

Name \_\_\_\_\_ Section \_\_\_\_\_

**University of Maryland  
Department of Physics**

**Physics 121  
Fall 2007**

**Exam 1**

**Dr. E. F. Redish  
12. October, 2007**

**Instructions:**

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

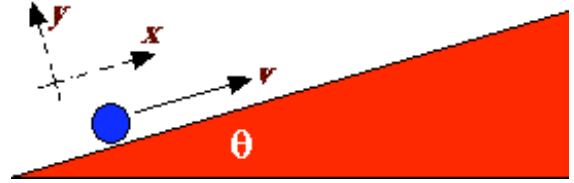
1. When the proctor tells you to begin, **write your full name and section number at the top of every page.** This is essential since this exam booklet will be separated for grading.
2. Do your work for each problem on the page for that problem. You might find it convenient to either do your scratch 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. **LITTLE OR NO CREDIT MAY BE EARNED FOR ANSWERS THAT DO NOT SHOW HOW YOU GOT THEM.** Partial credit will be granted for correct steps shown, even if the final answer is wrong.
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. All estimations should be done to the appropriate number of significant figures.
6. 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 examination.”

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

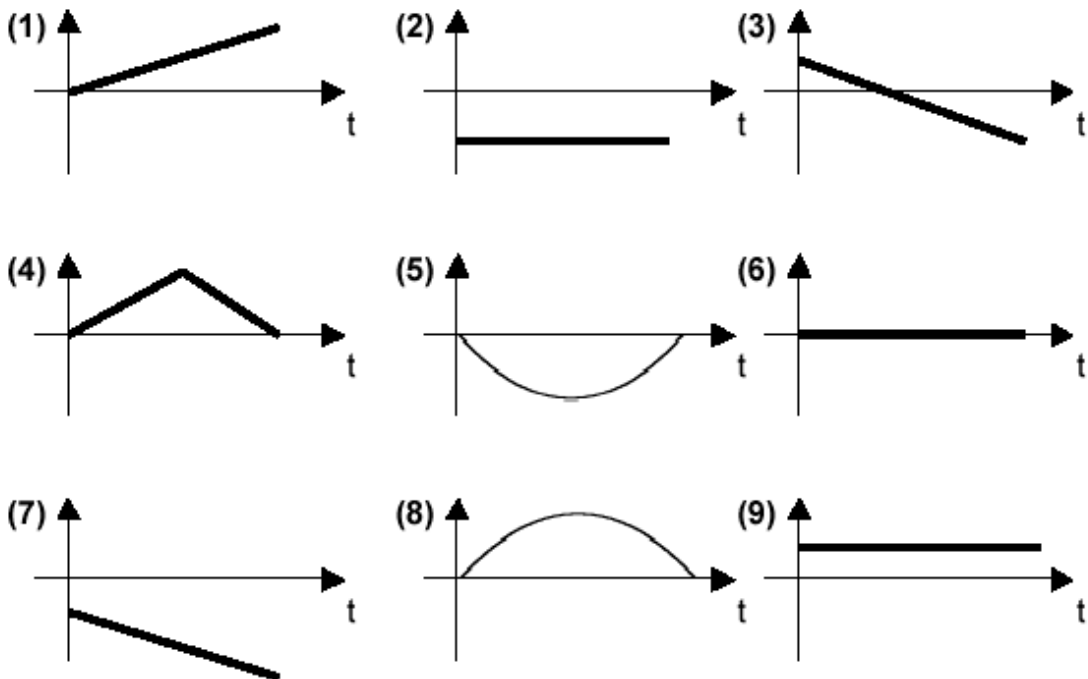
1. (30 points) A ball is launched up a ramp by a spring as shown in the figure at the right. At the time when the clock starts, the ball is near the bottom of the ramp and rolling up the ramp as shown. It goes to the top and then rolls back down.



For the graphs shown below, the horizontal axis represents the time. The vertical axis is unspecified.

For each of the following quantities, 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. (Note: “x component” of a vector means “the part of the vector in the x direction”.)

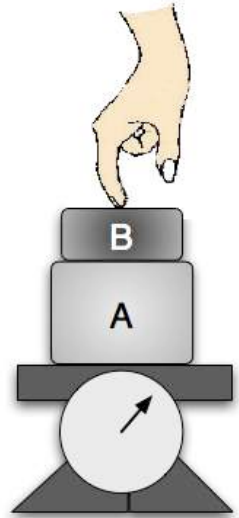
- (a) The x component of the ball’s position. \_\_\_\_\_
- (b) The y-component of the ball’s velocity \_\_\_\_\_
- (c) The x-component of the ball’s acceleration \_\_\_\_\_
- (d) The y-component of the normal force the ramp exerts on the ball \_\_\_\_\_
- (e) The x-component of the ball’s velocity \_\_\_\_\_



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



2. (20 points) Two blocks are sitting on a spring scale as shown in the figure. The reading on the spring scale is equal to the force the spring is exerting upwards. You press downward on the block labeled B with a constant force as shown in the diagram.



(a) In the boxes below, draw free body diagrams for the two blocks, labeling each force so as to identifying the character of the forces ( $N$ ,  $T$ ,  $f$ , or  $W$ ), who is causing the force, and who is feeling the force. (10 pts)

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(b) Which pairs of forces in your diagram in part (a) have magnitudes equal to each other, if any? For each pair you specify, give the reason why you think they are equal. (5 pts)

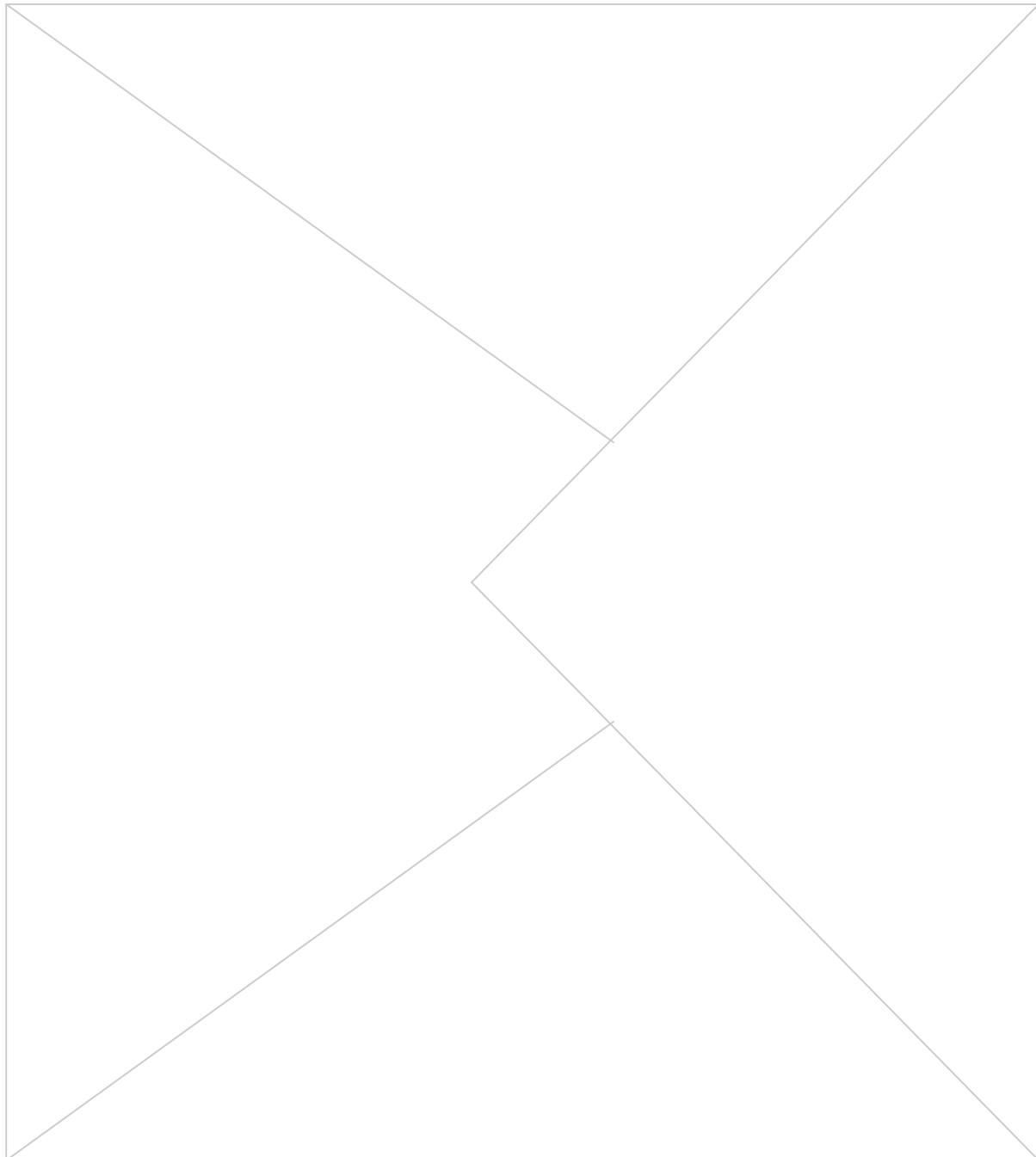
(c) Are there any equalities among combinations of forces in your diagrams in part (a) that you can identify? For each combination you specify, give the reason why you think the equality holds. (5 pts)

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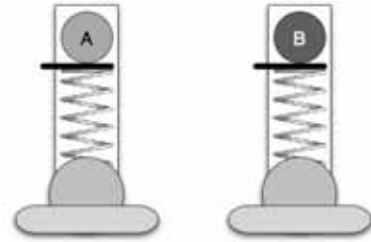
**3. (15 points)** A standard media for distributing computer information these days is a CD that can hold about 800 MegaBytes ( $8 \times 10^8$  Bytes) of data. Given that one English character (letter, number, etc.) requires 1 Byte of storage space, estimate how many novels can be stored on a single CD. *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.*



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5. (25 points) Consider two projectiles that can be shot upward by spring guns. Object A is made of solid aluminum and has a mass of 50 grams. Object B is made of cast iron and has a mass of 200 grams. For this problem, you may take the gravitational field strength to be  $g = 10 \text{ N/kg}$ . Put your answers in the boxes at the right, your reasoning in the space to the left.

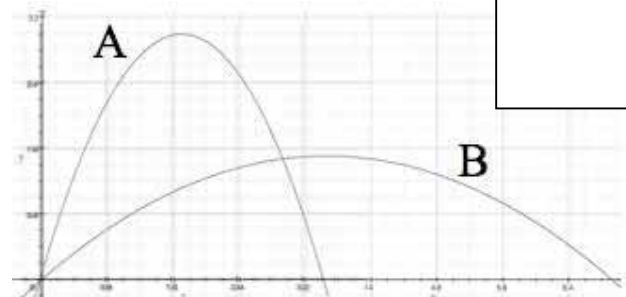


(a) Mass A is shot straight upward so that it exits the spring gun with a speed of 2.0 m/s. How high above the gun does it rise? (10 pts)

(b) Masses A and B are both shot straight upward at the same time. Mass A is shot with a speed of 2 m/s and mass B with a speed of 1 m/s. Which one hits the ground first? Explain your reasoning. (5 pts)

(c) In the situation explained in case (b), which goes higher? Explain your reasoning. (5 pts)

(d) The guns are tilted so that projectiles A and B follow the paths shown. If both are shot off at the same time, which one reaches its target first? Explain your reasoning. (5 pts)



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