Sultan Qaboos University

Physics Department, College of Science
Physics 2107: Physics for Engineering I
Fall Semester 2006 – Final Examination

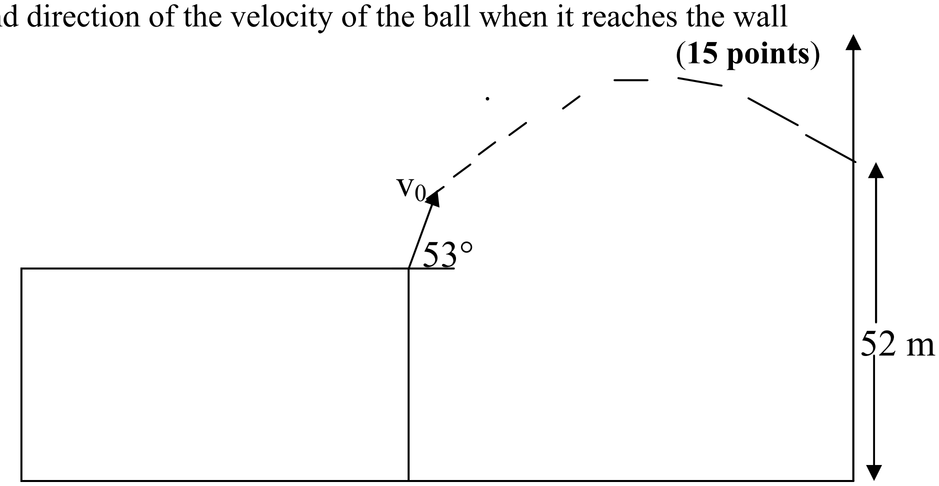
Saturday 23rd December 2006 **Time: 2:00 – 5:00 pm**

ID No.:	1	2	3	4	5	6	7	Total
Name:								

Full Mark:100 points	Please check that your examination paper has 7 **Questions** **Do not use additional papers. Do not write your section number**

1) A ball is thrown from the top of a building with a velocity of 40 m/s at an angle of 53 with the horizontal. After 2 s, it is seen to be at height of 84 m above the ground.
a) Find the height of the building
b) At which other time will the ball again be at a height of 84 m?
c) If the ball hits a wall at a height of 52 m above the ground, what is the distance of the wall from the building?
d) Find the magnitude and direction of the velocity of the ball when it reaches the wall

(15 points)



2) a) In the cross product F = 2.0VxB, take V=2.0i + 4.0j + 6.0k and F = 4.0i -20.0j + 12.0k (where î, j, k are unit vectors). What then is B in unit vector notation if Bx=By?

(6 points)

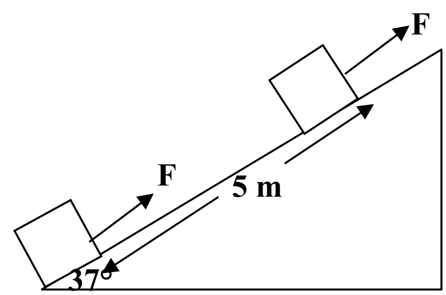
b) A force **F** = 3.0j +5.0k Newton acts at the position r=2i (where î, j, k are unit vectors) from the axis of rotation. Determine the net torque.

(6 points)

3) A box of mass 10 kg is pulled up a 37° inclined plane with an initial speed of 1.5 m/s. The pulling force F = 100N, is parallel to the inclined surface. The coefficient of kinetic friction between the box and the inclined surface is 0.40 and the box is pulled 5.0 m along the inclined plane.

a) How much work is done by the gravitational force on the box?
b) What is the increase in thermal energy of the box-inclined plane system due to friction?
c) How much work is done by the applied force?
d) What is the change in kinetic energy of the box
e) What is the speed of the box after being pulled by the distance of 5.0 m?
f) What is the acceleration of the box?

(15 points)



4) A rectangular plate lying on a surface is pivoted at point P and two forces, F_1 =20N and F_2 =10N, are acting on it as shown in figure (a):

a) Find the net torque on the plate about the pivot. In which direction will the plate rotate?

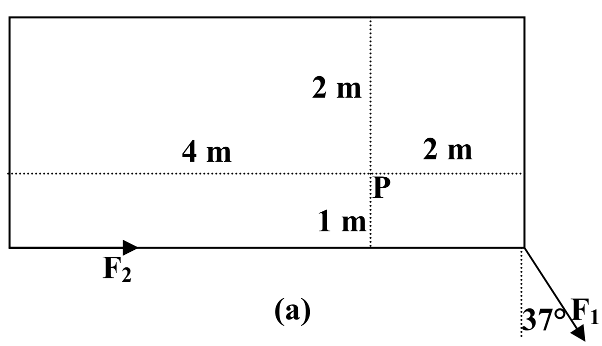
b) If the mass of the plate is 6 kg, what its moment of inertia about the pivot. (for a plate $I_{com}= M(a^2 + b^2)/12$

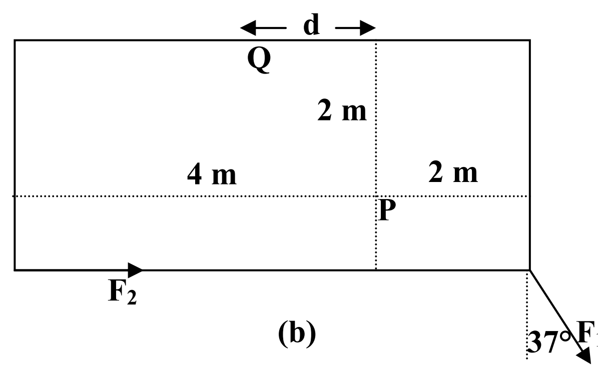
In order to keep the plate at equilibrium, a third force F_3 is applied on the plate at a point Q on its upper side as shown in Figure (b).

c) Find the x- and y- components of the necessary force F_3

d) At which horizontal distance from the pivot point should F_3 be applied?

(15 points)





5) A hockey puck B rests on a smooth ice surface and is struck by a second puck A, which was originally traveling at 40.0 m/s. Puck A is deflected by 30.0° from its original direction. Puck B acquires a velocity at an angle of 45.0° to the original direction of A. The pucks have the same mass.

a) Calculate the speed of each puck after the collision

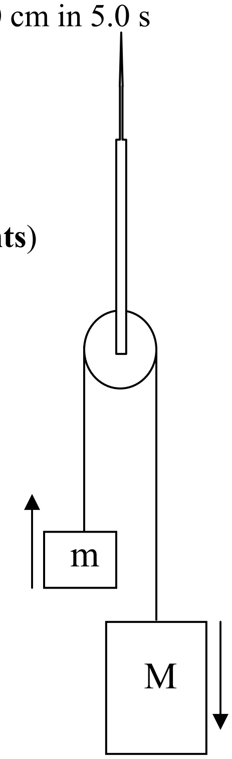
b) What fraction of the original kinetic energy of puck A dissipates during the collision?

(**13 points**)

6) In the figure one block has mass M=0.5kg, the other has mass m=0.46 kg and the pulley has a radius of 5.0 cm. When released from rest, the heavier block falls 75.0 cm in 5.0 s (without the cord slipping on the pulley).

a) What is the magnitude of the blocks acceleration?
b) What are tensions in the cord?
c) What is the magnitude of the pulley's angular acceleration?
d) What is the pulley's moment of inertia?

(15 points)



7) A block of mass 3 kg is attached to a horizontal spring with spring constant 48 N/m. The block is displaced 8 cm from its equilibrium position and then released.

a) How much time will it take for the block to move a distance of 11 cm after being released?

b) In how much time will the block complete 15 oscillations?

c) Find the velocity of the block 0.6 s after the motion starts

d) Find the kinetic energy of the block when it is 5 cm away from the equilibrium position?

e) Find the displacement at which the kinetic and potential energies are equal.

(15 points)