PHYSICS 215

Test #2

4 November 1999

Student's name_____ S.N._____

A. Multiple choice; choose the best of the list of answers given. (20 points total)

1. A car, with mass 1000 kg moving originally with a speed of 20 m/s collides with a tree and stops in 1 ms. What average force is exerted by the tree on the car?

   a) □ .50 N.
   b) □ 20 N.
   c) □ 500,000 N.
   d) □ 20,000,000 N.
   e) □ none of these.

2. A ball explodes at rest into two equal mass pieces. If one piece lands 2.0 m due east of the original spot, where will the second piece land?

   a) □ 2.0 m due east.
   b) □ 2.0 m due west.
   c) □ 1.4 m, 45° south of east.
   d) □ straight up, then straight back down.
   e) □ it won't move at all.

3. A car, driving in a circle at constant speed has

   a) □ both centripetal and tangential acceleration.
   b) □ only centripetal acceleration.
   c) □ only tangential acceleration.
   d) □ neither centripetal nor tangential acceleration.
   e) □ not enough information is given.

4. A ball is swung on a string 1 meter long, at $\omega = 1.0 rev/s$. While the ball is still rotating, the string is drawn in until it is only 0.50 meter long. What is the new angular velocity?

   a) □ 2.0 rev/s
   b) □ 0.50 rev/s
   c) □ 4.0 rev/s
   d) □ 0.25 rev/s
   e) □ unchanged, 1.0 rev/s

B. Solve 4 of the 6 problems given below. (20 points each)

1. Two identical cars, with a mass of 1000 kg each, collide at an intersection. The collision is perfectly inelastic. One car was moving 20 m/s before the collision.
   a) Find the final **velocity** of the two cars, if the second car was initially stationary.
   a) If the final velocity of the two cars is 20 m/s at 30° North of East, find the initial **velocity** of the second car.

2. In a ballistic pendulum experiment, a 57 g ball is shot into a 208 g pendulum. If the average increase in height of the (pendulum + ball) is 11.0 cm, find:
   a) the initial speed of the (pendulum + ball), V.
   b) the initial speed of the ball before collision, v.

3. A merry-go-round starts from rest, and accelerates with a uniform angular acceleration, α. After 60 s, a horse 6 m from the is moving 3 m/s. At this point in time, what is

   a) the angular speed of the merry-go-round, ω, in rad/s?

   b) the angular acceleration, α, in rad/s^2?

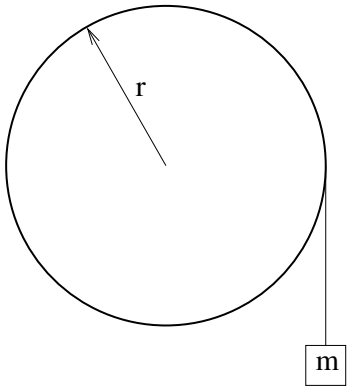
   c) the centripetal acceleration of the horse, a_c, in m/s^2.

4. Given the radius of the moon's orbit $= 3.840 \times 10^8 m$, the mass of the earth $= 5.975 \times 10^{24} kg$ and $G = 6.672 \times 10^{-11} Nm^2/kg^2$.
   a) What is the acceleration of gravity, due to the earth, at the moon's orbit?
   b) Given that the moon revolves around the earth is 27.4 days, what is the centripetal acceleration of the moon in orbit about the earth?

5. A cylinder of radius 24 cm is mounted on a horizontal axis coincident with its own axis. A cord is wound onto the cylinder's rim, and a 100 g mass is hung from it. After being released from rest, the mass drops 180 cm in 1.5 s. Find:

   a) the moment of inertia I.

   b) the tension in the cord T.



6. A sphere has a moment of inertia about its center of mass given by $I_s = \frac{2}{5}MR^2$. The sphere has a radius of 6.0 cm and a mass of 1.0 kg.

   a) The sphere starts from rest, and rolls without slipping down an inclined plane. What is its linear speed when it reaches a point 50 cm vertically lower than its starting point?

   b) What is the moment of inertia about an axis tangent to the sphere?