

Name of the Student: \_\_\_\_\_

Max. Marks : 22 Marks

Time : 22 Minutes

Mark Schemes

**Q1.**

- (a) (i) force acts towards left or in opposite direction to field lines ✓  
 because ion (or electron) has negative charge  
 ( $\therefore$  experiences force in opposite direction to field) ✓

*Mark sequentially.**Essential to refer to negative charge (or force on + charge is to right) for 2<sup>nd</sup> mark.*

2

- (ii) (use of  $W = Fs$  gives) force  $F = \frac{4.0 \times 10^{-16}}{63 \times 10^{-3}}$  ✓

$$= 6.3(5) \times 10^{-15} \text{ (N)} \quad \checkmark$$

*If mass of ion  $m$  is used correctly **using algebra** with  $F = ma$ , allow both marks (since  $m$  will cancel). If numerical value for  $m$  is used, max 1.*

2

- (iii) electric field strength  $E \left( = \frac{F}{Q} \right) = \frac{6.35 \times 10^{-15}}{3 \times 1.6 \times 10^{-19}} = 1.3(2) \quad \checkmark \quad 10^4 \text{ (N C}^{-1}\text{)} \quad \checkmark$

[or  $\Delta V \left( = \frac{\Delta W}{Q} \right) = \frac{4.0 \times 10^{-16}}{3 \times 1.60 \times 10^{-19}} \quad (833 \text{ V})$

$$E \left( = \frac{\Delta V}{d} \right) = \frac{833}{63 \times 10^{-3}} = 1.3(2) \quad \checkmark \quad 10^4 \text{ (V m}^{-1}\text{)} \quad \checkmark ]$$

*Allow ECF from wrong  $F$  value in (ii).*

1

- (b) (i) (vertically) downwards on diagram ✓  
 reference to Fleming's LH rule **or** equivalent statement ✓

*Mark sequentially.**1<sup>st</sup> point: allow "into the page".*

2

- (ii) number of free electrons in wire =  $A \times l \times$  number density  
 $= 5.1 \times 10^{-6} \times 95 \times 10^{-3} \times 8.4 \times 10^{28} = 4.1 \text{ (4.07)} \times 10^{22} \quad \checkmark$

*Provided it is shown correctly to at least 2SF, final answer alone is sufficient for the mark. (Otherwise working is mandatory).*

1

$$(iii) B\left(\frac{F}{Il}\right) = \frac{1.4 \times 10^{-25}}{0.38 \times 95 \times 10^{-3}} \checkmark = 0.16 \text{ (0.159) (T) } \checkmark$$

$$[or B\left(\frac{F}{Il}\right) = \frac{1.4 \times 10^{-25} \times 4.07 \times 10^{22}}{0.38 \times 95 \times 10^{-3}} \checkmark = 0.16 \text{ (0.158) (T) } \checkmark ]$$

In 2<sup>nd</sup> method allow ECF from wrong number value in (ii).

2

[10]

## Q2.

(a) (i) 128 V ✓

1

(ii) 64 V

CE from (i)

1

(iii)  $V_{rms} = 64 / \sqrt{2} \checkmark = 45.3 \text{ V } \checkmark$

CE from (ii)

2

(iv) frequency =  $1 / 0.01 \checkmark = 100 \checkmark \text{ Hz } \checkmark$

do not accept kHz for unit mark unless correct for candidate value  
if use 10 s instead of 10 ms then can score second two marks

3

(b) horizontal line ✓

through  $y = 45 \text{ (} 44 - 48 \text{) } x = 0 \checkmark$

CE from (a)(iii) + / - half square

straight line must extend to at least to 6.0 ms

2

(c) connect to y-input ✓

adjust / change time base ✓

so that each division is 2.0 ms OR 20 ms across screen ✓

reference to y-gain / sensitivity ✓

if inappropriate numbers quoted for y gain then lose last mark

3max

[12]