Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic: Particle And Radiation

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Name of the Student:_____
Max. Marks : 21 Marks **Time : 21 Minutes**

Mark Schemes

Q1.

(a) $q\bar{q}$ ✔

1

(b) Total energy = 2keV + 2 × 511 keV = 1024 keV ✔

= 1024 × 1.6 × 10^{-19} = 1.64 × 10^{-13}J ✔

Energy of each photon = 1.64 × 10^{-13}/2 = 8.19 × 10^{-14} (J) ✔

First mark for calculating the total energy in keV.

Second mark is for converting correctly into joules.

Third mark is for dividing by two so ecf for incorrect conversion into joules. Student must show at least 3sf.

3

(c) $\lambda = \frac{hc}{E} = \frac{6.63\times10^{-34}\times3\times10^{8}}{8.19\times10^{-14}}$ ✔

= 2.43 × 10^{-12} (m) ✔

First mark for the correctly rearranged equation or correct values substituted into equation.

Correct answer only scores 2 marks, ecf from 1 ***(b)***

2

(d) E_k= 2 keV = 2000 × 1.6 × 10^{-19} J = 3.2 × 10^{-16}J ✔

$v = \sqrt{\frac{2E_k}{m}} = \sqrt{\frac{2\times3.2\times10^{-16}}{9.11\times10^{-31}}}$ ✔

= 2.65 × 10^{7}(m s^{-1}) ✔

First mark for converting KE into joules.

Second mark for rearranging equation correctly or substituting correct values into equation.

Third mark for correct answer, must be to at least 3sf.

3

(e) $\lambda = \frac{h}{mv} = \frac{6.63\times10^{-34}}{9.11\times10^{-31}\times2.65\times10^{7}}$ ✔

= 2.75 × 10^{-11}(m) ✔

First mark for rearranging equation correctly or substituting correct values into equation.

Second mark for correct answer.

2

(f) Recognition that separation is 1.5 × 10^{-10} m and compared to 0.28 × 10^{-10} (ecf)✔

wavelength is about 5 times less than gap width✔

$\sin\theta = \frac{\lambda}{d} = 0.2 \rightarrow \theta \sim 11^{\circ}$ ✔

yes (diffraction would be observable)✔

Or words to that effect

4

[15]

Q2.

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.

Level	Criteria	QoWC
L3 5−6 marks	Good discussion of both elements in question with at least 4 points mentioned in each element	The student presents relevant information coherently, employing structure, style and sp&g to render meaning clear. The text is legible.
L2 3−4 marks	Good discussion with at least 3 points in one element and 2 points in the other element	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.
L1 1−2 marks	Discussion of one element only incorporating at least two points.	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.
0	Unsupported combination or no relevant analysis	The student's presentation, spelling, punctuation and grammar seriously obstruct understanding.

Collisions

- *Energy from collision of charged particles transfers to electrons in gas molecules.*
- *Electrons excited to higher energy levels.*

- *The more energy the electrons absorb the higher the energy levels reached.*
- *Electrons are unstable at higher energy levels so will fall back down.*
- *When it falls down it will emit a photon.*

Formation of spectral lines

- *Photon energy = hf/ or photon energy proportional to frequency.*
- *Spectral lines are at specific wavelengths.*
- *Each spectral line corresponds to an electron falling down to a lower energy state.*
- *Energy gap, $\Delta E = hc/\lambda$*
- *Larger energy gap means higher energy photon is emitted so shorter wavelength or vice versa.*

Responses with no mention of photons are likely to receive zero marks.

6

[6]