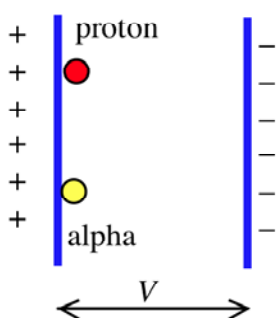


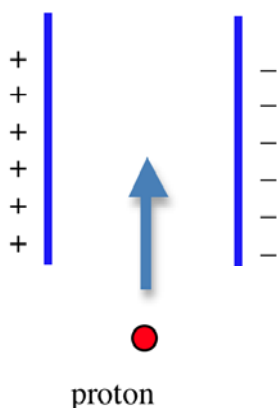
Extension Worksheet – Topic 5, Worksheet 5

- 1 The Earth orbits the Sun in an approximately circular orbit of radius 1.5×10^{11} m completing one revolution in one year.
 - a Calculate the gravitational field strength created by the Sun at the position of the Earth. [3]
 - b Use your answer to estimate the mass of the Sun. [2]
- 2 Describe one experiment or a set of observations that enable one to conclude that there are two different types of electric charge. [3]
- 3 A charge of 8.0 nC is deposited on a metallic sphere on an insulating stand and a charge of -2.0 nC on an identical sphere. The centres of the spheres are a distance d apart. The force between the spheres is attractive and has magnitude F . The spheres are allowed to touch and are then moved back to their original separation. Calculate the new force between the spheres in magnitude (in terms of F) and direction. [4]
- 4 A proton and an alpha particle are released from rest from a positively charged plate.



The potential difference between the plates is V . Calculate the ratio of the speed of the proton to the speed of the alpha particle when both reach the negatively charged plate. [3]

- 5 A proton enters the region between two parallel, oppositely charged plates.



The electric field in between the plates is assumed to be uniform and of strength $E = 2.4 \times 10^3 \text{ NC}^{-1}$.

- a Calculate the electric force on the proton while it is within the plates. [2]

A magnetic field is established within the plates so that the path of the proton is undeflected from its original direction. The speed of the proton is $4.1 \times 10^6 \text{ m s}^{-1}$.

b Calculate the strength of the magnetic field required and state its direction. [3]

The proton is replaced by an alpha particle that enters the region of parallel plates with the same speed as that of the proton. The electric and magnetic fields are unchanged.

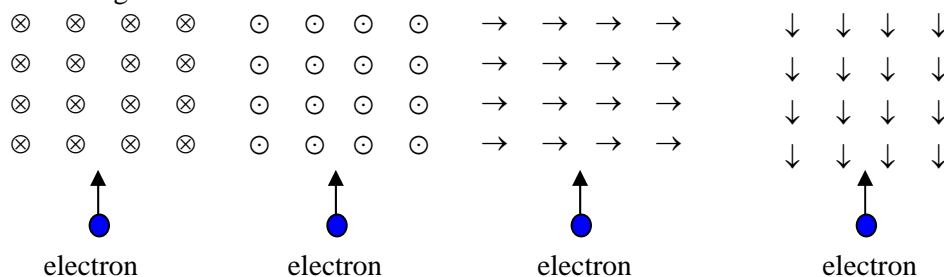
c State and explain whether the alpha particle will be deflected or not. [2]

6 Explain the difference between insulators and conductors. [2]

7 Explain why, in a conductor that is not connected to a source of emf, there is no current even though the electrons in the conductor move. [2]

8 In static electricity, explain why the electric field inside a conductor is zero. [2]

9 The diagram shows four electrons entering four different regions of magnetic field. The magnetic field in each case is directed as shown. For each case, state and explain the direction of the magnetic force on the electron the instant the electron enters the region of magnetic field.



[4]