

X1.5

205

PHYS-205 (5) (Kaldon-19298)

Name _____

WMU - Spring 2000

Exam 1 - 100,000 points + 20,000 ☆ points Book Title _____

5/10/2000•Rev.2a-9/23/2002r

State Any Assumptions You Need To Make – Show All Work – Circle Any Final Answers

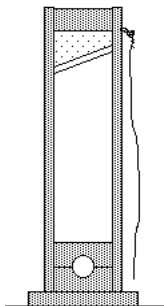
Use Your Time Wisely – Work on What You Can – Be Sure to Write Down Equations

Feel Free to Ask Any Questions

☆2a ☆2b ☆2c ☆2e

“Viva La Revolution!” (25,000 points)

1.) The metric system and the guillotine both came out of the French Revolution, but the guillotine came first.¹ Consider the test of a metric guillotine, where the blade starts at rest and free falls a distance d . If the final speed of the blade, just before it is brought to a stop, is 8.28 m/s, then find (a) the distance d that the blade traveled and (b) the time t that the blade fell. *You can find the answer to (b) without the answer to (a).*



(c) What is the *average speed* of the blade as it falls?

(d) During the test, the blade chops a cabbage in half and is brought to a stop in 4.00 cm. What is the acceleration, a , of the blade as it is stopped?

¹ The guillotine proposed to the National Assembly in 1789 by Paris physician Joseph Ignace Guillotin, 51, is a beheading machine originally called a *louisette* after Dr. Antoine Louis (who did not invent it any more than did Guillotin). A deputy of the Estates-General who was the first to demand a doubling of third-estate representatives, Guillotin says, “My victim will feel nothing but a slight sense of refreshing coolness on the neck. We cannot make too much haste, gentlemen, to allow the nation to enjoy this advantage.” Only 10 percent of guillotine victims will be of the nobility, most of the 400,000 people put to death in the revolution will be shot, burned, or drowned, and the guillotine will often require several chops to do its job. After Guillotin’s death in 1814, his children tried unsuccessfully to get the device’s name changed. When their efforts failed, they were allowed to change their name instead. *Microsoft Bookshelf ’95.*

A Star Problem is Born (25,000 points)

2.) An object begins its motion with x -components of: $x_0 = 9.00 \text{ m}$ and $v_x(t) = 9.00 \text{ m/s} + (9.00 \text{ m/s}^2)t$.

☆(a) Find the equation for the second derivative of x with respect to time of this object.

☆(b) Find the equation for the first derivative of x with respect to time of this object.

☆(c) Find the equation for the position, x , of this object.

(d) A second object can be described by the following equation. Find v_x of the second object at the time $t = 5.00 \text{ sec}$.

$$\vec{v}(t) = (5.00 \text{ m/s} + 5.00 \text{ m/s}^2 t) \hat{i} + (5.00 \text{ m/s}^3 t^2 + 5.00 \text{ m/s}^4 t^3 + 5.00 \text{ m/s}^5 t^4) \hat{j}$$

☆(e) Find a_y of this second object, at the time $t = 5.00 \text{ sec}$.

The Great Equalizer A TERM USED BY DR. PHIL'S DADDY (25,000 points)

3.) Two cars are sitting at a red traffic light – Car A is a 1984 Yugo and Car B is a 1984 Lamborghini Contach². When the light turns green, both drivers floor it, and accelerate to the legal posted speed limit of 60.0 mph (26.8 m/s). The “gerbil powered rubber bands” of the Yugo wheeze for 22.4 seconds to get it up to speed. The 550 horsepower turbocharged V-12 Italian sports car accelerates at a very impressive 6.38 m/s². (a) How far does the Yugo travel as it goes from *zero to sixty*?

(b) How much time does it take for the Lamborghini to go from *zero to sixty*?

(c) When the Yugo (finally) reaches 60.0 mph (26.8 m/s), it is exactly one mile (1609 m) to the next traffic light. Find how long (time) it takes the Yugo to drive this mile.

(d) The Lamborghini, also cruising at 60.0 mph (26.8 m/s), got to the next traffic light first (like *duh!*). Unfortunately, the lights are not timed for sports cars, so it has to stop for the red light. The brakes on the Lamborghini are *really* good – providing an acceleration of -1.10 *gee*'s. What is its stopping distance from *sixty to zero*?

(e) When the Yugo gets to the next traffic light, the light *just* has changed to green, so the Yugo passes the stopped Lamborghini. What was the *average speed* of the Lamborghini from green light to green light?

² Contach is pronounced COON-tahsh, which translates from the Italian roughly as “Wow, that’s really fast!”

Hail To The Vectors! (25,000 points)

4.) One vector is described in *standard form* as $\vec{A} = 5.57 \text{ m @ } 212^\circ$. Another vector is described as $\vec{B} = +4.53 \text{ m } \hat{j}$. (a) Find the *x*- and *y*-components of the vector A.

Find (b) the magnitude and (c) direction in form of the standard angle, of the vector B.

(d) Find $\vec{A} + \vec{B}$ in standard form.

(e) Find $\vec{A} - \vec{B}$ in standard form.