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

Name of the Student:_____
Max. Marks : 26 Marks **Time : 26 Minutes**

Mark Schemes

Q1.

(a) $\lambda \propto \frac{1}{\sqrt{V}}$

1

(b) The resolution is improved for shorter wavelengths or shorter wavelengths enable more detailed images.✔

0.1 nm is the same order of magnitude as the diameter of an atom.✔

2

(c) Image not accurately focused / blurred✔

Due to electrons not all having the same speeds so focused to different points by the magnetic lenses.✔

Electrons slowed down passing through the sample.✔

Wavelength changes by different amounts as they pass through the sample so each wavelength diffracted differently.✔

4

[7]

Q2.

(a) induced emf in the loop must be caused by changing magnetic flux through the loop✓

1

magnetic flux change must be caused by the wave passing through the loop so the wave has a magnetic nature✓

1

(b) Use another dipole aligned with the transmitter detects an electric field which changes ✓

1

(c) **The mark scheme gives some guidance as to what statements are expected to be seen in a 1 or 2 mark (L1), 3 or 4 mark (L2) and 5 or 6 mark (L3) answer. Guidance provided in section 3.10 of the '*Mark Scheme Instructions*' document should be used to assist in marking this question.**

Mark	Criteria	QoWC
6	All three aspects covered:	The student

	A full description of Hertz's experiment including a clear description of how the wavelength was determined and how frequency and wavelength are combined to work out speed. Analysis of Maxwell's prediction by stating link to em waves and calculation of speed from the formula. Outline of Fizeau's experiment to calculate speed of light, and result in line with Maxwell's formula.	presents relevant information coherently, employing structure, style and sp&g to render meaning clear. The text is legible
5	Two of the three aspects fully covered, with some detail missing from the third.	
4	One aspect fully covered, with some detail missing from the other two Or Two aspects fully covered, with little or no relevant information about the third.	The student presents relevant information and in a way which assists the communication of meaning. The text is legible. Sp&g are sufficiently accurate not to obscure meaning.
3	All three aspects partially covered, with some detail missing from each Or One aspect fully covered, with little or no relevant information about the other two	
2	Two aspects partially covered, with little or no relevant information about the third.	The student presents some relevant information in a simple form. The text is usually legible. Sp&g allow meaning to be derived although errors are sometimes obstructive.
1	One aspect partially covered, with little or no relevant information about the other two.	

0	Little or no relevant information about any of the three aspects.	The student's presentation, spelling punctuation and grammar seriously obstruct understanding.

The following statements are likely to be present:

To measure the speed:

- diagram showing or clear description of transmitter, reflector and receiver between them.
- stationary waves set up between the transmitter and reflector
- interference between incident and reflected waves.
- determine wavelength by measuring distance between nodes / antinodes
- measured / known frequency of the radio wave
- Calculate speed using $v = f\lambda$

How it supports Maxwell's prediction:

- Maxwell result developed from a prediction of e-m waves
- Evidence of a substitution of data from the data booklet into the formula to give result for speed
- The speed of radio waves is the same as the speed of electromagnetic waves predicted by Maxwell

Experimental evidence that suggests light is an em wave:

- Fizeau determined speed of light waves
- outline detail of experiment
- agreement with value predicted by Maxwell suggests light waves are also electromagnetic waves

6

[9]

Q3.

(a) current heats the wire ✓

1

electrons (in filament) gain sufficient KE (to leave the filament) ✓

1

(b) electrons would collide (or be absorbed or scattered) by gas atoms (or molecules) ✓

1

(c) Rearrange $\frac{1}{2} m v^2 = eV$ to give $v = (2eV / m)^{1/2}$

1

or correct substitution in equation.

1

$$v = \left(\frac{2 \times 1.6 \times 10^{-19} \times 4800}{9.1 \times 10^{-31}} \right)^{\frac{1}{2}} = 4.1 \times 10^{7} \text{ m s}^{-1}$$

1

$\lambda = \frac{h}{} = \frac{6.63 \times 10^{-34}}{}$ ✓ $= 1.8 \times 10^{-11}$m✓

1

(d) Increasing the pd increases the speed (or kinetic energy or momentum) of the electrons ✓

1

which decreases their de Broglie wavelength ✓

1

so they are diffracted less so the rings become smaller ✓

1

[10]