Name_____

University of Maryland
Department of Physics

Physics 122 **Dr. E. F. Redish**
Spring 2009 **Exam 2 (Makeup)** **23. April. 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 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."):

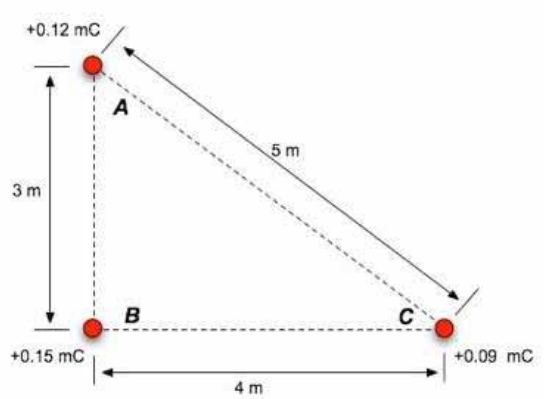
#1:	#2:	#3:	#4:	#5:	Total

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

NAME_____ **POINTS**_____

Physics 122 **Dr. E. F. Redish**
Spring 2009 **Exam 2 (M.U.)**

1. (30 points) The figure at the right shows a system of three positive point charges. A list of 5 changes to the system are indicated below and labeled 1-5. Each change is to be considered as a modification of the original situation. That is, the changes do not cumulate.



For each change, indicate how the electric force vector acting on B (F_B) and the electric field vector at the position of B ($E(r_B)$) will change by filling in the table below. (No explanations are required on this problem.) Select your answer (A-F) from the following list:

A. This will only change the direction of the vector.
B. This will only increase the magnitude of the vector.
C. This will only decrease the magnitude of the vector.
D. This will increase the magnitude of the vector and change its direction.
E. This will decrease the magnitude of the vector and change its direction.
F. This will leave the vector the same.
G. None of the above. (Explain on back.)

Change	***Effect on F_B***	***Effect on $E(r_B)$***
1. The charge on B is doubled. (6 pts)		
2. The sign of the charge on B is reversed. (6 pts)		
3. The charges on A and C are doubled. (6 pts)		
4. The charge on A is doubled. (6 pts)		
5. The charge on every particle is halved. (6 pts)		

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

NAME_____ **POINTS**_____

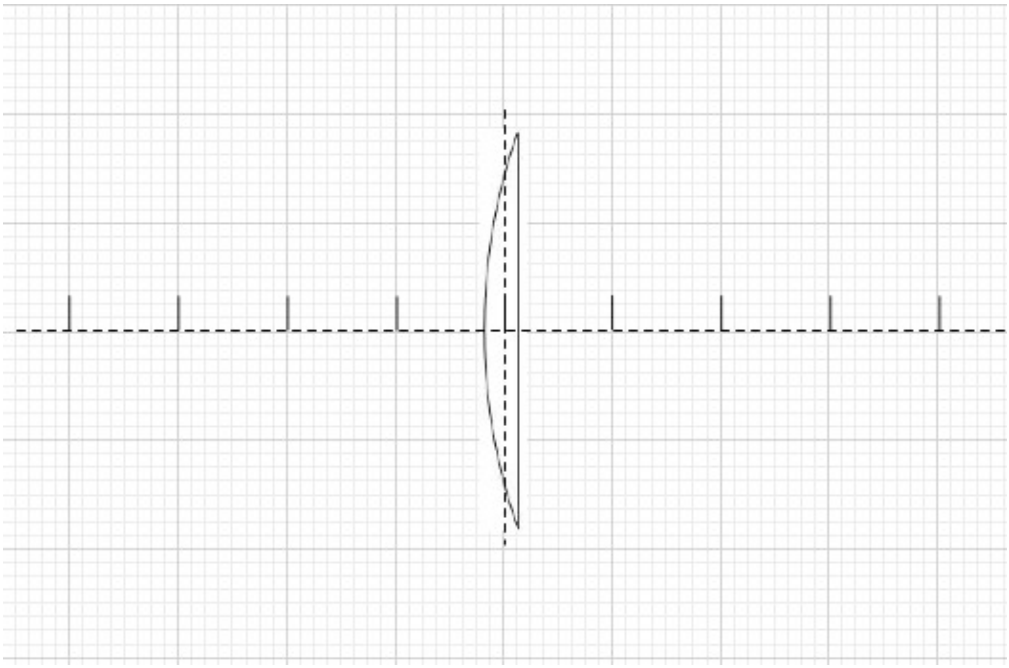
Physics 122 **Dr. E. F. Redish**
Spring 2009 **Exam 2 (M.U.)**

2. (25 points) In the figure below is shown a converging lens that you want to use as a magnifying glass to observe a colony of small leaf cutting ants (one is shown at the right) while you are doing fieldwork on entomology in Costa Rica. This lens has a focal length of 10 cm.

(a) If you hold it so the lens is 5 cm from the ant, where would the image of the ant appear to be? (7 pts)

(b) How much (by what factor) will the ant be magnified at those distances? (5 pts)

(c) On the figure below, construct a careful ray diagram that shows the situation described in parts (a)-(b). The markers on the centerline (drawn dashed) are 5 cm apart. (10 pts)



(d) Does your ray diagram agree quantitatively with your calculation? If not, explain why. (3 pts)

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

NAME_____ **POINTS**_____

Physics 122 **Dr. E. F. Redish**
Spring 2009 **Exam 2 (M.U.)**

3. (15 points) Estimate the number of cars on the beltway at rush hour. *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. ☐

NAME_____ **POINTS**_____

Physics 122 **Dr. E. F. Redish**
Spring 2009 **Exam 2 (M.U.)**

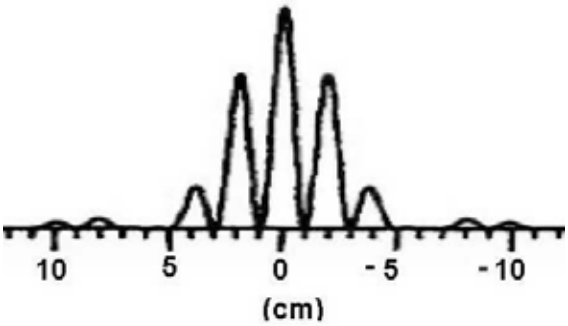
4. (10 points) In our discussion of models of light, we have considered two models: Newton's particle model and Huygens' wave model. Choose one of these models and describe it, specifying what it does effectively and what it does wrong (if anything). Explain briefly whether you think it is valuable considering both of these models or not. *Note: This is an essay question. Your answer will be judged not solely on its correctness, but for its depth, coherence, and clarity.*

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

NAME_____ **POINTS**_____

Physics 122 **Dr. E. F. Redish**
Spring 2009 **Exam 2 (M.U.)**

5. (20 points) When a laser beam is put through two slits as in your lab experiment, a graph of the intensity of the light on a screen 1 m away from the slits is given as a function of *y*, the distance from the center line, is shown at the right.



A. If the light has a wavelength of 500 nm, how far apart are the slits? Give your answer in mm. Explain your reasoning. (10 pts)

B. Can you tell from this graph how wide each slit is? Is so, find the width (in mm) and explain how you know. If not, explain why not, (10 pts)

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