

Name _____ Section _____

**University of Maryland
Department of Physics**

**Physics 121
Fall 2008**

Exam 1

**Dr. E. F. Redish
10. October 2008**

Instructions:

Do not open this examination until the proctor tells you to begin.

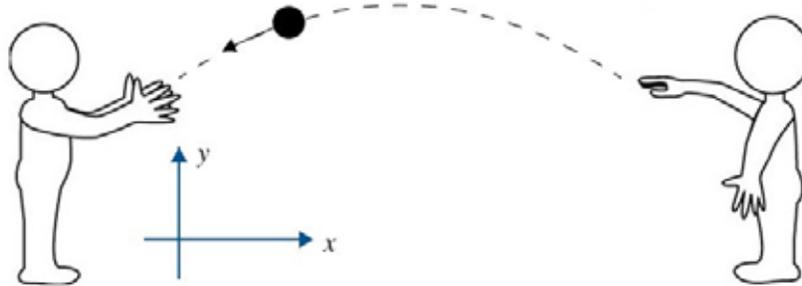
1. When the proctor tells you to begin, **write your full name at the top of every page.** This is essential since this exam booklet will be separated for grading.
2. Do your work for each problem on the page for that problem. You might find it convenient to either do your scratch work on the back of the page before starting to write out your answer or to continue your answer on the back. **If part of your answer is on the back, be sure to check the box on the bottom of the page so the grader knows to look on the back!**
3. On all the problems *except the multiple choice questions in problem 1 or where it says not to explain*, your answers will be evaluated at least in part on how you got them. If explanations are requested, more than half the credit of the problem will be given for the explanation. **YOU MAY EARN LITTLE OR NO CREDIT FOR YOUR ANSWERS IF YOU DO NOT SHOW HOW YOU GOT THEM.** Partial credit will be granted for correct steps shown, even if the final answer is wrong. Explanations don't need to be long, but they need to show what physics you are using and assumptions you make.
4. Write clearly and logically so we can understand what you are doing and can give you as much partial credit as you deserve. We cannot give credit for what you are thinking — only for what you show on your paper.
5. If you try one approach and then decide on another, cross out the one you have decided is wrong. If your paper contains both correct and incorrect approaches the grader will not choose between the two. You will not receive any credit when contradictory statements are present, even if one is correct.
6. All estimations should be done to the appropriate number of significant figures.
7. At the end of the exam, write and sign the honor pledge in the space below (“I pledge on my honor that I have not given or received any unauthorized assistance on this exam.”):

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#1:	#2:	#3:	#4:	#5:	Total
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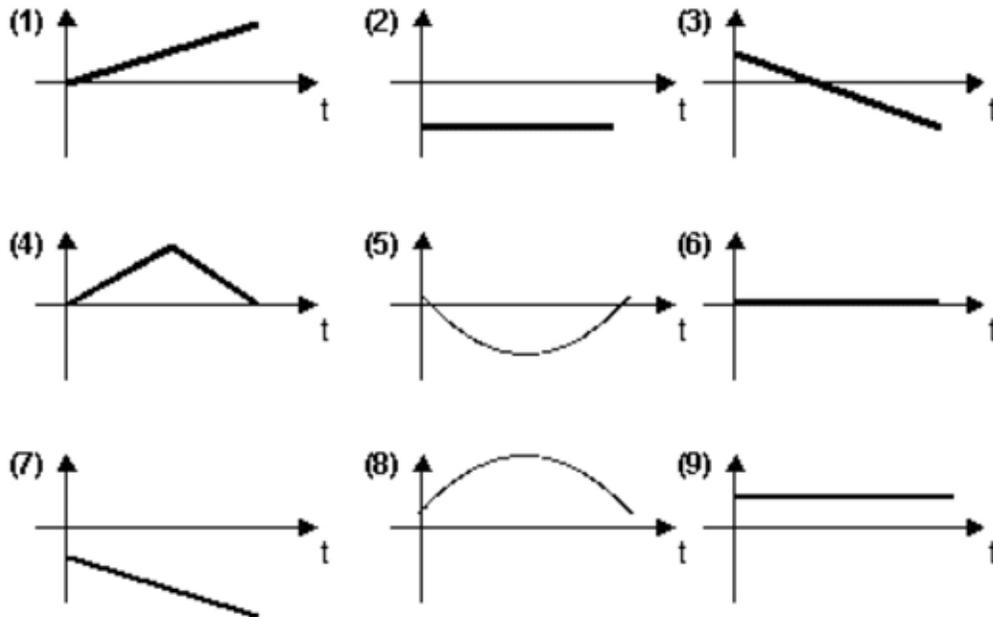
***** Good Luck *****

1. (25 points) Two space aliens are playing catch. During one exchange, the path followed by the ball is shown by the dotted line in the figure. For the graphs labeled (1)-(9), the horizontal axis represents the time. The vertical axis is unspecified. The velocity of the ball at the instant of the photo is shown by the arrow attached to the ball.



For each of the quantities a-e in the list below the graphs, select the number of the graph that could provide a correct graph of the quantity for the ball in the situation shown (if the vertical axis were assigned the proper units).

Use the x and y coordinates shown in the picture. If none of the graphs could work write N. The time graphs begin just after the alien on the right releases the ball.

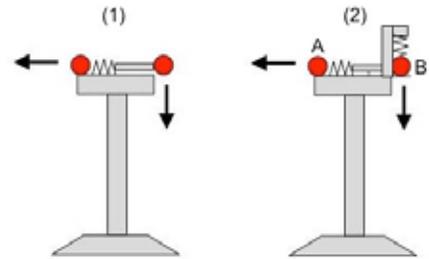


- _____ a. x-component of the ball's velocity
- _____ b. y-component of the ball's velocity
- _____ c. y-component of the net force on the ball
- _____ d. x-component of the ball's acceleration
- _____ e. x-component of the ball's position

If you need more space, continue on the back and check here.



2. (25 points) In lecture we did a demonstration with the “drop and shoot” apparatus in which one ball is dropped from rest at the same instant that another is shot out sideways. The apparatus is shown in the figure labeled (1). What happened was a surprise to some: both balls hit the ground at the same time.



In the figure labeled (2), we show another apparatus:

In this case, ball B is shot downward and the other (ball A) is shot out sideways. The springs are identical so both balls will start at the same time and with the same speed.

(a) Which of the two balls do you think will hit the ground first, A or B? Put your answer in the box at the right. Explain why you think so in the space below. (5 pts)

Both balls in figure (2) start with a speed of 2 m/s. For your calculations, take $g = 10 \text{ N/kg}$. (Suggestion: Take “down” as the positive direction. It makes the calculations easier.) Ball B has a mass of 0.1 kg and it hits the ground 0.30 s after being shot.

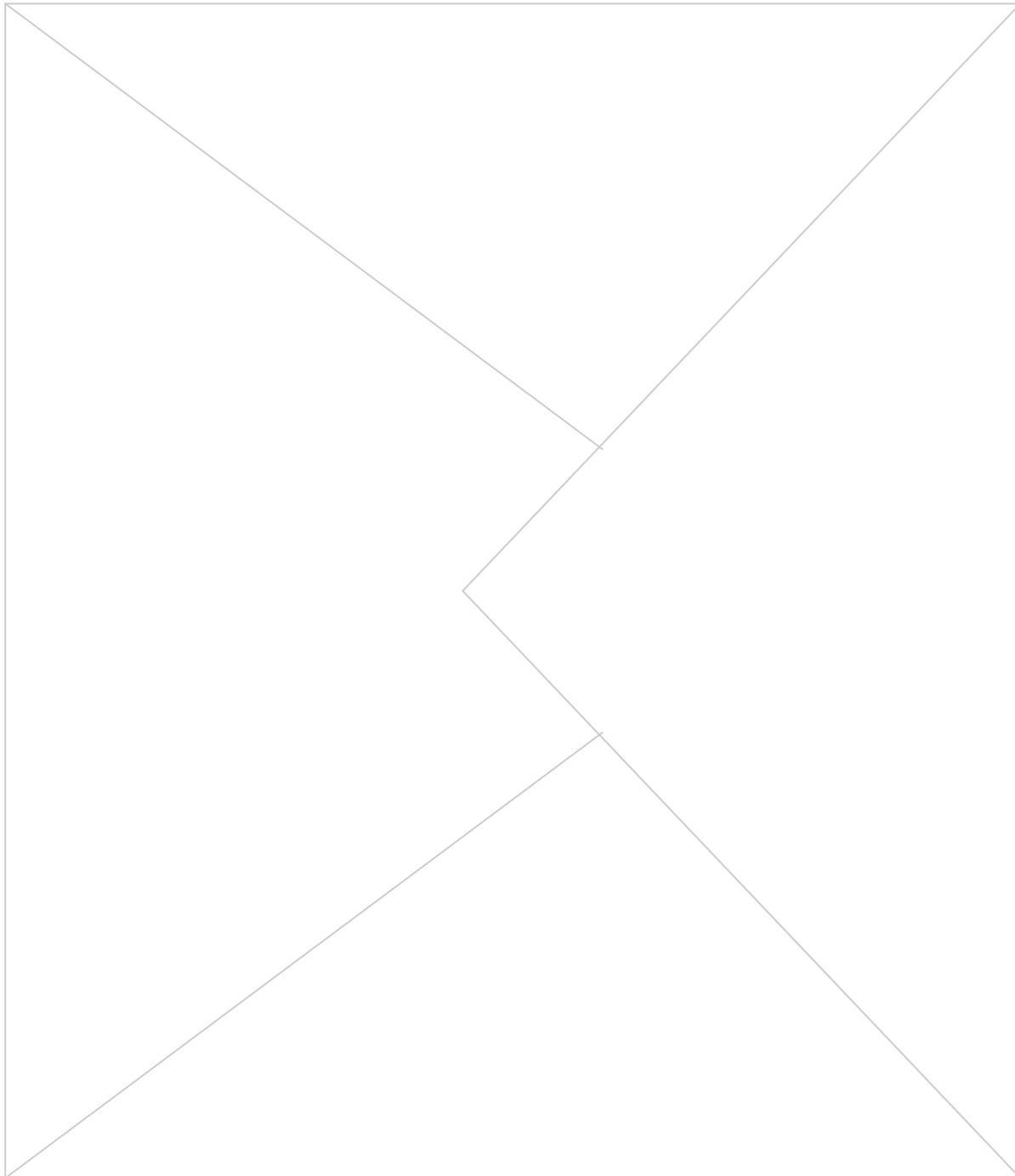
(b) With what speed will ball B hit the ground? (10 pts)

$V =$

(c) From what height was ball B shot? (10 pts)

$h =$

3. (15 points) In the current mortgage and credit crisis, the Federal Government has set aside \$700 Billion (7×10^{11} \$) to solve the problem. Assuming that these funds will be mostly used to buy up most of the “bad” mortgages (i.e., ones that the holders are having trouble paying back) and given that the average mortgage is about \$140,000, estimate the fraction of US households who might hold a “bad” mortgage. *Be sure to clearly state your assumptions and how you came to the numbers you estimated, since grading on this problem will be mostly based on your reasoning, not on your answer.*



If you need more space, continue on the back and check here.

5. (25 points) You are holding your physics book against the wall by pressing on it as shown in the figure at the right.

(a) You are pressing hard enough so that the book doesn't move. Draw a free-body diagram for the book, being sure to identify all the forces that might be acting on the book. For each force specify the kind of force, what object is causing it, and what object is feeling it. (8 pts)



(b) What relations are there among the forces in your diagram? That is, which forces or sums of forces have to be equal? How do you know? (7 pts)

(c) You start to get tired (a physics book is pretty heavy!) and the book starts to slide downward slowly. Assume the force you are exerting on the book is less than it was before. While the book is speeding up, which of the other forces that you identified in (a) have changed? What equalities that you identified in (b) are no longer true? Explain. (5 pts)

(d) Now you push a little harder and although you don't manage to keep the book from sliding, you do manage to keep the book from speeding up any more. While the book is sliding down at a constant velocity, what forces or sums of forces, if any, are now equal? Explain your reasoning. (5 pts)

If you need more space, continue on the back and check here.

