Name of the Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

Mark Schemes

Q1.

(a) Vertically up (third row of table) ✔

1

(b) (Using Flemings LHR) the configuration of the letters is S N ✔

Answer must be near / on the dashed lines.

1

(c) The tesla is the (strength) of the magnetic field / flux density that produces a force of 1 newton in a wire of length 1m with 1 ampere (flowing perpendicular to the field). ✔
(owtte but must contain 1N, 1A and 1m)

For mark a reference to 1N, 1A and 1m must be seen. However the word 'unit' is equivalent to '1'.

E.g. unit force = 1N.

Do not allow definitions based on F = Bqv.

1

(d) Use of ($B = F / I l$) = $m g / I l$ ✔ (mark may come from substitution as in next line)

Treat power of 10 error as an AE so lose one mark only.

$B = 0.620 \times 10^{-3} \times 9.81 / (3.43 \times 0.0500) = 0.035$ or 0.036 (T) ✔

Lack of use of 'g' is a PE and scores zero.

2

[5]

Q2.

(a) It is not possible as the force (due to the magnetic field) is perpendicular to the motion / direction of travel / velocity ✔ (it can only change the charged particle's direction or alternatively no work is done on the proton)
Or
No component of force in the direction of motion.

The main part being examined is the reference to the force being perpendicular to the motion.

1

(b) $B Q v = m v^2 / r$ ✔
$t_{semi\text{-}circle}$ (= distance / speed) = $\pi r / v$
Or use of t_{circle} (= distance / speed) = $2 \pi r / v$ ✔(this mark can only be awarded if it follows an attempt to answer the first mark)

combining gives
($t_{circle} = 2\pi\ m / B\ Q$ so)
$t_{semi\text{-}circle} = \pi\ m / B\ Q$
(which does not contain r / is independent of r) ✔

Accept 'e' if used instead of 'Q'
Alternatives can be given for the first two marks.
1st needs a centripetal force term.
2nd is a circular motion expression to enable r to be removed.

3

(c) (rearranging first equation in (b) or from data booklet $v = B\ Q\ r / m$)
$v = 0.44 \times 1.6 \times 10^{-19} \times 0.55 / 1.67 \times 10^{-27}$ ✔
$v = 2.3 \times 10^{7}$ (m s^{-1}) ✔

Correct answer scores both marks.

2

[6]

Q3.

(a) Ionisation is when an atom / molecule loses (or gains) one (or more) electrons ✔

1

(b) Potential energy of ion is transferred to kinetic energy of ion✔

Power supply transfers energy to the ion✔

Decrease in energy stored in supply = increase in (kinetic) energy stored by the ion✔

3

(c) electric force is constant✔

magnetic force increases with speed✔

(magnetic force dominates) direction of force predicted by any consistent named force rule✔

3

(d) Path curves upwards between the plates✔

1

(e) The magnetic force is the same (Bqv) ✔

So r increases / less curvature✔

OR

$Bqv = \frac{mv^2}{r}$ so $r = \frac{mv}{Bq}$ ✔

v, B, q constant so $r \propto m$ and r increases✔

2

(f) Same path in velocity separator ✔

since Bqv=Eq so v independent of q ✔

In mass selector radius is decreased ✔

since $r = \frac{mv}{Bq}$ so $r \propto \frac{1}{q}$ ✔

Both correct with one correct justification would get 3 marks

MAX 3

[13]