

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Mark Schemes

Q1.

- (a) (i) 1 N per A per m
 or 1 Wb m^{-2}
 or quotes: $B = F/IL$ with terms defined
 or induced $EMF = \Delta BAN/t$ with terms defined
 or a slightly flawed attempt at the definition in statement form

C1

It is the flux density (perpendicular to a wire) that produces a force of 1N per m on the wire when the current is 1A

or

$B = F/IL$ and 1 T is flux density when $F = 1\text{N}$; $I = 1\text{A}$ and $L = 1\text{m}$

or induced $EMF = \Delta BAN/t$ and 1 T is the flux change when $emf = 1\text{V}$ for $A=1$ $N=1$ and $t=1$ or similar

A1

2

- (ii) force on charge due to E field, $F_E = Eq$ or Vq/d
 and
 force due to B field, $F_B = Bqv$
 or $Eq=Bqv$

B1

$= Bqv$; cancels q and states explicitly $v = \frac{E}{B}$
 or $v = \frac{V}{dB}$

B1

2

- (iii) $v = 20000/0.14$ (seen) or $143 \times 10^3 \text{ m s}^{-1}$

B1

1

- (b) (i) $Bqv = mv^2/r$ or $r = mv/Bq$ (allow e instead of q)
 mass of ion = $1.7 \times 10^{-27} \times 58$ (may be in equation)
 or $(9.86 \times 10^{-26} \text{ kg seen})$

C1

or

radius = 0.14 m (may be in equation)

C1

Substitutes and arrives at 0.62 to 0.63 T

A1

3

- (ii) Calculates new radius (0.145 m) or diameter (0.288 m)
using $r \propto m$ or otherwise **allowing ecf**

C1

0.010 m (condone 0.01 m) or 0.0096 – 0.0097 m
(Allow 0.0079 m or 0.008 m due to use of different
sfs for B and v)

A1

2

[10]

Q2.

- (a) acceleration is (rate of) change of velocity
or velocity is a vector
or velocity has magnitude and direction

B1

velocity is changing since direction is changing
(must be clear that it is the velocity that is changing direction)

B1

allow 1 mark for 'it would move in a straight line at constant speed if it were not
accelerating'

do not allow 'because there is a force acting'
'because direction is changing'

(2)

- (b) (i) arrow toward centre of circle at **P**

B1

(1)

- (ii) $F = mv^2 / r$ **or** mrv^2

or numerical equivalent (r must be 200 m)

C1

5.4×10^{-16} N

A1

(2)

- (iii) graph showing correct curvature with F plotted correctly (e.c.f. for F)

(should be between 5×10^{-14} and 6×10^{-16} N

B1

double v , quadruple F

(should be possible to do these tasks to $\pm\frac{1}{2}$ a square)

B1

(2)

(c) (i) circumference = 1256 m or $2\pi r \times 420\,000$

(allow e.c.f. for incorrect r from (b)(ii))

C1

distance travelled = 5.3×10^8 m

A1

(2)

(ii) $s = \frac{1}{2}gt^2$ **or** $ut + \frac{1}{2}at^2$

C1

19.6m (20m)

A1

(2)

(iii) $mg = 1.7 (1.67) \times 10^{-26}$ N

B1

(1)

[12]