

GCE

Physics B (Advancing Physics)

H157/01: Foundations of physics

Advanced Subsidiary GCE

2021 Mark Scheme (DRAFT)

This is a DRAFT mark scheme. It has not been used for marking as this paper did not receive any entries in the series it was scheduled for. It is therefore possible that not all valid approaches to a question may be captured in this version. You should give credit to such responses when marking learner's work.

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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.

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1. Annotations

Annotation	Meaning
BOD	Benefit of doubt given
CON	Contradiction
×	Incorrect response
ECF	Error carried forward
L1	Level 1
L2	Level 2
L3	Level 3
TE	Transcription error
NBOD	Benefit of doubt not given
POT	Power of 10 error
^	Omission mark
SF	Error in number of significant figures
✓	Correct response
?	Wrong physics or equation

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

Annotation	Meaning			
I	alternative and acceptable answers for the same marking point			
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			

Section A: MCQs

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

SECTION B

Que	Question		Expected Answer	Mark	Rationale/Additional Guidance
21	а		0.1 nm	1	ALLOW 0.05 to 0.2
					REJECT anything with >= 2sf
	b		0.0021 kg	1	ALLOW conversion of 2.0x10 ²⁶ kg to g
			0.0021 Ng	•	ALLOW CONVENCION OF 2.5X TO Right G
			÷ 2.0 x 10 ⁻²⁶ to get ~ 1.1x10 ²³ atoms	1	
	С		Linear distance $\sqrt[3]{1.1 \times 10^{23}}$ (~ 4.5 x 10^7 atom lengths)	1	Look for: cube root and 1/ operations
			1 cm / linear distance = atom linear size (~ 0.2nm)	4	
			1 on 7 linear distance - atom linear size (* 0.21lin)	!	
			Total	5	

Que	stion)	Expected Answer	Mark	Rationale/Additional Guidance
22	а		coherence/coherent	1	
	b		d = 1 / 250		
			= 4.0 x 10 ⁻³ mm	1	correct answer only
	С		$650 \text{ nm} = 5 \times 10^{-6} \times \sin\theta$	1	
			$\sin\theta = 0.13$	1	
			θ = 0.13 x 180 ÷ π <i>or</i> calculator to get 7. 5°	1	
			Total	5	

Que	stion)	Expected Answer	Mark	Rationale/Additional Guidance
23	а		$p = h \div \lambda$		
			$= 6.63 \times 10^{-34} \div 5.6 \times 10^{-7}$	1	
			= 1.184 x 10 ⁻²⁷	1	
			~ 1.2 x 10 ⁻²⁷ Ns		
	b		-2p	1	ALLOW –2.4 x 10 ⁻²⁷ Ns
			·		ALLOW left / away from sail
					ALLOW positive value
	С				ALLOW
			Momentum is conserved so sail must have opposite change in momentum / momentum change = +2p	1	sail applies force to photon (to reflect it)
			Force is change of momentum in unit/given time	1	so Newton 3 says force on sail
			Total	5	

Que	stion	Expected Answer	Mark	Rationale/Additional Guidance
24	а	Add lens power	1	ALLOW correct use of lens formula
		= 1.6 m ⁻¹	1	
	b	Move it to the left / closer to the lens	1	
	С	Smaller brighter	1 1	
		Total	5	
		Total Section B	20	

SECTION C

Que	estion	Expected Answer			Mark	Rationale/Additional Guidance
25	а	Elastic / obey Hooke's law			1	State property ALLOW strong, tough, ductile REJECT malleable
		(So that) returns to sh	nape, won't break,	won't crack	1	Explain
	b	Reduce parallax error	/ read scale accu	rately	1	
	С	Data in table:				
		100	17.2	2.8	7	
		150	15.8	4.2	∐	correct answer only
		200	14.4	5.6		
	d	Any mass ÷ compression <i>e.g.</i> 0.1 ÷ 2.8 = 0.3571		1		
		Use of 9.81 e.g.		= 0.3504	1	
		Correct unit e.g.	0.35(04) N	I/cm or 35 N/m	1	ALLOW >2sf
	е	Less compression (for the same force)		1		
		Because load is spread between more springs			1	ALLOW spring constant of the system increases when number of springs increases
		Total			9	

Que	estion	Expected Answer	Mark	Rationale/Additional Guidance
26	а	66 cm	1	
	b	(22 fps =>) = 1.0 ÷ 22 s per frame	1	
		= 0.0454545 s	1	
		(= 0.045s 2sf)		
	С	$s = d \div t$		
		= 12 /÷ 0.045	1	ALLOW x 22 fps
		= 264 cm.s ⁻¹	1	ALLOW 2.64 m s ⁻¹ ALLOW 220 + 44 cm s ⁻¹
	d	a = Δv ÷ Δt		
		Evidence of $\Delta v = 44$ cm.s ⁻¹ between frames	1	
		= 44 ÷ 0.045	1	
		= 9.68 m s ⁻²	1	
	е	ANY 1 FROM:	1	ALLOW answers that improve precision as defined in 'Language of measurement' i.e. If more
		lighter ball		precise, repeating the experiment will give results that are closer together'
		taller drop		that are closer together
		• use more fps		ALLOW augrection to improve the picture quality
		improved lighting / contrast background		ALLOW suggestion to improve the picture quality
		Total	9	

Que	estion	Expected Answer	Mark	Rationale/Additional Guidance
27	а	Energy (provided by the cell)	1	ALLOW Work done by cell
		Per unit charge (passing through)	1	
	b	V = E – Ir		
		$0.799 = 0.825 - 7.04 \times 10^{-6} \times r$	1	
		r = (0.825-0.799) ÷ 7.04x10 ⁻⁶	1	
		= 3690 Ω	1	
	ci	Treated as anomalies because:	1	
		do not fit the (rest of the) pattern		
		not on the line (which is predicted by established theory)		
		if the student knows of conditions that changed during the		
		experiment that make these points invalid		
	cii	Not treated as anomalies because:	1	
		are in a clear pattern (despite not on a line)		
		show a trend (increasing negative gradient despite not on a line)		
		can't be excluded without knowing more about experimental conditions		
	d i	0.82 V	1	ALLOW 3sf ALLOW 0.81-0.83

d	gradient calculation	1	
ii	= in range 2800 – 3300 Ω		
		1	
е	ANY answer/reason PAIR FROM:	2	
	 That value was only calculated with one point Using the graph gradient gives a better, 'averaged' 		ALLOW
	result / reduces effect of random error		 so graph probably represents a more realistic value for the p.d.s /currents generated
	OR		
	The graph has a curve to it / systematic effect		
	The line averages-out this effect / a single point is affected by this vs the line (allow better or worse)		
	OR		
	(worse because) The gradient is too shallow		
	Because I excluded the final points		
	Total	12	
	Total Section C Total Sections B & C	30 50	

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