Oxford Cambridge and RSA

day June 20XX – Morning/Afternoon

AS Level Physics B (Advancing Physics)
H157/01   Foundations of 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.

Section A

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

Section B

Question			Answer	Marks	Guidance
21	**(a)**		correct orientated vector triangle with resultant labelled ✓ mag. = $\sqrt{(200^2 + 50^2)}$ = 206 **or** 210 (m s^{-1}) ✓ direction θ (E of N **or** bearing) = tan^{-1} (50/200) =14° ✓	**3**	diagram correct evaluation evaluation accept scale drawing method for full marks in ranges: 210 ± 10 m s^{-1} and 14° ± 2°
	(b)		$\sqrt{(200^2 - 50^2)}$ = 194 (m s^{-1})**or** 190 (m s^{-1}) ✓	**1**	no credit for just correct new vector diagram
			Total	**4**	

Question			Answer	Marks	Guidance
22	**(a)**		**AD** ‹ **BC** both distances covered in same time **or** λ decreases in 2nd medium ✓	**1**	(whilst *f* remains constant)
	(b)		angle *r* = angle ACD correctly indicated and labelled ✓	**1**	
	(c)		= **BC** / **AD** ✓ = (**BC/AC**)/(**AD/AC**) **and** = **BC** / **AD** ✓	**2**	first equation Δ*t*'s cancel second equation **AC**'s cancel and both elements for 1 mark
			Total	**4**	

Question			Answer	Marks	Guidance
23	**(a)**		½ λ vibration shown with antinode at centre ✓	**1**	
	(b)		*f* = *v* / λ = 660/(2 x 0.75) ✓ = 440 (Hz) ✓	**2**	allow ecf from **3(a)** method must remember to take λ = 2 x *L* of string evaluation 880 (Hz) scores 1 mark
			Total	**3**	

Question			Answer	Marks	Guidance
24	**(a)**		(curvature added $P = 1/(0.080)$) $= 12.5$ (D) ✓	**1**	Correct answer gains 1 mark
	(b)		$1/v = $ curvature out of lens $= -1/0.082 + 12.5 = 0.305$ (D) ✓ $v = 1/0.305 = 3.28$ **or** 3.3 (m) ✓	**2**	Method evaluation
	(c)		($M = v/u = 3.28/0.082$) $= 40$ ✓	**1**	ecf on v from (b) Correct answer gains 1 mark
			Total	**4**	
Question			Answer	Marks	Guidance
25	**(a)**		edge detection ✓	**1**	
	(b)		pixels across $D = (2.2/6.5) \times 315 \approx 110$ ✓ resolution $= 0.1/110 = 9.4 \times 10^{-4}$ (m pixel^{-1}) ✓	**2**	**allow** $(2.2/5.3) \times 260 \approx 110$ **accept** in range 105 to 115 **accept** in range $(9.0 \text{ to } 9.8) \times 10^{-4}$ (m pixel^{-1})
			Total	**3**	
Question			Answer	Marks	Guidance
26			(electric) charge / C ✓ J C^{-1} **or** V ✓	**2**	**accept** electronic charges or electrons / C
			Total	**2**	

SECTION C

Question			Answer	Marks	Guidance
27	(a)		$F \alpha x$ **or** force directly proportional to compression **or** linear **and** through origin ✓	1	accept proportionalities with variables reversed
	(b)		$E = \frac{1}{2} F x$ **or** area under the graph ✓ $= \frac{1}{2} \times 20 \times 0.06$ ($= 0.60$ J) ✓	2	accept $E = \frac{1}{2} k x^2$ with $k = 330$ N m^{-1}
	(c)	(i)	$\frac{1}{2} m v^2 = \frac{1}{2} Fx \rightarrow v = \sqrt{(Fx/m)}$ ✓ $v = \sqrt{(20 \times 0.06/0.03)} = 6.3$ (m s^{-1}) ✓ $v_h = 6.3 \cos 60° = 3.2$ (m s^{-1}) ✓ $v_v = 6.3 \sin 60° = 5.5$ (m s^{-1}) ✓	4	accept $\frac{1}{2} m v^2 = 0.60 \rightarrow v = \sqrt{(2 \times 0.60/m)}$
	(c)	(ii)	 p.e. gained = k.e. lost **or** apply equations of motion ✓ $mgh = \frac{1}{2} mv_v^2 \rightarrow h = v_v^2/(2g)$ ✓ $= 1.5(2)$ (m) ✓	3	*alternative method* $v^2 = u^2 + 2as$ $0^2 = v_v^2 - 2gs \rightarrow s = v_v^2/(2g)$ **allow** 1 mark for using v_{total} gives 2.0(3) (m)
			Total	10	

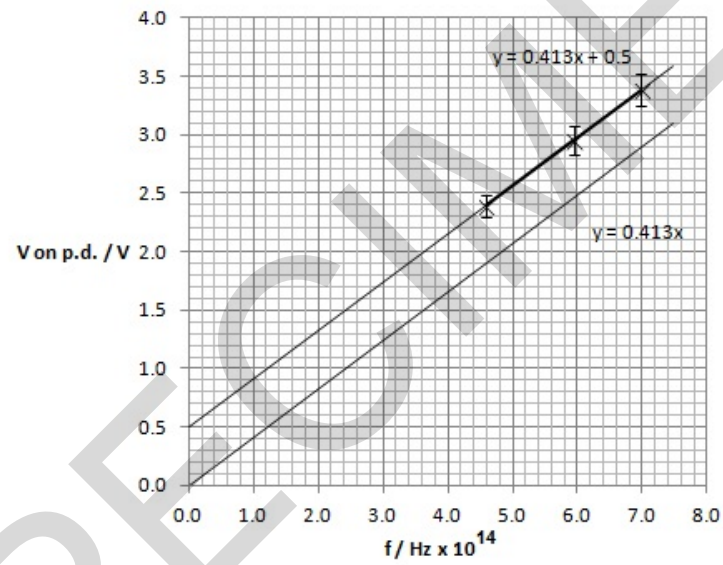| Question			Answer	Marks	Guidance
28	(a)		equal increments on axis represent equal factors **or** each small division is x10 **or** each large division is x10^5 ✓	1	
	(b)		$(10^{29} / 10^{18}) = 10^{11}$ ✓	1	Correct answer gains 1 mark
	(c)	(i)	the number of free electrons per m^3 of material ✓	1	**accept** ions **or** holes free to move per m^3 of material
	(c)	(ii)	1 m^3/(volume per atom) **or** sensible assumption ✓ accept answers in range 5 x 10^{28} to 2 x10^{29} m^{-3} ✓	2	method stated find number of atoms m^{-3} **or** any sensible assumption from: • packing fraction between 0.6 and 1 • volume of atom D^3 **or** $4\pi R^3/3$ • 1 or 2 free electrons per atom credit bare estimates in this range 1 mark max
	(d)		$\sigma = GL/A = 4L/(R \times \pi D^2)$ **or** correct values ✓ $= 1.6 \times 10^3$ (S m^{-1}) ✓	2	method **accept** $\sigma = L/(R \times \pi r^2)$ **or** $\rho = RA/L$ correct evaluation
			Total	7	

Question			Answer	Marks	Guidance
29	(a)	(i)	1 a sensitive ammeter in series with LED as V increased find the p.d. value when it starts conducting ✓ 2 black-out and shaded vision tube to judge V value when visible light is first observed as V increased ✓	2	accept galvanometer or µA or mA meter **accept** 1 & 2 either way round
	(a)	(ii)	fully functioning circuit with variable supply / potential divider, LED with voltmeter in parallel(if ammeter used must be in series) ✓	1	with series current limiting resistor good but **NOT** a series variable resistor to control circuit
	(b)	(i)	bottom line of table completed correctly ✓ h = 8.0 ± 0.3 x 10^{-34} Js ✓ estimate with uncertainty in range (0.2 to 0.5) x 10^{-34} Js ✓ anomaly of 5.38 identified in the table ✓	4	allow table <table><tr><td>inc all data</td><td>4.04</td><td>6.46</td><td>9.3</td></tr><tr><td>exc V_3 = 5.38</td><td>3.38</td><td>5.41</td><td>7.7</td></tr><tr><td>inc V_3 = 3.38</td><td>3.38</td><td>5.41</td><td>7.7</td></tr></table> allow 1 S.F. estimates i.e. (8 or 9) x 10^{-34} Js allow ecf if outlier counted in

Question			Answer	Marks	Guidance
29	(b)	(ii)	points with uncertainties plotted by dot plot or ± bars ✓ extended best fit line, not through origin – see below ✓ $V = hf/e \rightarrow h = e$ xgradient / 1.6 x 10^{-19} x 0.41 x 10^{-14} ✓ $h = (6.6 \pm 0.3)$ x 10^{-34}(Js) ✓	4	allow ecf if outlier is used for a point allow ecf if outlier used in best fit line correct method attempted: algebra / numbers / words **accept** uncertainties in range (0.2 to 0.5) x 10^{-34} (Js) **NOT** ecf on use of outlier for evaluation mark

Question			Answer	Marks	Guidance
29	**(b)**	**(iii)**	better value h from gradient of graph because: range includes h_{true} **or** smaller ± uncertainty **or** more precise **or** effect of systematic error can be seen and eliminated✓ repeat and check linearity for more colours of LED **or** systematic error on voltmeter used of + 0.50 V due to graph intercept **or** check calibration of voltmeter **or** change voltmeter and repeat due to graph intercept ✓	**2**	comment on h suggestion for improvement
			Total	**13**	