GCE

Physics B (Advancing Physics)

H157/01: Foundations of physics

Advanced Subsidiary GCE

Mark Scheme for November 2020

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

Annotations

Annotation	Meaning
BOD	Benefit of doubt given
CON	Contradiction
	Incorrect response
ECF	Error carried forward
NBOD	Benefit of doubt not given
POT	Power of 10 error
^	Omission mark
TE	Technical error (includes rounding & arithmetic errors)
SF	Error in number of significant figures
	Correct response
X	Incorrect response
	Wrong physics or equation
L1 L2 L3	Indicates level of response in extended response questions indicated * by the question number

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
(1)	Separates marking points
reject	Answers which are not worthy of credit
not	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
ecf	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

MARKING INSTRUCTIONS

Section A: MCQs

Question	Answer	Marks	Guidance
1	C	1	
2	A	1	
3	B	1	
4	C	1	
5	C	1	
6	D	1	
7	A	1	
8	D	1	
9	B	1	
10	B	1	
11	B	1	
12	B	1	
13	B	1	
14	A	1	
15	C	1	
16	B	1	
17	C	1	
18	A	1	
19	D	1	
20	D	1	
	Total	20	

SECTION B

Question			Expected Answer	Mark	Rationale/Additional Guidance
21	**a**		$(b = \log_2 256) = 8$ ✓	**1**	Bare answer scores mark
	b		457 x 353 / 1024 ✓ = 158 (kilobytes) ✓	**1** **1**	Method Evaluation. **ALLOW** 161 kB (using 1000B = 1kB)
			Total	**3**	

Question			Expected Answer	Mark	Rationale/Additional Guidance
22	**a**		C B A ✓✓	**2**	Answers in the order shown 2 marks if all three correct **ALLOW** 1 mark for one correct
	b	i	A ✓	**1**	
	b	ii	A ✓	**1**	
			Total	**4**	

Question			Expected Answer	Mark	Rationale/Additional Guidance
23	a		(P = VI) = 12 x 2.4 ✓	1	
			= 28.8 ✓	1	**ALLOW** 29
			W ✓	1	**ALLOW** Js^{-1} but no other alternatives
	b		t = 2 x 60 = 120 (s) ✓	1	Conversion to seconds anywhere seen in solution
			($E = V^2t/R$) = 12^2 x 120 / 4 ✓	1	**ALLOW** other equivalent e.g. E=VIt if correct
			= 4320 (J) ✓	1	**ALLOW** 72 (J) for 2 marks
	c		Energy dissipated/lost <u>to surroundings</u> ✓	1	**DO NOT ALLOW** just "energy lost"
			so less energy goes to heating the block ✓	1	
			Total	8	

Question			Expected Answer	Mark	Rationale/Additional Guidance
24	a		Light dependent resistor ✓	1	**ALLOW** LDR
	b		(V1/V2 = R1/R2) = 2/6 = R/18 000 ✓	1	Valid method and correct substitution. **ALLOW** alternative methods e.g. potential divider equation and substitution. **ALLOW** one mark for calculation of current in circuit (3.3×10^{-4} A as part method)
			R = 6000 (Ω) ✓	1	
	c		Adjust lighting to the required level (on/off point) ✓	1	**ALLOW** until light just turns on
			Adjust variable resistor until reading on V is 6.0V ✓	1	
			Total	5	
			Total Section B	20	

SECTION C

Question			Expected Answer	Mark	Rationale/Additional Guidance
25	**a**		Distance travelled = 2 mm AND Time taken = 800ms ✓ (Speed = 2/800) = 0.0025 (ms^{-1}) ✓	**1** **1**	Identification of *both* values Evaluation
	b		The ball is <u>accelerating</u> ✓ 1s (1000 ms) is less than halfway between n = 2 and n = 3 ✓	**1** **1**	Second mark for some idea that the instantaneous speed varies between n = 2 and n = 3 but that at 1s it is closer to the n = 2 frame
	c		The distance travelled between frames is constant ✓ And remains constant for all subsequent frames ✓	**1** **1**	Second mark must be clear that the distance travelled is constant for **every** frame past n = 5
	d		(3 x 10^{-3} / 0.8) = 0.00375 (ms^{-1}) ✓ uses all four frames to get values (e.g. 9 x 10^{-3} / 2.4) ✓	**1** **1**	**ALLOW** statement that as the distance between all four frames is the same then (3 x 10^{-3} / 0.8) is valid.
			Total	**8**	

Question			Expected Answer	Mark	Rationale/Additional Guidance
26	a		No variation (in brightness) ✓	1	**ALLOW** stays the same brightness
	b		Decreases <u>to zero</u> ✓ Then increases (rapidly) ✓	1 1	
	c		56 ✓	1	Only this value
	d		(Completely plane) polarised ✓ Perpendicular (to the axis of the polarising filter) ✓	1 1	 **ALLOW** horizontally
	e		(±) 1 degree ✓	1	Insist on unit
	f		(Yes) – a curve with <u>minimum at 58</u> ✓ Would pass through all the error bars ✓	1 1	**REJECT** 'the point at 58 has an error bar that touches zero'
			Total	9	

Question			Expected Answer	Mark	Rationale/Additional Guidance
27	a		2.05 ✓	1	Check in table and on answer space
	b	i	Points at (5.00, 2.05) and (5.83,2.40) ✓ Line of best fit drawn ✓	1 1	ECF from part a. **ALLOW** ½ square tolerance on plotting
	b	ii	Values read or triangle marked where $\Delta x > 1.5 \times 10^{14}$ ✓ $= 4.3 \times 10^{-15}$ (Vs) ✓	1 1	Method mark for large range being used. **ALLOW** max ½ square misread **ALLOW** ecf from ½ square misreads only
	c		E ($= 2.40 \times 1.60 \times 10^{-19}$) $= 3.84 \times 10^{-19}$ (J) ✓	1	3sf answer only.
	d		1 Vs $= 1.6 \times 10^{-19}$ (Js) ✓ *h* = gradient x 1.6×10^{-19} ✓ $= 6.9$ (6.856) $\times 10^{-34}$ (Js) ✓	1 1 1	Must use gradient in calculation, or zero marks.
	e		They may not be identical ✓ This improves accuracy/precision ✓	1 1	**ALLOW** check the one in use wasn't somehow anomalous **ALLOW** find an average p.d.

	f			Any **one pair** from: Darken the room / shield the LED / view through black paper tube ✓ To improve contrast ✓ To go from unlit to lit and back again to find turn on point Sometimes get flickering at turn-on point Any suggestion to get finer control of p.d. e.g. to use potential divider Because the LVU control is too coarse	**1** **1**	1 for suggestion 1 for explanation **ALLOW** any other reasonable pairs of suggestion / explanation
				Total **Total Section C** **Total Sections B & C**	**13** **30** **50**	

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk