Practice Question Set For A-Level
Subject : Physics
Paper-3 Topic: Section B (Section 13_ Electronics)

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Name of the Student:_____

Max. **Marks : 18 Marks**   **Time : 18 Minutes**

Mark Schemes

Q1.

(a)

$$c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$$ seen

AND μ_0 ε_0 substituted separately from data booklet ✔

To give value of c AND compared with c in booklet ✔

> *For MP1 condone formula seen AND answer given to at least 5 sf*
> *(2.9986×10^8 (ms^{-1}))*
>
> *For MP2 need to see a valid comment that compares calculated value with data booklet value with units to at least 3sf*

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(b)   Maxwell's model as varying perpendicular E and B fields (transmitting through space) ✔

(Oscillating) current in T indicates presence of (oscillating) E field ✔

> *For MP2 allow idea of distribution of charge in T giving rise to electric field*

Oscillating current in T produces (horizontal) B field ✔

> *For MP3 allow moving electrons produces a (varying) magnetic field*

Varying (horizontal) B field induces varying emf in loop
OR
Varying (vertical) E field creates a varying emf in loop ✔

> *For MP4 allow*
> *idea of magnetic field applying force on (moving) charges in the receiver (which is an emf)*
> *OR*
> *Idea of electric field causing change in charge distribution within the loop (which is an emf)*

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(c)   In order to determine speed, need to measure wavelength/ distance between nodes OR antinodes in stationary wave ✔

From frequency of 75 MHz and $c = f \lambda$, wavelength = 4 m

> *For MP3 and MP4 allow for correct calculation leading to idea that three waves will fit between transmitter and detector so YES*

OR nodes/antinodes are 2 m apart ✔

Which is less than separation of transmitter and reflector so YES ✔

Answer refers to nodes ✔
In MP3 allow ecf for incorrect wavelength

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[10]

Q2.

(a) 2 From ✔✔

(High) electric field pulls electrons from (gas) atoms/ ionises (gas) atoms

positive ions in tube are accelerated to C/cathode and strike surface/electrons in surface

Electrons (in cathode) emitted and accelerated towards A (and B) (to form cathode ray).
Do not award MP3 if there is a suggestion of a p.d. between A and B

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(b) Y to X ✔

1

(c) Reference to $v = E/B$ (when path straight) ✔

(Eg Electric force = magnetic force

$Eq = Bqv$

$v = E/B$)

(Therefore for greater v)

    Either increase E ✔

    Or decrease B. ✔
For MP2 and MP3 there must be some correct supporting theory e.g.
$F_M = Bqv$

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(d) (Magnitude of) specific charge much greater (approximately x 2000) specific charge of hydrogen (ion), (largest then known). ✔

(If charges similar) Cathode rays particles <u>mass</u> much smaller than hydrogen ion and therefore smaller than atom. ✔
Do not condone "he deduced they were electrons"
MP2 cannot be awarded if MP1 is incorrect.
If no other creditable answer given, one mark can be awarded for stating that the sign of the specific charge of cathode ray is opposite to that of hydrogen ion.

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[8]