)

Two boxes of masses M_1 and m_2 are placed on an inclined plane of angle θ lying one on top of the other and connected by a massless unstretchable string attached through a massless frictionless pulley as shown. There is friction between the boxes with coefficient μ but not between box M_1 and the inclined plane. (M_1 is greater than m_2)

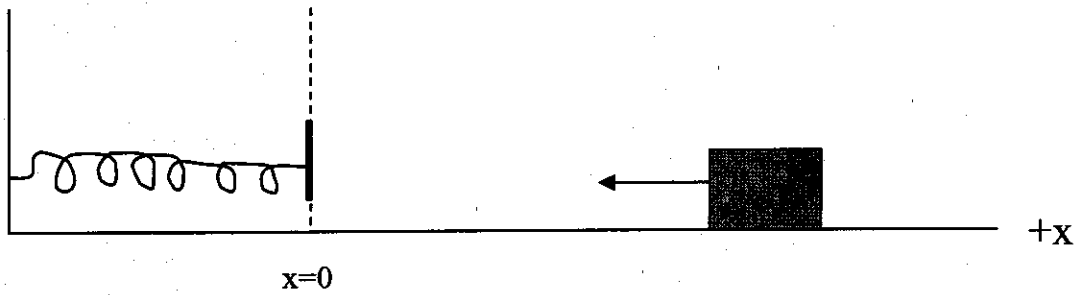
- (10) If M_1 begins to slide down, draw the free-body force diagram for each of the boxes.
- (10) If M_1 begins to slide down, what is the magnitude of its acceleration?
- (10) What is the minimum coefficient of friction needed for the boxes to remain at rest.



Problem 2: (40 points)

A block of mass m is moving at a velocity of magnitude v_0 along a frictionless horizontal surface towards a spring which exerts a force given by $\vec{F}_{spring} = (-kx - \alpha x^3)\vec{i}$. The mass of the spring is negligible.

- a) (15) Calculate the potential energy function of the force of the spring.
- b) (25) Obtain the equation to find the maximum distance the spring will be compressed. Give your answers in terms of m, v_0, k, α .



Problem 3: (30 points)

A box of mass M starts from rest and it is placed touching a spring with a constant k compressed a distance A from its initial uncompressed length. The mass is released and goes up the inclined plane at angle θ .

- a) (15) Determine the maximum height, h , it will reach if you assume no friction.
- b) (15) If instead of h it reaches a height h' , determine the coefficient of friction μ between the box and the plane.

