OCR
Oxford Cambridge and RSA

…day June 20XX–Morning/Afternoon

AS Level Physics A

H156/01 Breadth in physics

SAMPLE MARK SCHEME

Duration: 1 hour 30 minutes

MAXIMUM MARK 70

This document consists of 16 pages

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. **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

11. 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.

CATEGORISATION OF MARKS

The marking schemes categorise marks on the MACB scheme.

B marks: These are awarded as independent marks, which do not depend on other marks. For a **B**-mark to be scored, the point to which it refers must be seen specifically in the candidate's answers.

M marks: These are method marks upon which **A**-marks (accuracy marks) later depend. For an **M**-mark to be scored, the point to which it refers must be seen in the candidate's answers. If a candidate fails to score a particular **M**-mark, then none of the dependent **A**-marks can be scored.

C marks: These are compensatory method marks which can be scored even if the points to which they refer are not written down by the candidate, providing subsequent working gives evidence that they must have known it. For example, if an equation carries a **C**-mark and the candidate does not write down the actual equation but does correct working which shows the candidate knew the equation, then the **C**-mark is given.

A marks: These are accuracy or answer marks, which either depend on an **M**-mark, or allow a **C**-mark to be scored.

Note about significant figures:

If the data given in a question is to 2 sf, then allow to 2 or more significant figures.
If an answer is given to fewer than 2 sf, then penalise once only in the entire paper.
Any exception to this rule will be mentioned in the Additional Guidance.

SECTION A

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

SECTION B

Question			Answer	Marks	Guidance
21	(a)		A quantity that has both direction and magnitude. Correct example given, e.g. velocity.	B1	**Note**: The B1 mark is for a correct statement and a correct example.
	(b)	(i)	speed = $\frac{2 \times \pi \times 0.60}{20}$ speed = 0.19 (m s^{-1})	C1 A1	
		(ii)	Displacement is the direct distance of the locomotive from **A**, so the graph is symmetrical about t = 10 s. At t = 20 s it returns back to **A or** at t = 10 s it is 1.2 m from **A or** at t = 10 s, it is at **C**.	B1 B1	
	(c)		resultant force = $(7.0^2 + 5.0^2 - 2 \times 7.0 \times 5.0 \times \cos 40)^{1/2}$ resultant force = 4.51 (N) acceleration = 4.51/0.320 = 14 (m s^{-2})	C1 C1 A1	**Allow**: resultant force = $[(7.0 - 5.0\times\cos 40)^2 + (5.0\times\sin 40)^2]^{1/2}$ **Allow** full marks for a correct scale drawing to determine the resultant force; resultant force = 4.5 $\pm$ 0.1 N **Allow** full marks for resolving into horizontal and vertical components and combining correctly.
			Total	8	

Question			Answer	Marks	Guidance
22	(a)		Gradient of graph is equal to acceleration. The acceleration decreases as time increases.	B1 B1	
	(b)		Correct use of light-gate and timer **or** light-gate and data-logger **or** video technique to determine time interval. Speed determined by dividing length of car **or** interrupt card by time taken (to pass through light gate). Mass of car determined using scales and KE = ½ × mass × speed^2.	B1 B1 B1	
	(c)	(i)	There is friction. GPE is transferred to KE and heat **or** thermal (energy).	B1	
		(ii)	work done = (0.50 – 0.36) (J) **or** work done = 0.14 (J) $F \times 0.90 = 0.14$, therefore resistive force = 0.16 (N)	C1 A1	
			Total	**8**	

Question			Answer	Marks	Guidance
23	(a)		1.6 ($\times 10^{-3}$ m).	B1	
	(b)	(i)	Data point plotted to within $\pm$ ½ small square and correct line of best fit though all the data points.	B1	
		(ii)	Gradient of line determined. E = gradient = $(8.8 \pm 0.1) \times 10^{10}$ (Pa).	M1 A1	**Allow** 1 mark for $(8.8 \pm 0.1) \times 10^{n}$ Pa; where $n \neq 10$
	(c)		The actual cross-sectional area will be smaller. The actual stress values on the graph will be larger (because stress $\propto$ area^{-1}) The gradient of the graph will be larger; hence the Young modulus of the metal must be larger than the student's value.	B1 B1 B1	
			Total	7	

Question			Answer	Marks	Guidance
24	(a)		Fig. 4.1: total resistance = 3*R* Fig. 4.2: total resistance = 2*R*/3 ratio = $\frac{V}{3R} \div \frac{V}{2R/3}$ = 0.22	C1 C1 A1	 **Allow**: 2/9
	(b)		Any **three** from: • Total resistance of the lamps increases by a factor of 1.5. • Resistance of each lamp increases with current. • Resistance increases because of increased temperature. • Lamps are non-ohmic components.	B1×3	
	(c)	(i)	resistance = 1.80/0.026 (= 69.2 Ω) resistivity $= \frac{69.2 \times 1.3 \times 10^{-7}}{0.75}$ = 1.2 × 10^{-5} (Ω m)	C1 A1	
		(ii)	Contact resistance due to croc clips hence the resistance in the circuit must be greater. **or** Heating of wire hence the resistance of the wire increases. **or** (Finite) resistance of ammeter hence the total resistance of circuit increases. **or** Actual length between croc-clips is shorter or < 0.75 m; hence resistance of wire is greater.	B1 B1	**Allow**: Correct zero error on meters (e.g voltmeter reading is 'higher' or ammeter reading is 'lower') hence the (determined) resistance is greater.
			Total	10	

Question			Answer	Marks	Guidance
25	(a)		There is a constant phase difference between the waves.	B1	
	(b)		The net amplitude is non-zero. Destructive interference occurs.	B1 B1	
	(c)	(i)	Bright fringes are due to constructive interference and the dark fringes are due to destructive interference. Path difference is $n\lambda$ **or** phase difference is 0° at positions of bright fringes. Path difference is $(n + ½)\lambda$ **or** phase difference is 180° at positions of dark fringes.	B1 B1 B1	
		(ii)	**A** emits shorter wavelength of light. Since $x = \frac{\lambda D}{a} \propto \lambda$, the separation between the adjacent fringes is smaller.	B1	
		(iii)	There is no interference of light from the two slits **or** the bands disappear **or** there is only diffraction from a single slit.	B1	
			Total	8	

Question			Answer	Marks	Guidance
26	(a)	(i)	Less energy used from power stations, which in turn produce less carbon dioxide emissions and hence less environmental damage **or** Infrequent need for disposal of LED lamps has less impact on landfill sites or use of natural resources.	**B1**	
		(ii)	The energy of a photon depends on the wavelength **or** frequency. Energy does not depend on intensity therefore energy of the photon is the same.	**B1** **B1**	
	(b)	(i)	Electrons behave **or** travel as waves. The rings demonstrate that the electrons are diffracted by individual carbon atoms / spacing between carbon atoms. The (de Broglie) wavelength of the electrons is comparable to the 'size' of the carbon atoms or the spacing between carbon atoms.	**B1** **B1** **B1**	
		(ii)	$v^2 = \frac{1.6\times10^{-19}\times1200}{0.5\times9.11\times10^{-31}}$ or $v = 2.053..\times10^7$ (m s^{-1}) $\lambda = \frac{6.63\times10^{-34}}{9.11\times10^{-31}\times2.053\times10^7}$ wavelength = 3.5×10^{-11} (m)	**C1** **C1**	Correct use of $\frac{1}{2}mv^2 = eV$
		(iii)	Results published to allow peer review Procedure shared with other scientists to allow replication	**B1**	
			Total	**9**	

Summary of updates

Date	Version	Change
January 2019	2.0	Addition to the rubric clarifying the general rule that working should be shown for any calculation questions

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