OXFORD
INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL AS Physics

(9630)

Unit 2: Electricity, waves and particles

Mark Scheme

June 2017

Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Question	Marking guidance	Mark	Comments
01.1	$I = Q/t = 9.4 \times 10^{18} \times 1.6 \times 10^{-19} / 18 \times 10^{-6}$ ✓ = 84 000 A (83 556 A) ✓	2	
01.2	Up/upwards/from ground to cloud ✓	1	

Question	Marking guidance	Mark	Comments
02.1	Finding a mean for T (1.405 or 1.44) or for 10T (14.05 or 14.4) ✓ Correct mean =1.44 (must ignore anomaly) ✓	2	Correct answer only
02.2	Use of *their* $1.44 = 2\pi\sqrt{\frac{L}{9.81}}$ ✓ L = 0.49–0.52 (m) ✓	2	

Question	Marking guidance	Mark	Comments
03.1	Electron diffraction or words to that effect ✓	1	(NOT just diffraction but, for example, "they can diffract" is allowed
03.2	v = $\sqrt{\frac{1.02 \times 10^{-24}}{0.5 \times 9.11 \times 10^{-31}}}$ or correct rearrangement to give $v = \sqrt{\frac{2E_k}{m}}$ ✓ v =1496 (m s^{-1}) ✓	2	Must see this not just 1500
03.3	Use of λ= $\frac{h}{\text{their } m \times \text{their } v}$ ✓ λ = 4.86 × 10^{-7} (m) ✓	2	

Question	Marking guidance	Mark	Comments
04	Correct general shape in 1st quadrant ✓ Symmetry in 1st and 3rd quadrant ✓ Goes through (12, 0.8) ± 1mm but doesn't get to 0.8A before 10V✓ gradient at (0, 0) should be 0.2 (can check with, for example, (1,0.2) or (2, 0.4)) ✓	4	Must not be linear beyond V = ± 2V

Question	Marking guidance	Mark	Comments
05.1	θ_c marked (as incident angle at BC) ✓	1	
05.2	$\sin \theta_c = \frac{1}{n} \quad \left(= \frac{1}{1.55}\right)$ ✓ $\theta_c = 40.2(°)$ ✓	2	
05.3	Use of $1.55 = \frac{3 \times 10^8}{v}$ $v = 1.94 \times 10^8$ (m s^{-1})	1 1	

Question	Marking guidance	Mark	Comments
06.1	Use of $P=V^2/R$ with substitution 144/any value of R ✓ R = 41.1 (W) ✓	2	
06.2	Use of 1/R formula with substitution of some data even if not all 5 resistors 1/R = 0.93 R = awrt 1.1 (Ω)	3	

Question	Marking guidance	Mark	Comments
07.1	As temperature increases, the resistance of the thermistor decreases ✓ As more charge carriers become available for conduction/ are raised to the conduction band ✓ A larger share/proportion of the battery pd across the buzzer (or reference to a potential divider) ✓	3	
07.2	Use of $\frac{1.2}{1.8} = \frac{R}{123}$ or $I = \frac{1.8}{123}$ or $I = 0.0146\ (A)$✓ R = 82 (Ω) ✓	2	Must see 82 not just 80. Answers based on checking can only score both marks if unrounded values are seen.
07.3	Attempt to find gradient as $\Delta y/\Delta x$ with correct values read from graph Gradient = –5 ($\Omega\ K^{-1}$)	2	Must have negative sign for second mark.

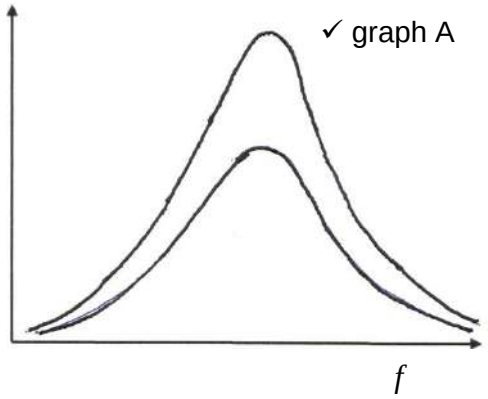
07.4	T = 3.0 (°C)	1	If clearly use 80 Ω from 7.2 can gain full marks. In this case T=3.4 °C)

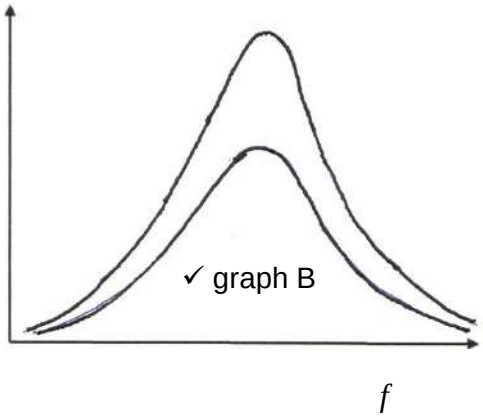
Question	Marking Guidance	Mark	Comments
08.1	Comment on how interference occurs = mention of diffraction at slits, superposition or coherence ✓ Constructive interference causes bright fringes and / or destructive interference causes dark fringe✓ Correct reference to phase difference at bright OR dark fringe ✓ Correct reference to path difference at bright OR dark fringe ✓	3 max	
08.2	From diagram w = 0.24/8 = 0.03 m $\lambda = ws/D$ = their $w \times 7.3 \times 10^{-5} / 3.5$ $\lambda = 6.3 \times 10^{-7}$ (m)	3	Correct answer only
08.3	A valid basic method ✓ Details of all measurements to be made ✓ Details of measuring instruments (2 out of metre rule, Vernier calipers, travelling microscope)✓ Describes a technique that improves accuracy (e.g. use of multiple fringes or a laser which allows D to be large)✓	4	

Question	Marking guidance	Mark	Comments
09.1	Ωm ✓	1	
09.2	Use of R = ρl/A seen ✓ Correct value for at least 1 resistance (zinc 0.037 Ω, silver 0.020 Ω) ✓ Use of $P = I^2R$ with a correct substitution of their R ✓ Correct value for both currents (8.1 A for zinc 11.6 A for silver) or powers and statement justifying the use of silver ✓	4	Allow reverse argument i.e. calculating power needed to melt fuses starting from 11 A
09.3	Any sensible factor eg corrosion, cost, availability ✓	1	

Question	Marking guidance	Mark	Comments
10.1	Well drawn line passing through all points and the origin (Straight up to strain = 0.6×10^{-2}) ✓	1	Allow ± 1 mm
10.2	Triangle or working lines seen – at least half size of straight section ✓ Data read correctly from graph (ignore powers of 10) ✓ 7.0×10^{10} – 7.4×10^{10} (Pa) to 2 or 3 sf ✓	3	
10.3	Micrometer (screw gauge) ✓ Plus : repeat <u>and</u> average (at various points along length or at different diameters to check for circularity) ✓	2	
10.4	Metre rule OR tape measure ✓ Choose long value of length OR repeat <u>and</u> average (the measurement) ✓	2	

Question	Marking guidance	Mark	Comments
11.1	Oscillations perpendicular to (the direction of propagation of) wave or direction of energy transfer ✓	1	
11.2	All buildings vibrate at the forcing frequency f = 12 / 24 = 0.5 (Hz) ✓	1	
11.3	Resonance occurs in building C ✓ Since $f = f_0$ or WTTE ✓	2	
11.4	Correct substitution into $T = 2\pi\sqrt{\frac{M}{k}}$ or a correct rearrangement to give $k = \frac{4\pi^2 M}{T^2}$ ✓ = 1.67 × 10^9 OR 1.7 × 10^9 (N m^{-1}) ✓	2	

11.5	amplitude  ✓ graph A f	1	

11.6	amplitude  ✓ graph B f	1	Note: Graph B = same shape, but all inside of graph A. Peak of graph B must not appear sharper than peak of graph A, nor should it appear to the right of graph A peak.

Section C

In this section, each correct answer is awarded 1 mark.

Question	Key
12	B
13	A
14	D
15	C
16	D
17	C
18	D
19	A
20	C
21	B
22	D
23	B
24	C
25	A