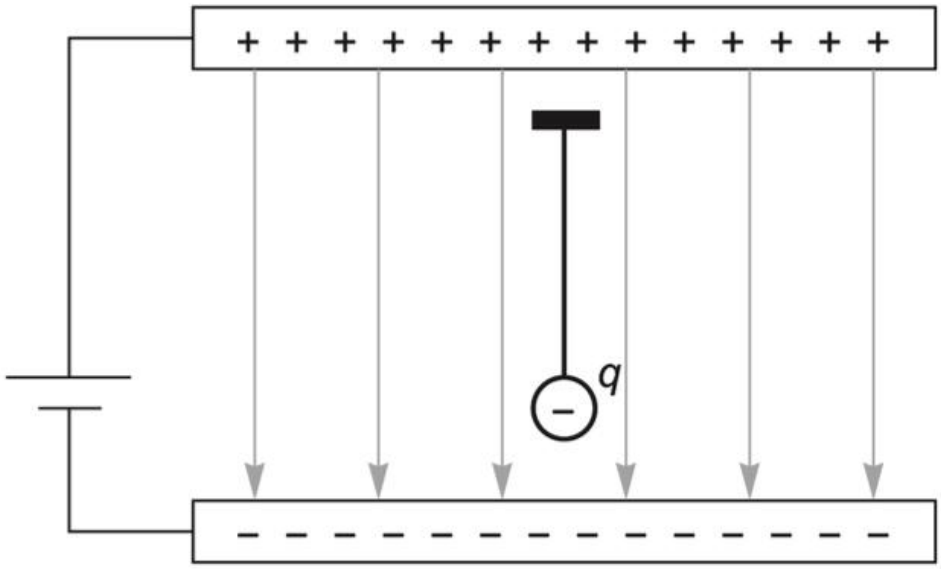
Question 14 **(13 marks)**



A 0.200 kg metal sphere with a net negative charge of 2.72 mC is suspended by a 0.800 m long almost massless string in a uniform electric field. The plates of the field are 1.20 m apart and the potential difference between the positive top and the negative bottom plate is 1.80×10^2 V.

(a) Calculate the strength of the electric field. (1 mark)

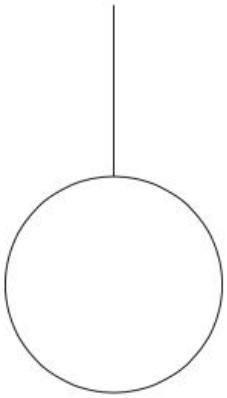
Answer _____ V m^{-1}

(b) Calculate the tension in the string. (4 marks)

Answer _____ N

(c) The sphere is pulled to one side and released. At the bottom of the swing, the sphere is travelling at 2.80 m s^{-1}.

(i) Draw a free body diagram of the forces acting on the sphere in this position. Label all forces. Do **not** show the net force acting on the sphere. (3 marks)



(ii) Derive an expression for the net force acting on the sphere in terms of the forces in your diagram. (1 mark)

F_{net} =

(iii) Calculate the tension in the string at the bottom of its swing. (4 marks)

Answer _____ N