Phy131 Fifth Homework Assignment
Due Monday February 22nd

Due to the short time between posting the solutions and the exam, **you only need to turn in 4 of the 8 problems**. I will post the solutions to all 8 before the exam.

Figures for the questions can be found the the last page of the assignment

Question 1.

A 10 Kg sled is given a kick on a frozen pond, imparting to it an initial speed $v_0 = 2$ m/s. The coefficient of kinetic friction between the sled and the ice is $\mu_k = 0.1$. Use the work-energy theorem to find the distance the sled moves before coming to rest.

Question 2

A 3 kg object starting at rest falls from a height of 10 meters to the ground. Air resistance is not negligible, and the magnitude of the work done by air friction is 20 Joules. What is the object's speed just before hitting the ground.

Question 3

A mass m is attached to a light string of length l, which is attached to a pivot point as shown on the last page. Directly below the pivot point is a block of mass $3m$, which is at reat on a frictionless surface. The mass m is released, and it swings down like a pendulum. At the bottom of its swing it collides with the block. The collision is elastic, and the mass m swings back up towards where it was. The block moves to the left with velocity v.

a) Find the velocity of the block, mass $3m$ as it slides off to the right after the collision.
b) What is the maximum height, h, that the ball swings back up to?

Express your answers in terms of g and l.

Question 4

Wolfram makes a small bomb, which has a mass of 8 kg. When the bomb explodes, it brakes up into 3 pieces: One piece, with mass 1 kg, flies directly north (along the y-axis) with a speed of 3 m/s. Another piece, with mass 2 kg, flies directly east (along the x-axis) with a speed of 2 m/s. A third piece has a mass of 5 kg as

shown in the figure on the last page.

a) What is the velocity of the third piece, 5 kg, after the collision? Be sure to give both the magnitude and direction of the 5 kg mass.
b) How much kinetic energy was released in the explosion?

Question 5

A ball of mass m is moving with a velocity of 20 m/s to the right. It collides with two identical balls that are touching each other as shown in the figure on the last page. The moving ball hits each of the other two balls at exactly the same time. The collision is elastic. What are the final velocities of each of the three balls after the collision?

Question 6

Initially a ball of mass 5 kg is moving to the right with a velocity of 20 m/s, while a ball of mass 10 kg is at rest. After the collision, the 5 kg mass has a velocity of 4 m/s at an angle 90° from its original direction. See the figure on the last page.

a) What is the volocity of the 10 kg mass after the collision?
b) How much kinetic energy is lost in the collision? Express your answer in Joules.

Question 7

Find the location of the center of mass of the table shown in the figure on the last page. Each of the legs has a length L and a mass m. The table top is a square with each side having a length L. The mass of the table top is $8m$.

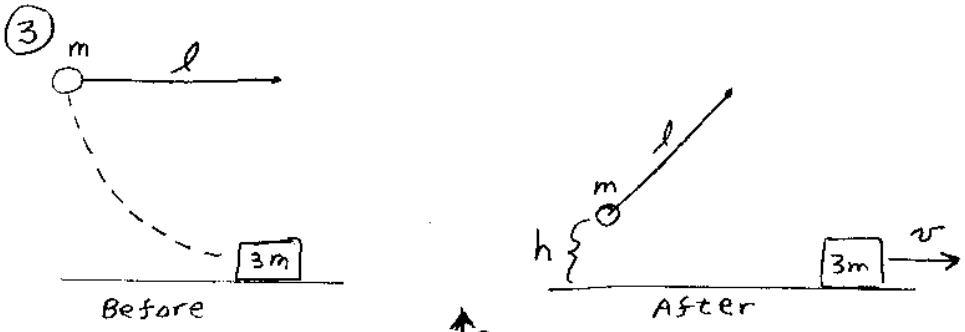
Question 8

Norberto, mass 90 kg, and Angelika are sitting in a canoe on Lake Tahoe. The canoe is not moving, and has a mass of 20 kg. They are sitting 4 meters apart. Norberto wants to find out Angelika's mass, which is less than his, so he tricks her into changing places with him. After they have changed places and are both sitting, he notices that the canoe has moved 1 meter. What is Angelika's mass? Neglect any frictional effects that the water might have on the boat.

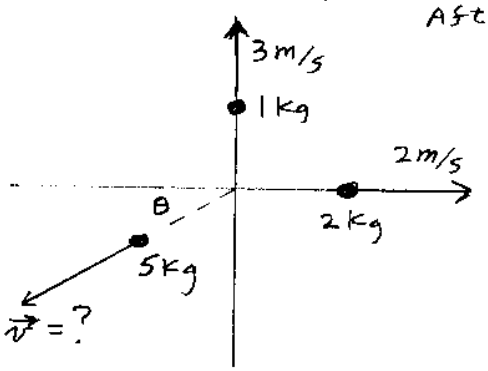
See the next page for the figures

Figures for Homework 5

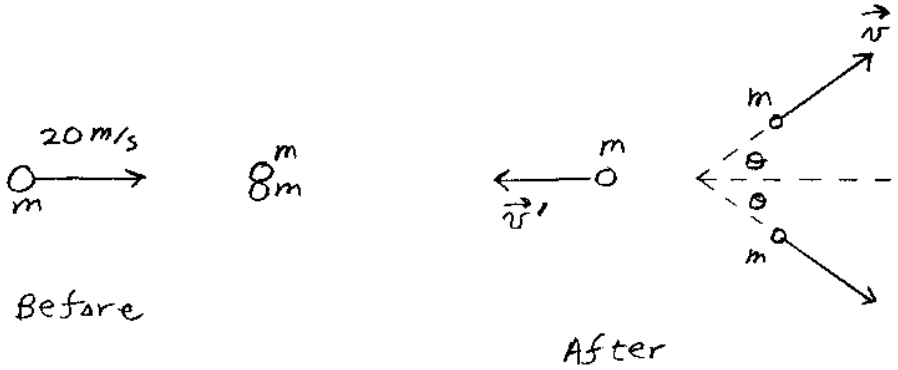
③



④



⑤



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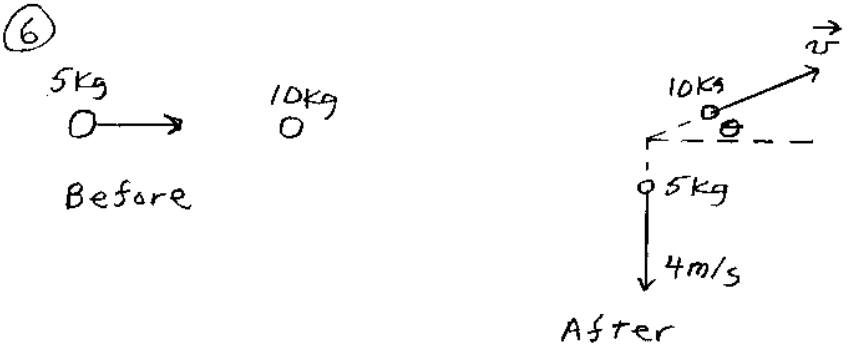
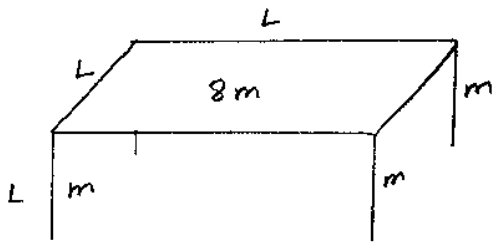
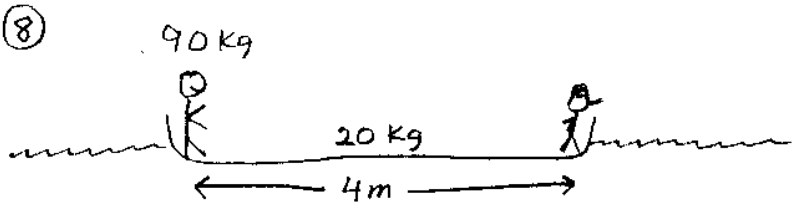

5kg
10kg
Before
10kg
$\vec{v}$
θ
5kg
4m/s
After

⑦


L
L
8m
m
L
m
m

⑧


90kg
20kg
4m