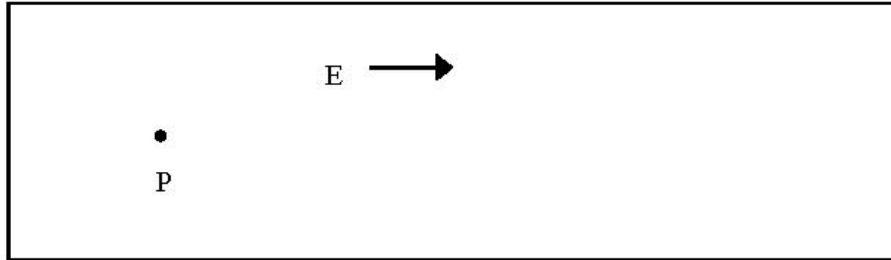


Homework #4 for Thursday, June 23, 2005

Name _____ Section _____



The figure above shows a (rectangular) region of space with a uniform magnetic field: the electric field everywhere has the same magnitude and direction. The direction of the electric field is indicated by the arrow. We will study what happens to a positive charge placed in this region and allowed to move.

1. Suppose that a positive charge q is placed at position P , and then is released so that it (the charge q) is free to move. Draw a dotted line representing the path along which this particle will travel in the region shown.

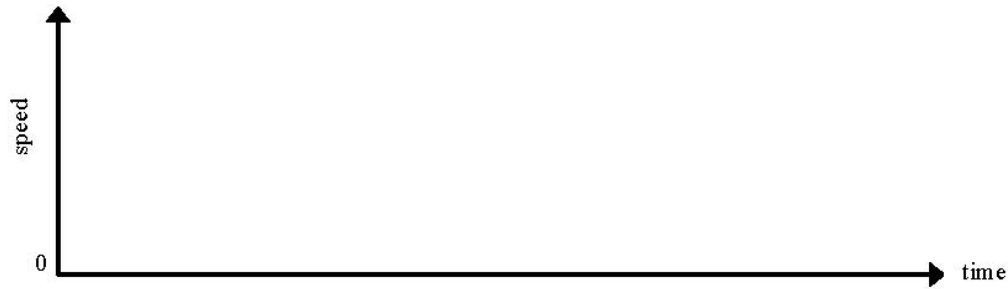
2. In the space below, sketch a graph of the *magnitude of the electric force* acting on the particle q as a function of time, during the period of time that the particle is moving through the region.



3. In the space below, sketch a graph of the *magnitude of the particle's acceleration* as a function of time, during the period of time that the particle is moving through the region.



4. In the space below, sketch a graph of the particle's speed as a function of time, during the period that the particle is moving through the region.



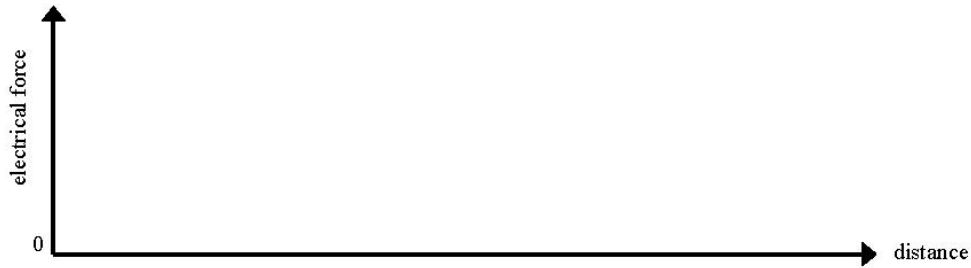
5. Along the path you have indicated in the figure at the beginning, draw a number of arrows which indicate the velocity vectors of the particle q at different times. Indicate the speed of the particle at any given time by the length of the arrow; for example, if the speed remains constant all the arrows should have the same length.

6. As the particle moves through the region, should its total mechanical energy ($KE + PE$) increase, decrease, or remain the same. Remember that the electrical force is a conservative force. Explain your answer.

7. As the particle moves through the region, will its kinetic energy increase, decrease, or remain the same? Explain your answer.

8. As the particle moves through the region, will its electric potential energy increase, decrease, or remain the same? Explain your answer.

9. In the space below, sketch a graph of the *magnitude of electrical force* acting on the particle q as a function of *distance traveled*, during the period that the particle is moving through the region.



10. In the space below, sketch a graph of the *magnitude of the particle's acceleration* as a function of *distance traveled*, during the period that the particle is moving through the region.



11. Recall from Physics 111 the definition of work in terms of force and distance. Write down an expression for the electrical work done on the particle as a function of d , the distance traveled by the particle. Write it in terms of quantities such as q and E and d .

12. In the space below, sketch a graph of the *work done on the particle by the electrical force*, as a function of *distance traveled*, during the period that the particle is moving through the region.



13. Recall from Physics 111 how the kinetic energy of the particle is related to the work done on the particle. In the space below, sketch a graph of the *particle's kinetic energy* as a function of *distance traveled*, during the period that the particle is moving through the region.



14. In the space below, sketch a graph of the *particle's electric potential energy* as a function of *distance traveled*, during the period that the particle is moving through the region.



15. Summarize what happens to the positive charge as it moves in the region of the uniform electric field by describing what happens to each of the following quantities (remains constant, increases, or decreases):

Magnitude of the force:

Magnitude of the acceleration:

Speed:

Total mechanical energy:

Kinetic energy:

Electric potential energy: