Name_____

University of Maryland
Department of Physics

Physics 122 **Dr. E. F. Redish**
Spring 2009 **Exam 1 (Makeup)** **12. March. 2009**

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. More than half the credit of the problem may 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 what assumptions you are making.
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 calculations 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."):

#1:	#2:	#3:	#4:	#5:	Total

****** Good Luck ******

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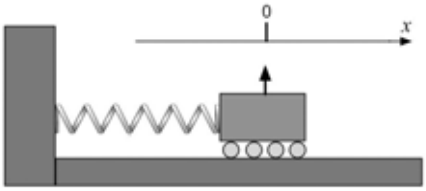
1. (25 points) A small cart with low friction wheels is attached to a sturdy wall with a high quality spring that has negligible internal damping. Use a coordinate system where the cart is at equilibrium when the cart's indicator points to 0. The cart at rest is shown in the figure at the right. The cart has a mass of 0.750 kg and the spring constant is 12 N/m.



The cart is pulled to the right by 0.1 m and released at time $t = 0$. It then oscillates back and forth. As the cart oscillates, various variables associated with the cart's motion change. For each variable, put the letter of the graph that could represent the time dependence of that variable if the vertical axis were given the right units. (Note that the time units are given and 4 s are shown.) You may use a graph more than once and if there is no graph that correctly describes the variable, put N.

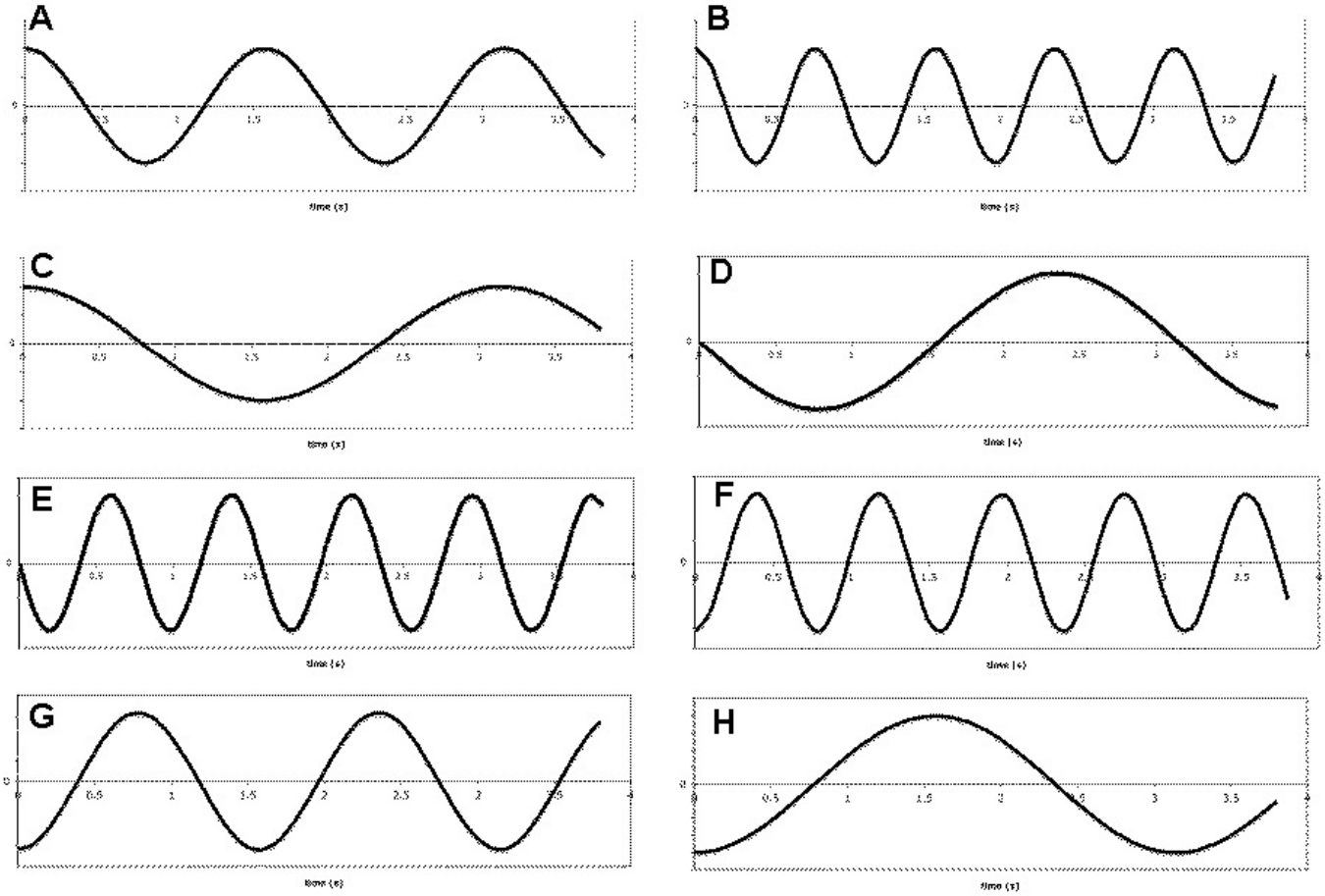
_____ 1.1. Position of the cart.

_____ 1.2. Velocity of the cart.

_____ 1.3. Acceleration of the cart.

_____ 1.4. Net force on the cart.

_____ 1.5. Force the spring exerts on the cart.



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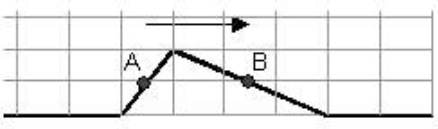
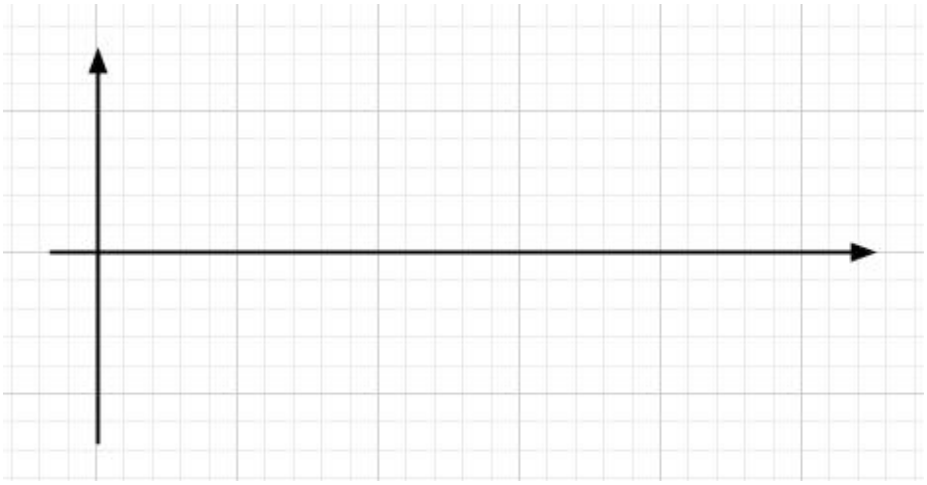
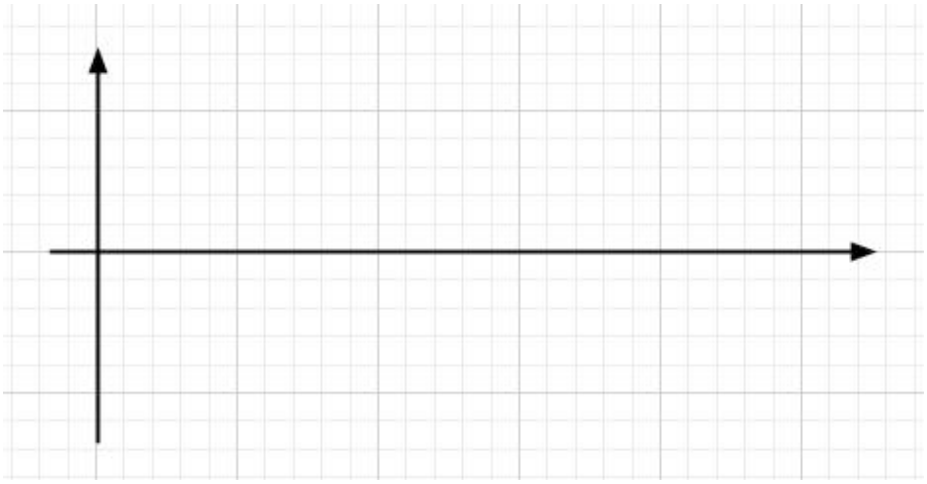
2. (25 points) A long spring is carrying a pulse that is traveling on it in the positive direction as indicated in the sketch (that idealizes a photograph) shown at the right. Each horizontal box in the grid represents 1 cm; each vertical box in the grid represents 1 mm. The speed of pulses on the spring is 240 cm/s.



A. Sketch a time graph of the <u>position</u> of the point B, starting at $t = 0$ when the pulse just reaches point B and lasting until after the pulse has passed. Label your axes and show the scales you are using. (10 pts)



B. Sketch a time graph of the <u>velocity</u> of point B starting at $t = 0$ when the pulse just reaches point B and lasting until after the pulse has passed. Label your axes and show the scales you are using. (10 pts)



C. A demonstrator made the pulse by flicking her hand. How long did it take her to generate this pulse? (5 pts)

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3. (15 points) Suppose that in January of this year, a single dangerous virus mutated so that it could both cause a fatal disease and become sufficiently virulent to spread from one person to another. If the virus spreads so as to double the number of people infected every month, how long will it be before everyone in the world is infected? *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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4. (10 points) In our discussion of mirrors, we considered two kinds of images, virtual and real. Some of the phenomena associated with these images were surprising. Describe one example of a result with images that surprised you and explain how you made sense of it. (If there were no results that surprised you, pick one that might surprise a friend and describe how you would explain it to them.) You may find it useful to include a diagram and space is left for one. *Note: This is an essay question. Your answer will be judged not solely on its correctness, but for its depth, coherence, and clarity.*

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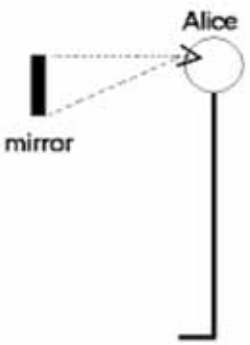
5. (25 points)

A. Alice faces a looking glass (mirror) and is standing at a level so that her eyes appear to her to be right at the top of the mirror as shown in the figure. At the position she is standing, she can just see her belt buckle at the bottom of the mirror. If she steps back far enough

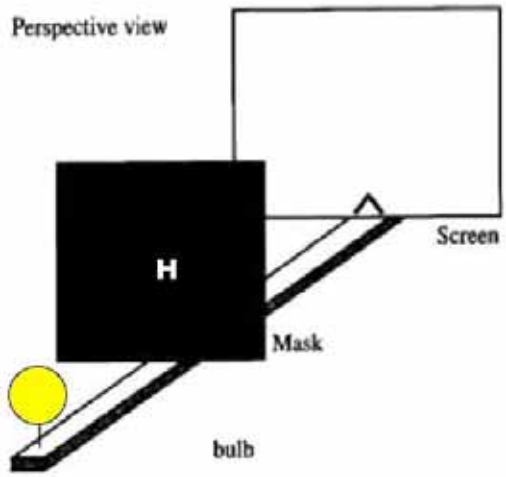
1. She will be eventually able to see all of herself in the mirror at the same time.
2. She will see no change in how much of herself she can see.
3. She will see less of herself as she steps back.
4. Some other result (explain)

Put the letter of the choice that completes the sentence correctly in the box at the left and explain why you think so with a few sentences and some rays on the diagram. (13 pts)



B. A large spherical bulb is supported in front of a black mask with a hole in it shaped like an H as shown in the figure at the right (approximately to scale). If the system is in the dark and the bulb is lit, what do you think the pattern on the screen would look like?

1. A sharp letter H.
2. A sharp circle.
3. Somewhat like an H but fuzzy or a bit distorted.
4. Somewhat like a circle but fuzzy or a bit distorted.



Put the letter of the choice that completes the sentence correctly in the box at the left and explain why you think so with a few sentences and some rays on the diagram. (12 pts)

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