

PHYS-113(x) (Kaldon-xxxxx)
WMU - Fall 2006
Exam 0 - 000,000 points

Name _____

Book Title _____ *This is for Topic 1, not your textbook!* _____

Section: 3a 3b 3c 3d
A to G H to M N to S T to Z Rev. 9/09/01

Sample Exam

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

"You have the right to remain silent. You have the right to an attorney." (25,000 points)

1.) In class you were shown the classic pursuit problem where a speeding car undergoing Uniform Motion passes by a stopped police car which then begins Constant Acceleration. (a) To "catch" the speeder, the cop and the speeder have to be in the same place at the same _____. (*Fill in the blanks for (a) and (b).*)

(b) One problem with this classic pursuit is that the cop ends up traveling _____ as fast as the speeder, because the cop was accelerating.

(c) Here is a different kind of pursuit problem: A crook and a cop spot each other on the street at the same time, but the cop is at $x = 0.00\text{ m}$ and the crook is at $x = 20.0\text{ m}$. At time $t = 0$, the crook starts running away from the cop at 6.55 m/s and the cop starts chasing him at 7.55 m/s . *VERY* briefly explain why it is reasonable that the cop will catch the crook in 20.0 seconds .

(d) Write an equation for x for the crook and solve it for $t = 20.0\text{ sec}$.

(e) Write an equation for x for the cop and solve it for $t = 20.0\text{ sec}$. Do you get the same x as in (d)?

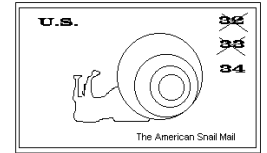
Sample Exam 1

Fall 2001

Page 2

Neither Rain Nor Sleet Nor Snow Nor Gloom of Night... (25,000 points)

2.) A letter starts on its way into the United States Postal Service by passing through a slot and falling into a mailbox, starting from rest. If the height that it fell was 0.504 meters , (a) how long (time) did the letter take to fall?



(b) How fast was the letter going just before it hit the bottom of the mailbox? *You do not need the answer to (a) to solve this.*

(c) A sorting machine needs to get the letter from *rest* to 11.0 m/s in a distance of 45.0 cm . What is the acceleration of the letter in this machine?

(d) The letter is sent on a truck for 500. miles. Which would get there faster: (I) Traveling half the distance at 55.0 mph and half the distance at 70.0 mph or (II) Traveling half the time at 55.0 mph and half the time at 70.0 mph ? *BRIEFLY explain your answer. You may not need to calculate anything to answer this.*

(e) The letter was mailed at 8:00:00 am on Tuesday and delivered at 10:00:00 am on Thursday (50.0 hours) and traveled some 518.7 miles (834.6 km). What was its average speed? *Give answer in m/s, of course.*

"He's at the 50... the 40... the 30... he... could... go... all... the... way..." (25,000 points)

3.) It's fourth down and a football player kicks a football to the other team. The football travels 45.0 meters in the horizontal and 22.2 meters at its highest point in the vertical. (a) How long (time) was the football in the air?



(b) What was the initial $v_{0,y}$ of the football right after it was kicked? *Note: this can be solved without (a).*

(c) What is v_y at the top of the arc, at $y = 22.0\text{ m}$?

(d) What is the acceleration of the ball in the x -direction, a_x ?

(e) Find the initial $v_{0,x}$ of the football right after it was kicked. *If you didn't get an answer to (a), then use $t = 5.50\text{ seconds}$.*

Soviet Space Secrets (25,000 points)

4.) (a) During a "normal" launch into space (as if *any* launch into space is "normal"!), the payload has to be accelerated from rest to an orbital speed of 7880 m/s (about 17,600 mph) in 8.00 minutes. Find the average acceleration of this launch.

(b) Find the distance that the rocket traveled, if it spent 8.00 minutes at this average acceleration. *If you did not get an answer to (a), use $a = 20.0\text{ m/s}^2$.*

(c) In 1983, the Soviet Soyuz T-10A was all set to be launched, when a fire broke out on the launch pad ten minutes before launch. An emergency escape rocket finally blasted the Soyuz and the cosmonauts on board two thousand feet into the air (610. meters) just six seconds before the main booster blew up. Ignoring air resistance and parachutes, as usual, find the time it takes to fall to the ground from rest at a height of 610. meters.

(d) At what speed would an object in free-fall from rest at 610. meters hit the ground? *This can be found even if you don't have the answer to (c).*

(e) On another mission, the booster rocket taking the Soyuz 18A capsule into space failed on the way up. Again the capsule was safely jettisoned in time, but the emergency maneuver had a peak deceleration at a brutal 20.6 gee 's. At this rate, how long (time) would it take for them to slow down from 8000 mph (3580 m/s) to where the parachutes can open at 340 mph (152 m/s)?