Midterm Exam 02 (2016 Spring)

PHYS 203A: College Physics

Date: 2016 Mar 23

(Name) (Signature)

Instructions

1. Seating direction: Please be seated on odd-numbered seats.
2. Total time = 50 minutes.
3. There are 8 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. (**10 points.**) Your mass is 95 kg. How much will you weigh on a bathroom scale (designed to measure the Normal force) inside an elevator that is slowing down at $1.0\,\mathrm{m/s^2}$ while moving upward?

2. (**10 points.**) A block is projected up a frictionless inclined plane with initial speed $v_0 = 3.5$ m/s. The angle of incline is $\theta = 20.0°$. How much time does it take for the block to return back to the bottom?

3. (**10 points.**) Three boxes with masses $m_1 = 1.50\,\text{kg}$, $m_2 = 4.50\,\text{kg}$, and $m_3 = 7.50\,\text{kg}$ are placed on a frictionless surface as shown in the diagram below. If you push on box m_1 with a force of $8.25\,\text{N}$, find the magnitude of the contact force between boxes 1 and 2.

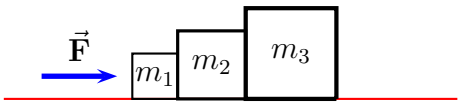

Figure 1: Problem 3

4. (**10 points.**) A 12.0 kg traffic light is suspended from two cables as described in Figure 2. Let $\theta_1 = 20.0°$, and $\theta_2 = 50.0°$. Find the tension in each cable.

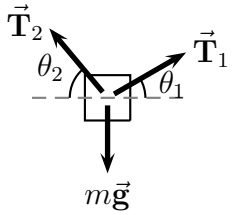

Figure 2: Problem 4

5. (**10 points.**) A block of mass $m_1 = 45.0\,\text{kg}$ on a horizontal surface is connected to a mass $m_2 = 15.0\,\text{kg}$ that hangs vertically as shown in the figure below. The two blocks are connected by a string of negligible mass passing over a frictionless pulley. Assume that the horizontal surface is smooth. Determine the magnitude of the tension in the cord.

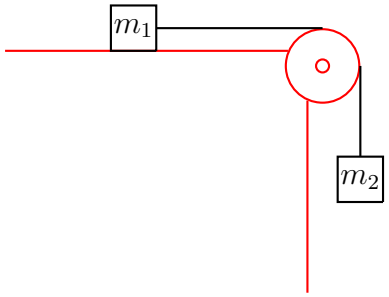

Figure 3: Problem 5

6. (**10 points.**) What is the stopping distance of a car that is traveling at 35.0 m/s on a horizontal highway? Let the coefficient of kinetic friction between road and tires be 0.60 and the coefficient of static friction between road and tires be 0.95.

7. (**10 points.**) A typical ramp in a cloverleaf interchange design on the interstate has a radius of 150 m. What is the centripetal acceleration of a car exiting an interstate at a speed of 30.0 m/s.

8. (**10 points.**) A stuntman drives a car over the top of a hill, the cross section of which can be approximated by a circle of radius $R = 150\,\text{m}$. What is the greatest speed at which he can drive without the car leaving the road at the top of the hill?

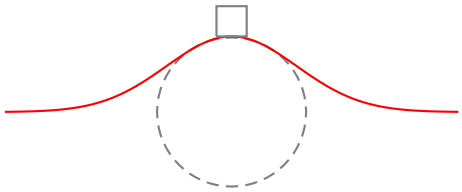

Figure 4: Problem 8