Final Exam (2021 Fall)

PHYS 203A-002: College Physics

Date: 2021 Dec 9

(Name) (Signature)

Instructions

1. Seating direction: Please be seated on seats with seat numbers divisible by 4.
2. Total time = 120 minutes.
3. There are 9 questions in this exam.
4. Equation sheet is provided separately.
5. To be considered for partial credit you need to show your work in detail and organize it clearly.
6. A simple calculator (with trigonometric functions) is allowed.
7. Use of mobile phones is strictly prohibited. It should stay out of reach during the exam.

1. (**5 points.**) Express $9.8\,\mathrm{m/s^2}$ in units of meter/hour^2.

2. (**5 points.**) An airplane flying horizontally at a uniform speed of $50.0\,\mathrm{m/s}$ over level ground releases a bundle of food supplies. Ignore the effect of air on the bundle. What is the horizontal component of the velocity of the bundle right before it lands?

3. (**5 points.**) Is it possible to go around a circle with uniform speed without accelerating?

4. (**5 points.**) Which of the two objects is easier to rotate about it's symmetry axis under the action of a torque: A solid cylinder of mass M and radius R about it's symmetry axis ($I = MR^2/2$,) versus a ring of mass M and radius R about it's symmetry axis ($I = MR^2$.)

5. (**10 points.**) A ball is thrown vertically upwards. How long does it take to reach the highest point of 15 m?

6. (**10 points.**) A 5.0 kg mass is hanging by a string from the ceiling of an elevator. Determine the force of tension exerted by the string on the mass when the elevator is speeding up at $2.0\,\mathrm{m/s^2}$ while moving upward.

7. (**10 points.**) A solid sphere, (with $I = \frac{2}{5}MR^2$ when the axis of rotation passes through the center of the sphere,) rolls perfectly (without sliding or slipping) on an inclined plane. If the sphere started from rest at the top, vertical height of 1.20 m, what is the velocity of the sphere when it reaches the bottom of the incline?

8. (**10 points.**) Planets E and J are hypothetical planets. The distance between planet E and planet J is 6×10^{11} m. Mass of planet E is 6×10^{24} kg, and mass of planet J is 8×10^{27} kg. How much energy is needed to move planet E to infinity, keeping J fixed?

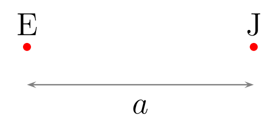

Figure 1: Problem 8

9. (**10 points.**) Three identical masses, each of mass M, are positioned at the corners of an equilateral triangle of side length L. Determine the total gravitational potential energy of this configuration of three masses.