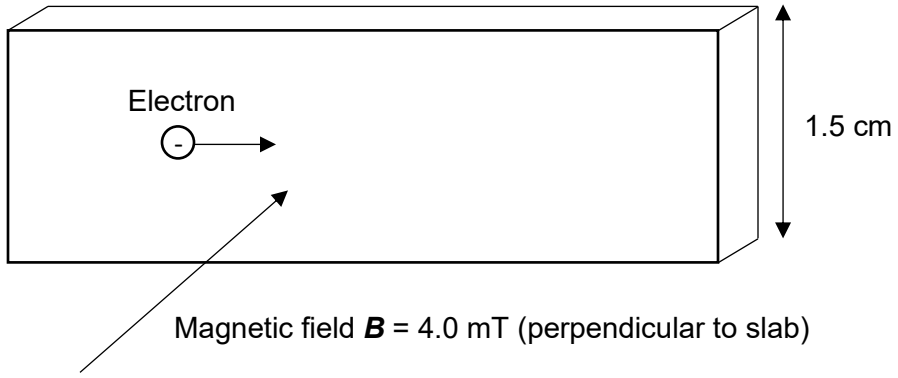
4 An electric current consisting of electrons flowing horizontally from left to right through a thin slab of conductor of width 1.5 cm. The slab of conductor is immersed in a uniform magnetic field ***B*** of 4.0 mT, which is applied perpendicularly to the slab of conductor, as shown in the diagram below:



(a) The speed of the electrons is 0.60 mm s^{-1}. Calculate the magnetic force acting on each electron. [2]

(b) Because of the magnetic force, the electrons accumulate on one side of the conductor. Indicate on the diagram above, where the electrons will accumulate. [1]

(c) A vertical electric field is created across the slab as a result of the accumulation of electrons.

(i) Draw on the diagram above an arrow to represent the electric field. Label it as ***E***. [1]

(ii) As more and more electrons accumulate, the electric field gets stronger and stronger. The rate of electron accumulation decreases. Eventually, further electrons do not accumulate anymore, but continue to travel horizontally.

1. Explain why the rate of accumulation of electrons decreases, and why eventually further electrons do not accumulate anymore. [3]

2. Calculate the potential difference across the horizontall sides of the slab of conductor when the accumulation of electrons stops. [3]