…day June 20XX – Morning/Afternoon

AS Level Physics B (Advancing Physics)

H157/02   Physics in depth

SAMPLE MARK SCHEME

Duration: 1 hour 30 minutes

MAXIMUM MARK   70

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

SCORIS

1.   Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2.   Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3.   Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1.   Mark strictly to the mark scheme.

2.   Marks awarded must relate directly to the marking criteria.

3.   The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4.   If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5.   Work crossed out:

    a.   where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks

    b.   if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6.   Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7.   There is a NR (No Response) option. Award NR (No Response)

-        if there is nothing written at all in the answer space

-        OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')

-        OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8.   The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or e-mail.

9.   Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

- Read through the whole answer from start to finish.
- Decide the level that **best fits** the answer – match the quality of the answer to the closest level descriptor.
- To select a mark within the level, consider the following:
  Higher mark: A good match to main point, including communication statement (in italics), award the higher mark in the level
  Lower mark: Some aspects of level matches but key omissions in main point or communication statement (in italics), award lower mark in the level.

Level of response questions on this paper are **4d**, **5d, and 6f**.

11. **Annotations**

Annotation	Meaning
DO NOT ALLOW	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

12. **Subject-specific Marking Instructions**

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives

- the question paper

- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Section A

Question			Answer	Marks	Guidance
1	**(a)**		$mg\Delta h$ = 4.58 x 9.8 x 200 ✓ = 8980 (J) ✓	**2**	No sf penalty.
	(b)		Force = 8980/0.08 ✓ = 1.1(2) × 10^5 N✓	**2**	ecf from (a) or equivalent
	(c)		Force acting on cylinder from ground has increased ✓ Sensible reason, e.g. increased friction, compression of soil. ✓	**2**	Can gain second mark from discussing energy transfer; if a greater force is acting on the cylinder the same work is done over a shorter distance. AW
			Total	**6**	

Question			Answer	Marks	Guidance
2	(a)		Ns = kg m s^{-2} x s ✓ Clear cancelling of s to give stated units ✓	2	Must show clear working to gain both marks
	(b)	(i)	total momentum before collision = (0.6 x 6) + (0 x 6) ✓ = 3.6 (kg ms^{-1}) ✓	2	
		(ii)	Initial k.e = ½ x 0.6 x 6^2 = 10.8 (J) ✓ Final k.e. = 2.7 + 4.05 ✓ = 6. 75 (J) ✓	3	or ' 2.7 + 4.05 is less than 10.8 J' for third mark
		(iii)	Either: Impulse = 3.6 – 1.8 = 18 Ns✓ Force = 18/40 x 10^{-3} = 45 N ✓ Or: Force = m x a = 0.6 x ((6 – 3)/40 x 10^{-3}) = 0.6 x 75 ✓ = 45 N ✓ Sensible reason eg balls compress on contact, force decreases as second ball starts moving ✓	3	
			Total	10	

Question			Answer	Marks	Guidance
3	**(a)**		$640 \times 960 \times 8 \times 3 / 5 \times 10^6$ ✓ = 2.9 seconds ✓	**2**	
	(b)		$6.2 \times 10^9 \times 8 /(640 \times 960 \times 8 \times 3 \times 30)$ ✓ = 112 s ✓	**2**	
	(c)		Form of processing: Digital compression reduces file size ✓ Manipulating the original image to create a new image ✓ Benefits of processing: Files require less data storage ✓ Ability to Skype / rapid transmission of images ✓ Posting to social media ✓ Reducing "red-eye" ✓ Creating artistic effects ✓ Risks/disadvantages of processing: Manipulation of images to alter opinions ✓ Reduction in resolution ✓ Implications: Keeping families and friends in contact ✓ Cyber bullying using manipulated photos ✓	**3**	Three marks can be gained by looking at implications, risks and benefits of a single facet.
			Total	**7**	

Section B

Question			Answer	Marks	Guidance
4	**(a)**		(light at both slits) has constant phase relationship/difference ✓	**1**	AW
	(b)		fringe spacing = 35 x 10^{-3}/6 = 5.8 x10^{-3} (m) ✓ λ = 5.8 x 10^{-3} x 2.5 x 10^{-4}/2.3 ✓ = 6.3 x 10^{-7} m ✓	**3**	Or, from nλ = d sinθ and calculating sine of the angle.
	(c)	**(i)**	two arrows of same length at 180° ✓	**1**	
		(ii)	First pair showing simple addition✓ Second pair showing right angled triangle✓	**2**	Phasor arrows must be tip-to-tail.
		(iii)	Calculating relative amplitude^2 of each phasor pair (= 4/2)✓ ratio given as 2✓	**2**	First mark can be via direct measurement and squaring or by simple proportion. Bald answer worth two marks.

Question			Answer	Marks	Guidance
4	(d)*		**Level 3 (5–6 marks)** Marshals argument in a clear manner linking the problems of wave model or simple particle model with two pieces of evidence (interference pattern and developing picture) Recognises the crucial nature of the probabilistic interpretation in explaining both pieces of evidence with the phasor model. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Considers at least two aspects of the argument. Includes some understanding of the role of probability. *There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.* **Level 1 (1–2 marks)** Makes at least two independent points that are relevant to the argument. Structuring of the answer may be poor. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No response or no response worthy of credit.	6	**Indicative scientific points may include:** **Limitations of wave model:** • Image will always be the same variation of intensity as the final image. • The image will never show the random nature of the low exposures shown in the figure. **Limitations of particle model:** • Interference pattern requires superposition • (classical) particles cannot superpose • No interference pattern would be observed if (classical) particles passed through the slits. **Phasor model:** • Inteference pattern can be explained by adding phasors from the two slits. • Recap of phasor explanation of interference pattern using ideas from earlier in the question. • This gives a probability of arrival, not a (simple) wave amplitude. • Because the resultant amplitude gives a probability of arrival it explains the random nature of the early exposures.
			Total	15	

Question			Answer	Marks	Guidance
5	(a)		Graph is straight line through origin/ force is proportional to extension. ✓	1	
	(b)		Suitable pair of values for F, x. ✓ Correct calculation of c.s.a = 1.26×10^{-7} m^2 ✓ Substitution into equation using suitable pair of values✓ Calculation to answer of 2.2×10^{11} (N m^{-2}) ✓	4	If diameter used rather than radius maximum of 3 marks are available.
	(c)	(i)	X marked on 240, 0.115 +/- one small square ✓	1	
		(ii)	Ratio of stress: strain gives stiffness✓ Stiffness decreases from 0.2% to 0.5 %✓	2	Accept gradient

SPECIMEN

Question			Answer	Marks	Guidance
5	(d)*		**Level 3 (5–6 marks)** Marshals argument in a clear manner giving clear reasoning at all points. Each part of the question fully covered and the connection made between elastic behaviour, plastic behaviour and allowing in microscopic terms. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Covers at least two aspects of the argument. May not link the aspects together. Shows understanding of the basic model of a metal. *There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.* **Level 1 (1–2 marks)** Makes at least two independent points that are relevant to the argument. Structuring of the answer may be poor. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No response or no response worthy of credit.	6	**Indicative scientific points may include:** **Elastic behaviour** • metal described as positive ions in a sea (AW) of free electrons • interatomic (interionic) spacing increasing as metal is put under tension • this increase in spacing is uniform (parallel to tension) • when tensile force removed atomic separation returns to initial values. • no energy lost in stretching and relaxing elastically. **Plastic behaviour** • planes of atoms slide (AW) over one another • dislocations allow plastic behaviour to occur at a lower stress. • dislocation allow bonds to be broken one bond at a time. **Effect of Alloying** • foreign/guest atoms pin down dislocations • this makes slip less likely/ planes move over shorter distances
			Total	14	

SECTION C

Question			Answer	Marks	Guidance
6	(a)		High resistance means that negligible current flows through the voltmeter✓ Negligible resistance means that pd across the ammeter is minimal/reduced so that it does not affect the readings ✓	2	Or resistance of voltmeter-resistor pair is v. close to that of the resistor alone.
	(b)		(Suggestion is incorrect) Increased resistance gives lower current ✓ Constant absolute uncertainty AW ✓ with lower current values give a higher % uncertainty ✓	3	
	(c)		Points plotted correctly ✓ Correct line of best fit drawn ✓	2	
	(d)		3 (V)✓ correct unit (V)✓	2	Allow ± 0.1V. ecf for their line of best fit.
	(e)		Correct method for calculating gradient ✓ *x* values > 750 mA ✓ 0.5Ω ✓	3	Allow ±0.1Ω
	(f)*		**Level 3 (5–6 marks)** Constructs argument in a clear manner giving clear reasoning at all points. Each part of the question fully covered and the connection made with data on the graph. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Covers at least two aspects of the argument. May not link the aspects together. Shows understanding of the effect on uncertainties.	6	**Indicative scientific points may include:** **Adding switch** • Idea of reducing heating effect • No energy lost/draining of the battery/cells. • Improved reliability **Adding another cell** • Increase in pd -> increase in current • Change to the overall resistance • % uncertainty in current reading reduces • Graph would have a steeper gradient and higher intercept **Reversing the cell** • Reduces the pd -> reduces the current flow • % uncertainty would increase.

Question			Answer	Marks	Guidance
			There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence. **Level 1 (1–2 marks)** Makes at least two independent points that are relevant to the argument. Structuring of the answer may be poor. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No response or no response worthy of credit.		• Overall internal resistance would be the same • Would produce a lower intercept but same gradient.
			Total	18	