Midterm Exam No. 01 (2023 Fall)

PHYS 205A-002: UNIVERSITY PHYSICS

Department of Physics, Southern Illinois University–Carbondale
Date: 2023 Sep 18

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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 4 conceptual questions and 3 problems in this exam.

4. Equation sheet is provided separately.

5. To be considered for partial credit you need to present your work in detail and organize it clearly.

6. A simple calculator (with trigonometric functions) is allowed.

7. Use of smart devices, including smart watches, is strictly prohibited. They should stay out of reach during the exam.

8. Restroom breaks are allowed. Under questionable circumstances this might lead up to a Makeup Exam.

9. Academic misconduct will lead to a failing grade in the course.

1. (**5 points.**) What is the dimension of the physical quantity associated with the expression

$$\frac{at}{7v},\tag{1}$$

where t has the dimension T, v has the dimension LT^{-1}, and a has the dimension LT^{-2}.

2. (**5 points.**) A ball is dropped from rest from a height of 10.0 m above the ground. Neglect air resistance. Determine the velocity of the ball right before it reaches the ground.

3. (**5 points.**) Find the components of vector $\mathbf{A}$ whose magnitude is 10.0 m and its direction is 30.0° counterclockwise with respect to the negative x axis.

4. (**5 points.**) A projectile is launched with an initial velocity of magnitude $v_0 = 25\,\text{m/s}$ at an angle $\theta_0 = 30°$ above the horizontal. What is the magnitude and direction of the velocity of the projectile when it is at the highest point B in Figure 1? Neglect air resistance.
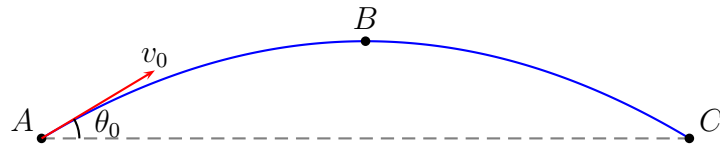

Figure 1: Problem 4.

5. (**10 points.**) While standing on the edge of a 50.0 m tall building you throw a stone straight upwards at a speed of 19.6 m/s. How long does the stone take to reach the highest point in the trajectory? Neglect air resistance.

6. (**10 points.**) A golfer takes two strokes to putt a golf ball into a hole. On the first stroke, the ball moves 5.0 m at an angle 60.° East of South. On the second, it moves 5.0 m at an angle 30.° South of West. If the golfer had instead hit the ball directly into the hole on the first stroke, what would have been the magnitude and direction of the displacement of the ball?

7. (**10 points.**) A package is dropped from an aeroplane while it is moving horizontally with a speed of $45 \, \text{m/s}$ at a height of $300. \, \text{m}$ from the ground. What is the speed of the package right before it hits the ground? Neglect air resistance.