Midterm Exam No. 02 (2017 Fall)

PHYS 205A-001: University Physics

Date: 2017 Oct 13

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(Name)   (Signature)

Instructions

1. Seating direction: Please be seated on seats with seat-numbers divisible by 4.

2. Total time = 50 minutes.

3. There are 7 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.**) A placekicker must kick a football from a point 36.0 m (about 40 yards) from the goal. Half the crowd hopes the ball will clear the crossbar, which is 3.05 m high. When kicked, the ball leaves the ground with a speed of 21.0 m/s at an angle of 48.0° to the horizontal. By how much does the ball clear or fall short of clearing the crossbar?

2. (**10 points.**) A boat is able to move through still water at $20\,\text{m/s}$. It makes a round trip to a town $3.0\,\text{km}$ downstream. Assume all motion to be along a straight line. That is, the boat first travels in the direction of river and while returning travels against the direction of river. If the river flows at $5\,\text{m/s}$, determine the time required for this round trip.

3. (**10 points.**) A block slides down a frictionless plane having an inclination of $20.0°$. The block starts from rest at the top, and the length of the incline is $3.00\,\mathrm{m}$.

   (a) Find the acceleration of the block.

   (b) Find the time taken by the block to reach the bottom of the incline.

4. (**10 points.**) Two objects (32.0 kg and 28.0 kg) are connected by a massless string that passes over a massless, frictionless pulley. The pulley hangs from the ceiling.

(a) Find the acceleration of the objects.

(b) If the 32.0 kg mass is initially at rest at a height of 3.0 m from ground, how long does it take for it to reach the ground.

5. (**10 points.**) A 25.0-kg block is initially at rest on a horizontal surface. A horizontal force of 75.0 N is required to set the block in motion, after which a horizontal force of 60.0 N is required to keep the block moving with constant speed. Find the coefficient of static friction between the block and the surface.

6. (**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 $R = 250\,\mathrm{m}$. What is the greatest speed at which he can drive without the car leaving the road at the top of the hill?

7. (**10 points.**) A block slides with constant velocity down an inclined plane that has a slope angle θ. The block is then projected up the same plane with an initial speed v_0. Determine the acceleration of the block while it is moving upward on the incline. Express your answer in terms of g, θ, and v_0.