1 When a current I is passed through the length of a metal plate of thickness d in a uniform magnetic field with a magnetic flux density B, a potential difference V is generated across its width. This potential difference, known as the Hall Voltage, is given by the relationship

$$V = \frac{BI}{ned}$$

where n is a physical quantity related to the type of metal used, and e is the charge of the electron.

(a) By using the definition of the magnetic flux density, show that the SI base units of B is kg s^{-2} A^{-1}.

[2]

(b) In practice, the Hall Voltage is used to measure the value of the magnetic flux density in a region.

(i) In a particular experiment, a silver plate is placed in a uniform magnetic field of an unknown magnetic flux density B.

The following are the recorded values of the various quantities along with their uncertainties.

$V = (7.9 \pm 0.1)$ μV

$I = (100 \pm 1)$ A

$d = (0.20 \pm 0.01)$ cm

The value of n for silver is 5.9×10^{28} m^{-3} and this value is known to a high degree of precision.

Determine the magnitude of B with its associated uncertainty.

[4]

B = ……....±…….. T

(ii) The vernier caliper used to measure d was found to have a zero error which was not accounted for in the recorded value of d.

State whether there are effects on

1. the value of d,

……..……..……..……..……...

[1]

……..……..……..……..……

2. its uncertainty**.**

……....………………………………………………..………………………..

[1]

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