General Physics I (PHYS 2010)
Spring 2014
Prof Richard Ignace

HOMEWORK #6

Notes:

- This homework is due by the beginning of class on Apr 3. It covers material from chapter 7, and sections 8.3 and 8.5 of chapter 8.
- You will need a calculator and lots of scrap paper.
- Answers are to be recorded on a scantron that you will turn in. You may keep the questions (i.e., these sheets).
- You may (should) use your book. You may even work with other students. However, you should not copy the answers of other students. The homeworks are exam prep, and so you need to be able to work these problems yourself. If you do not apply yourself and do your own work, you are not likely to perform well on the exams.

1. A spool of thread has an average diameter of 1.8 cm. If the spool contains 39.2 m of thread, how many turns of thread are on the spool?

   a. 693
   b. 71
   c. 7
   d. 2,200

2. A Ferris wheel starts at rest and builds up to a final angular speed of 0.90 rad/s while rotating through an angular displacement of 8.6 rad. What is its average angular acceleration?

   a. 3.4 rad/s^2
   b. 0.84 rad/s^2
   c. 0.047 rad/s^2
   d. 9.6 rad/s^2

3. A 0.40-kg mass, attached to the end of a 0.75-m string, is whirled around in a circular horizontal path. If the maximum tension that the string can withstand is 650 N, then what maximum *angular* speed can the mass have if the string is not to break?

   a. 25 rad/s
   b. 47 rad/s
   c. 91 rad/s
   d. 135 rad/s

4. At what angle (relative to the horizontal) should a curve 188 m in radius be banked if no friction is required to prevent a car from slipping when traveling at 31 m/s? (g = 9.8 m/s^2)

   a. 58°
   b. 32°
   c. 28°
   d. 12°

5. An object of mass 2.0 kg is transported to the surface of Planet X where the object's weight is measured to be 30 N. The radius of the planet is 5.8×10^6 m. What is the mass of Planet X? (where $G = 6.67 \times\ 10^{-11}$ N m^2/kg^2)

   a. 1.3×10^{16} kg
   b. 3.8×10^{18} kg
   c. 7.6×10^{24} kg
   d. 5.4×10^{26} kg

6. Consider a planet of mass M_P and radius R_P. The Earth has mass M_E and radius R_E. If the masses are the same, but the planet is 80% as large in radius (or 20% smaller), what is the acceleration due to gravity at the planet's surface?

   a. 6.3 m/s^2
   b. 7.8 m/s^2
   c. 9.2 m/s^2
   d. 15.3 m/s^2

7. Somewhere between the Earth and the Sun is a point where the gravitational attraction of the Earth is canceled by the gravitational pull of the Sun. The mass of the Sun is 300,000 times greater than that of the Earth. How far from the center of the Earth is this point?

   a. 549/550 of the way to the Sun
   b. 1/550 of the way to the Sun
   c. 1/2 of the way to the Sun
   d. none of the above

8. For any object orbiting the Sun, Keplers Law may be written $T^2 = kr^3$. If T is measured in years and r in units of the Earths distance from the Sun, then k = 1. What, therefore, is the time (in years) for a comet to orbit the Sun if its mean radius from the Sun is 10^4 times the Earths distance from the Sun?

   a. 10^4 years
   b. 10^6 years
   c. 10^8 years
   d. 10^{10} years

9. Masses are distributed in the x,y-plane as follows: 6.0 kg at (0.0 m, 0.0 m), 4.0 kg at (2.0 m, -4.0 m), and 5.0 kg at (2.0 m, 3.0 m). What is the y-coordinate of the center of gravity of this system of masses?

   a. +0.8 m
   b. +1.1 m
   c. –0.20 m
   d. –0.07 m

10. Consider a rod of length L. Imagine rotating the rod about an axis that is perpendicular to its length (draw a picture). Consider the coordinate x as being the location of the axis from one end of the rod, so x ranges from 0 to L. Which of the curves in the accompanying graph best represents the moment of inertia for the rod rotated about an axis that is located at position x along its length. (This is a qualitative question.)

    a. the line marked (a)
    b. the line marked (b)
    c. the curve marked (c)
    d. cannot be determined