2024 Sec 4 Advanced Physics Exercise 2B

Magnetic Fields

Name: _____ ( ) Class: 4/ ___ Date: _____

Given formulae and constant:

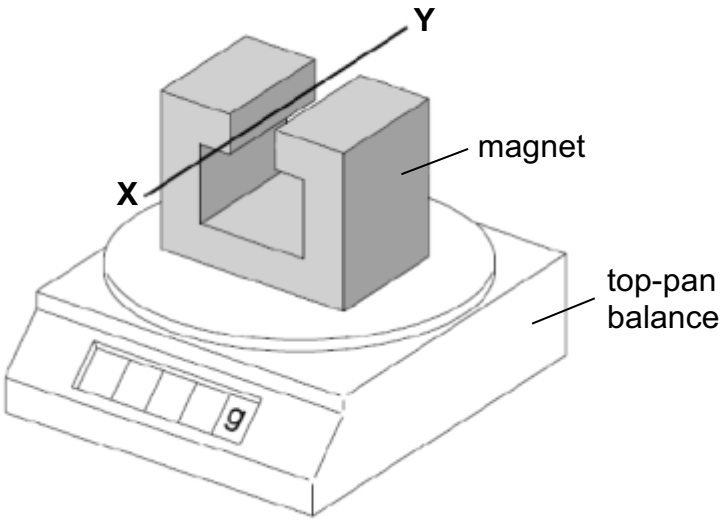
$E = \frac{F}{q}$ $\quad F = \left|\frac{kQq}{r^2}\right|$ $\quad F = BIL$ $\quad F = Bqv$

where k = 8.99 × 10^9 kg m^3 s^{-4} A^{-2}

$v = r\omega$ $\quad a = \frac{v^2}{r}$

For relevant calculations, you may take the mass of a proton to be 1.67 × 10^{-27} kg and its charge to be 1.60 × 10^{-19} C.

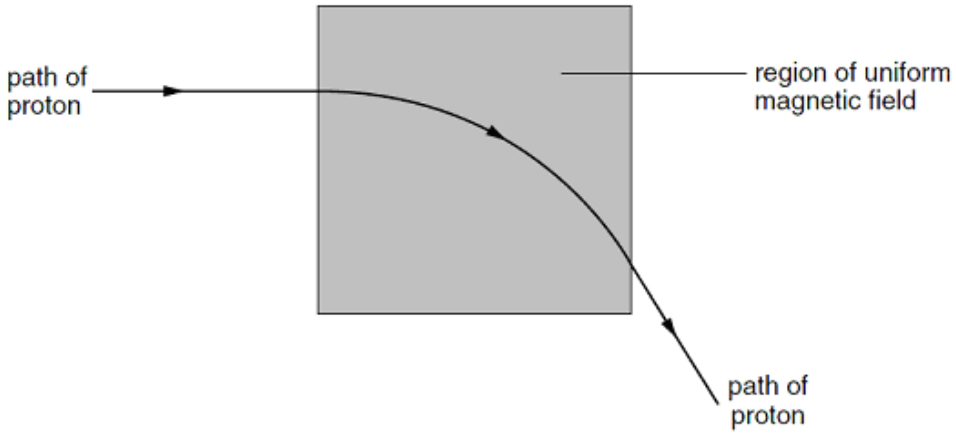
1 A horseshoe magnet rest on a top-pan balance with a wire situated between the poles of the magnet. When no current flows in the wire, the reading on the balance is 142.0 g. When a current of 2.0 A flows in the wire in the direction XY, the reading on the balance changes to 144.6 g.



What is the reading on the balance when there is a current of 3.0 A in the wire in the direction YX?

reading on the balance = ……

2 A proton, travelling in a vacuum at a speed of 4.5×10^6 m s^{-1}, enters a region of uniform magnetic field of flux density 0.12 T. The path of the proton in the field is a circular arc, as illustrated in the figure below.



(a) State the direction of the magnetic field.

……

(b) Calculate the radius of the path of the proton in the magnetic field.

radius = ……

(c) A uniform electric field is now applied in the same region as the magnetic field, so that the proton passes undeviated through the region.

(i) On the figure above, mark with an arrow labelled *E*, the direction of the electric field.

(ii) Calculate the magnitude of the electric field strength.

E = ……

Answers:	1. 138.1	2(a). out of the page	2(b). 0.39 m
	2(c)(i). upwards	2(c)(ii). 5.4×10^5 N C^{-1}	