

Fall 2000

Physics 131: Midterm II  
Professor Frank De Lucia

3:30 Section

Name (1 pt): \_\_\_\_\_

Recitation Instructor (1 pt): \_\_\_\_\_

There are four pages to this midterm, plus an equation sheet. It is important that you write your name on each page and the name of your recitation instructor on the first page. Each name is worth one point. Be sure to include the proper units in your answers.

Section I – short problems (10 pts each)

Problem I-1: A car with a 100 hp engine ( $1 \text{ hp} = 746 \text{ W}$ ) and a mass of 1000 kg accelerates to 10 m/s. At this instant what is the acceleration of the car?

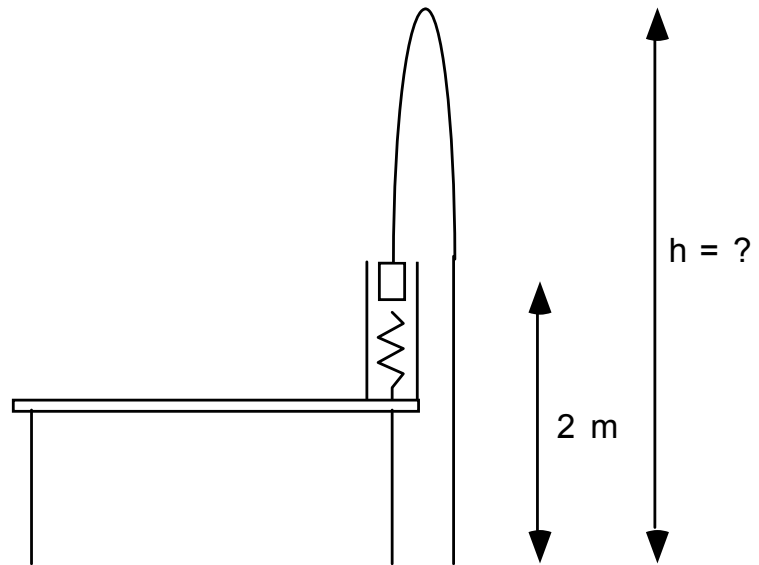
Problem I-2: A 4.0 kg mass sliding on a frictionless surface explodes into two 2.0 kg masses. After the explosion the velocities of the 2.0 kg masses are 3.0 m/s, due north, and 5.0 m/s,  $30^\circ$  north of east. In unit vector notation, what was the original velocity of the 4.0 kg mass?

Name (1pt): \_\_\_\_\_

Section II - Problems (25 points each)

Problem II-1: A frictionless spring loaded gun is positioned vertically (almost) as shown in the figure. If the force constant of the spring is  $1500 \text{ N/m}$ , the spring is compressed  $0.1 \text{ m}$ , the mass is  $0.5 \text{ kg}$ , and the mass is initially (with the spring compressed)  $2 \text{ m}$  above the floor,

(a) What is the maximum height above the floor that the mass attains?



(b) With what speed does the mass hit the floor?

Name (1 pt): \_\_\_\_\_

Problem II-2: A 10 kg mass is projected up a  $30^\circ$  incline plane with an initial velocity of 5 m/s. The coefficient of kinetic friction is 0.2.

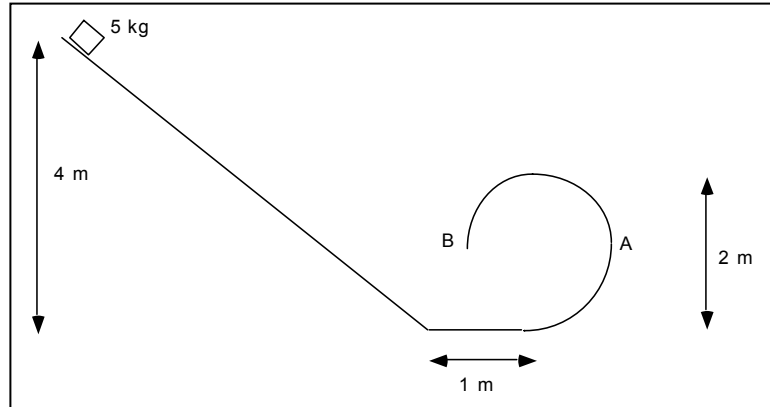
(a) As measured along the incline plane, how far does the mass travel before coming to a rest?

(b) How many Joules of heat are produced during this process?

Name (1 pt) \_\_\_\_\_

Problem II-3: A block of mass 5 kg starts at the top of an inclined track which is 4 m high and slides without friction down the incline, along a flat track one meter long where the coefficient of friction between the block and mass is 0.5, and around the inside of the frictionless 3/4 circle track shown in the figure.

- (a) With what speed does the block leave the track (point B)?



- (b) What force is exerted on the block at the right of the circle (point A) by the track?