Honors Physics
Exam II

October 31 to November 4, 2003

Prof Alex Dzierba

a. Show all your work in the blue books available in SW135
b. Please write your solutions neatly
c. Explain all your work –please do not include false starts or crossed out work
d. Each problem is worth 20 points – there are 5 problems
e. This is an open book exam
f. You may not consult with anyone about this exam until after you turn it in at 9:05 am Tues Nov 4
g. If you have a questions please send me an e-mail

Sign and print your name here to indicate that you followed the rules and turn this sheet in with your bluebooks:

Problem 1

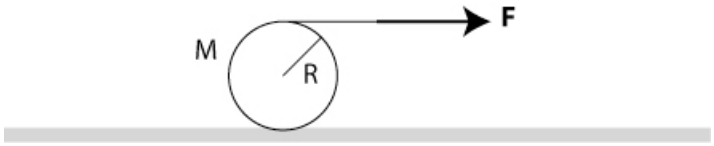
A 500 kg satellite orbits the Earth in a circular orbit whose plane contains the Earth's equatorial plane. Point P is on the surface of the Earth and on the equator and on the line connecting the satellite and the center of the Earth. The position of point P on the equator never moves with respect to the Earth.

a. How high above the Earth's surface (in km) is the satellite?
b. What is its total energy in joules?

Problem 2

A cylinder has mass *M* and radius *R* and it rests on a frictionless surface. A string is wrapped around its outside and a constant horizontal force F is applied to the string for a short time period T. *Note: don't worry about the details of the string – it is just there to provide a torque for time T*

a. After time T what is the velocity v of the center of mass of the cylinder?
b. After time T what is the angular velocity ω of the cylinder of the cylinder about its axis?
c. After tine T the kinetic energy is equally divided between translational and rotational motion. What is the moment of inertia of the cylinder? Describe the makeup of the cylinder in words .

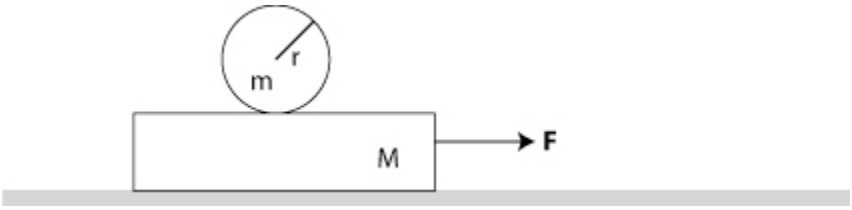


Problem 3

Three planets of equal mass m are at the vertices of an equilateral triangle the length of each side being a. A massive star of mass M is located at the center of mass of the three planets and the star is stationary. The planets move on a circle centered at the star and the distance between them does not change. What is the period of the planets moving around the star? Give your answer in terms of m, M, a and G

Problem 4

In the figure below the solid ball of mass *m* and radius *r* rests on a block of mass *M*. The block rests on a frictionless surface and the coefficient of friction between the ball and block is μ. A horizontal force **F** is applied to the block. We do not want the ball to slide on the block. What is the maximum value of **F** that satisfies this condition?



Problem 5

The stick (mass *M* and length *L*) shown below is held such that it makes angle θ with respect to the floor. The contact between the end of the stick and the floor is frictionless. The stick is released and it falls to the floor.

a. What horizontal distance (if any) does the left end of the stick travel during its fall?
b. With what speed does the right end hit the floor?