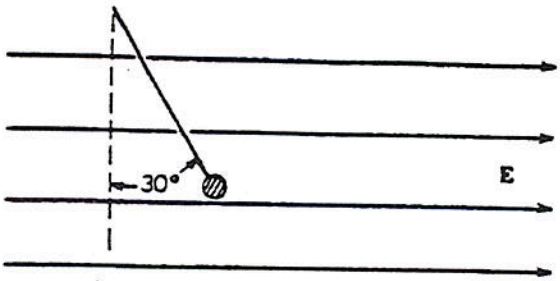
SIDE 1

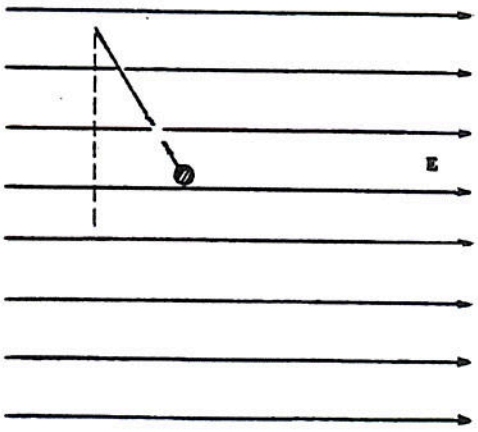


1981B3. A small conducting sphere of mass 5×10^{-3} kilogram, attached to a string of length 0.2 meter, is at rest in a uniform electric field E, directed horizontally to the right as shown above. There is a charge of 5×10^{-6} coulomb on the sphere. The string makes an angle of 30° with the vertical. Assume g = 10 meters per second squared.

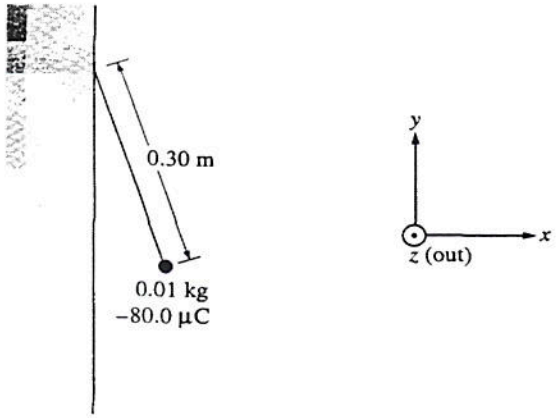
a. In the space below, draw and label all the forces acting on the sphere.

b. Calculate the tension in the string and the magnitude of the electric field.

c. The string now breaks. Describe the subsequent motion of the sphere and sketch on the following diagram the path of the sphere while in the electric field.

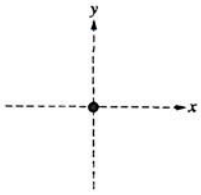


SIDE 2



(15 points) 1998B2. A wall has a negative charge distribution producing a uniform horizontal electric field. A small plastic ball of mass 0.01 kg, carrying a charge of -80.0 μC, is suspended by an uncharged, nonconducting thread 0.30 m long. The thread is attached to the wall and the ball hangs in equilibrium, as shown above, in the electric and gravitational fields. The electric force on the ball has a magnitude of 0.032 N.

a. On the diagram below, draw and label the forces acting on the ball.



b. Calculate the magnitude of the electric field at the ball's location due to the charged wall, and state its direction relative to the coordinate axes shown.

c. Determine the perpendicular distance from the wall to the center of the ball.

d. The string is now cut.

   i. Calculate the magnitude of the resulting acceleration of the ball, and state its direction relative to the coordinate axes shown.

ii. Describe the resulting path of the ball.