GCE A LEVEL MARKING SCHEME

SUMMER 2025

A LEVEL
PHYSICS – COMPONENT 2
A420U20-1

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

GCE A LEVEL PHYSICS

COMPONENT 2 – ELECTRICITY AND THE UNIVERSE

SUMMER 2025 MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks
Examiners must mark in red ink.
One tick must equate to one mark (except for the extended response question).
Question totals should be written in the box at the end of the question.
Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules
All work should be seen to have been marked.
Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.
Crossed out responses not replaced should be marked.
Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question
A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statement.

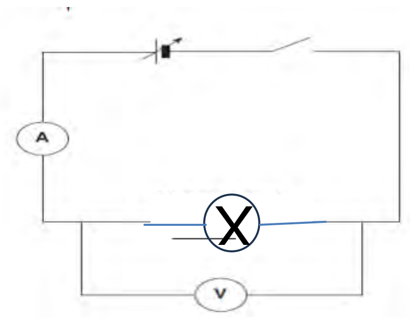
Marking abbreviations
The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

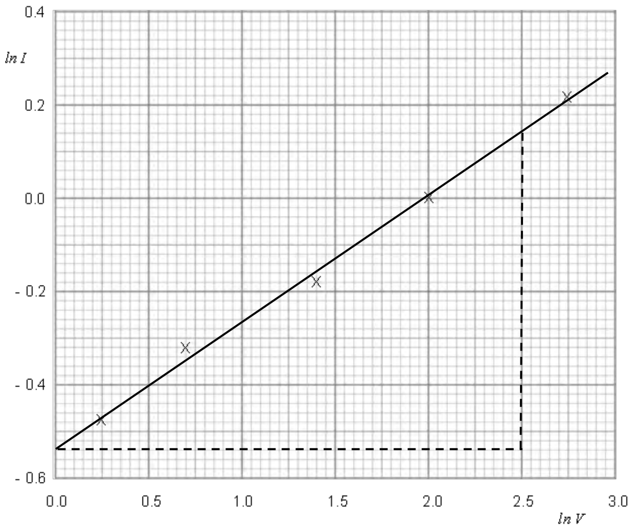
cao	=	correct answer only
ecf	=	error carried forward
bod	=	benefit of doubt

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)	Copper ('it') allows **charge (or electrons) to {pass / flow}** through it (1) Accept contains free / delocalised electrons. Don't accept reference to current without explanation in terms of charge or electrons	1			1		
		(ii)	Diagram (e.g. cylinder) with l and A (or d or r) labelled (1) Volume = vtA or lA - can be obtained from diagram (1) No of free electrons in this volume = $vtAn$ or lAn (1) Divide by t **and** multiply by e to show: Current = $\frac{vtAne}{t}$ or $\frac{lAne}{t}$ (1) Need to see statement defining N or n – deduct 1 mark if not seen **Alternative:** Diagram (e.g. cylinder) with v and A labelled (1) Volume swept per second = vA (1) Number of electrons passing point/sec = nvA (1) $I = nAve$ (charge per second) (1)	4			4	2	
		(iii)	Recognition that I, n, e are same in both wires e.g. $n \times A_{0.2} \times 6.0 \times 10^{-4} \times e = n \times A_{0.3} \times v \times e$ **or** look for $\frac{4}{9}$ (or 0.444) $\times$ 6.0 $\times$ 10^{-4} (1) or by implication $v = 2.67 \times 10^{-4}$ [m s^{-1}] (1) don't accept 2.6×10^{-4} [m s^{-1}]		2		2	2	

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)	Charge calculated: $0.15 \times 4 \times 3600 = 2160$ [C] (1)		1				
			EMF shown as $\frac{12\,960}{2160}$ (or 6) (**ecf** on Q) **J C^{-1} or V** (1)	1					
			PD shown as $\frac{11\ 664}{2160}$ (or 5.4) (**ecf** on Q) **J C^{-1} or V** (1)		1				
			Units must be shown to award 2nd and 3rd marks. **Alternative two step:** $P = \frac{W}{t}$ e.g. $\frac{12\,960}{4 \times 3600} = 0.9$ [W] $E = \frac{P}{I} = \frac{0.9}{0.15} = 6$ [V] And repeat for p.d. so Calculation of P i.e. $\frac{W}{t}$ (1) Calculation of $V = \frac{P}{I}$ (1) $\times$ 2 answers and units (1)				3	2	

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
		(ii)	[Award charge mark in (b)(i) if 2160 [C] calculated here] Concept of 'lost' volts (1) e.g. 1. 6.0 – 5.4 (or 0.6) or 2. $\frac{12\,960}{2160} - \frac{11\,664}{2160}$ (**Not** 12 860 – 11 664) $r = \frac{0.6}{0.15}$ = 4 [Ω] (1) Answer gains both marks (**ecf** on 6.0 and 5.4) Marks may be awarded for direct use of $r = \frac{(E - V)}{I}$		2		2	2	
			Question 1 total	**6**	**6**	**0**	**12**	**8**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)		 Note: switch optional Variable resistor or potentiometer could be used as alternatives for varying pd in a correct circuit	1			1		2
	(b)		$\ln I = \boldsymbol{n}\mathbf{ln}\boldsymbol{V} + \mathbf{ln}\boldsymbol{k}$ (order not important)		1		1	1	1

<table>
<tr><th colspan="3" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td></td><td></td><td></td><td>6</td><td>6</td><td>5</td><td>6</td></tr>
<tr><td></td><td></td><td></td><td>Acceptable line of best fit (see above) (1)
Large triangle (should be close to extremities of the line of best fit i.e. over half the line used i.e. the base has to be ≥ 1.5) or values taken at extremities or 2 widely spaced points (1)
Gradient calculated correctly (1) (e.g. $\frac{0.68}{2.5}$ or 0.27[2] ignore sig figs)
Intercept determined correctly (1) (e.g. – 0.54)
k calculated correctly (1) (e.g. from intercept i.e. 0.58) (if the intercept is left as positive then k = 1.75 2 marks will be lost apply ecf for final equation)
Equation written correctly with values of n and k to 2 or 3 sig figs. Apply ecf for incorrect values of n and k (1) no need for consistency
e.g. $I = 0.58V^{0.27}$ accept $I = 0.6V^{0.3}$ or accept in log equation form:
$\ln I = 0.27\,\mathbf{\ln V} + \mathbf{\ln}\,(0.58)$</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Question			Marking details	AO1	AO2	AO3	Total	Maths	Prac
				Marks available					
		(ii)	Some spread with data points - they do not lie close to LOBF **or** data points make it difficult to determine best line of fit or equivalent (1) (Don't accept only 5 data points.) Take more readings (increase range) **or** smaller intervals between readings (1) Accept repeat (or re-take) readings **and** determine mean values **OR** repeat readings **and** relevant link to uncertainties or error bars			2	2		2
	(d)		Current or y-intercept will increase × **3** (or resistance will reduce by **factor 3**) (for each value of pd) (1) Hence k will treble **or** k = 1.8 (depends on candidate value from (c)(i)) (1) No change in n (1) Explanation e.g. $kV^n + kV^n + kV^n = 3kV^n$ **or** each lamp still receives the same voltage or equivalent (1)		4		4	2	4
			Question 2 total	**1**	**5**	**8**	**14**	**8**	**14**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)		$R = \frac{V}{I}$ **and** volt per amp stated (or $V\,A^{-1}$) (1) Volt given as $J\,C^{-1}$ **and** Amp given as $C\,s^{-1}$ (1) $\frac{\text{volt}}{\text{amp}}$ expressed algebraically e.g $\frac{J\,C^{-1}}{C\,s^{-1}}$ (1) (Could award 2nd mark from this or in equation form). **Alternative: Power approach:** 1st mark as above Power given as $J\,s^{-1}$ and Amp given as $C\,s^{-1}$ (1) $\frac{P}{I^2}$ expressed algebraically e.g. $\frac{J\,s^{-1}}{(C\,s^{-1})^2}$ (1) (Could award 2nd mark from this or in equation form) **Or:** 1st mark as above Power given as $J\,s^{-1}$ and Volt given as $J\,C^{-1}$ (1) $\frac{V^2}{P}$ expressed algebraically e.g. $\frac{(J\,C^{-1})^2}{J\,s^{-1}}$ (1) (Could award 2nd mark from this or in equation form)	1 1	1		3	2	

Question			Marking details	AO1	AO2	AO3	Total	Maths	Prac
				Marks available					
	(b)	(i)	$V_D = \frac{1600}{2000} \times 10$ (1) $V_D = 8.0$ [V] (1) **Alternative:** $I = \frac{10}{2000}$ [= 0.005 A] (1) $V_{LDR} = 0.005 \times 1600 = 8.0$ [V] (1)	1	1		2	1	
		(ii)	**2.0** (1) = $\frac{R_{combination}}{320 + R_{combination}} \times 10$ $R_{combination} = 80$ [Ω] (1) $\frac{1}{80} = \frac{1}{400} + \frac{1}{R}$ (1) $R = 100$ [Ω] seen (1) **Alternative (1) for the 1st 2 marks:** $I_{LDR} = \frac{8}{320} = 0.025$ [A] (1) $R_{combination} = \frac{2}{0.025} = 80$ [Ω] (1) **Alternative (2) for the 1st 2 marks:** $8 = \frac{320}{320 + R_{combination}}$ (1) $8\,R_{combination} + 2560 = 3200$ so $R_{combination} = \frac{640}{8} = 80$ [Ω] (1)	1 1	1 1		4	3	

Question			Marking details	AO1	AO2	AO3	Total	Maths	Prac
			Alternative: R_{LDR} = 320 [Ω], when V_{LDR} = 8 V, $I = \frac{8}{320}$ = 0.025 [A] (1) V_{R} = 10 - 8 = 2 [V], current through 400 Ω = $\frac{2}{400}$ = 5 × 10^{-3} [A] (1) So current through R = 0.025 – 0.005 = 0.02 [A] (1) So R = $\frac{2}{0.02}$ = 100 [Ω] (1) **Alternative** using 100 Ω to show V across combination = 2 V: Substitution into parallel R equation (1) $R_{\text{comination}}$ shown to be 80 Ω (1) Substitution into potential divider equation (1) $V_{\text{comination}}$ shown to be 2.0 V (1)						
	(c)		Use of $R = \frac{\rho l}{A}$ **and** A = 2.01 × 10^{-8} [m²] (1) $l = \frac{(100 \times 2.01 \times 10^{-8})}{1.1 \times 10^{-6}}$ = 1.83 [m] (1) accept 1.8 [m] **Alternative:** Use $R = \frac{\rho l}{A}$ **and** A = 2.01 × 10^{-8} [m²] where R = 109 [Ω] (1) Ratio: $\frac{100}{109} \times 2$ = 1.83 [m] (1) Comment: Cut wire to 1.83 [m] **or** use 1.83 [m] of wire **or** cut 0.17 [m] from wire or equivalent (1)			3	3	2	
			Question 3 total	**5**	**4**	**3**	**12**	**8**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
4	(a)		**Indicative content:** When the switch is closed electrons flow from the negative terminal on to plate Y and from plate X towards the positive terminal at the same rate. Initially the readings on the ammeter are at their maximum (given by $I = \frac{V}{R}$) but decrease with time until they reach zero. The reading / deflection on the ammeter indicates that the electron [charge] flow is in the same direction around the circuit. The charge build-up on plates X and Y oppose further electron flow and as these charges increase so does the pd between the plates until it equals that of the supply. As the pd across the capacitor increases, the pd across the resistor decreases and the current decreases. The voltmeter reading increases from an initial value of 0 V up to the value of the supply voltage. Electron flow then stops. The capacitor plates have equal but opposite charges on them. Plate Y is negatively charged and plate X is positively charged. Additional response which can be treated as neutral: • The rate of increase (of Q or V) / decrease (of I) dependent on R and C. • Candidates may use the terms ‘exponential’ or ‘time-constant’ in their responses.	4	2		6		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				5-6 marks A comprehensive description of the process is provided. *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.* **3-4 marks** A basic description of the process is provided. *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure.* **1-2 marks** A very limited description of the process is provided. *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure.* **0 marks** *No attempt made or no response worthy of credit.*						
	(b)	(i)	I	$V = V_0 e^{-\frac{t}{CR}}$ **or** $Q = CV$ **and** $Q = Q_0 e^{-\frac{t}{RC}}$ (1) Substitution and valid step using logs (1) $t = 4.4 \times 10^{-4}$ [s] (1) Answer gains full marks	1	1 1		3	2	
			II	$v = \dfrac{0.1}{4.4 \times 10^{-4}}$ **ecf** on t $v = 227$ [m s^{-1}]	1			1	1	

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
		(ii)	Application of C of M: $0.54 \times 10^{-3} \times v = (0.6 + 0.54 \times 10^{-3}) \times 0.2$ (1) Award mark if mass of bullet omitted on RHS, but not if incorrectly used e.g. 0.654 seen. $v = 222$ [m s^{-1}] (1) Relevant comment e.g. good consistency or within x% of each other or ratio calculated etc (1) (**ecf**) **Alternative:** Application of C of M: $0.54 \times 10^{-3} \times 227$ (**ecf**) $= (0.6 + 0.54 \times 10^{-3}) \times v$ (1) Award mark if mass of bullet omitted on RHS, but not if incorrectly used e.g. 0.654 seen. v = 0.2043 [m s^{-1}] (1) Relevant comment e.g. good consistency or within x% of each other or ratio calculated etc (1) (**ecf**)			3	3	3	
			Question 4 total	**6**	**4**	**3**	**13**	**7**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)		Appropriate diagram [or good description] to include: rubber band supported vertically, ruler [can credit from method], {weights / masses} (or force-meter attached to band) (1) Accept horizontal valid setup Method. **Award 1 mark for both** of the following: • Add {weights / masses} in [incremental] steps • Place ruler at appropriate point relative to band or use optical pin (or equivalent e.g. at eye level) [can credit from diagram] Measuring extension. **Award 1 mark for:** Measure original length, then stretched length and subtract to find extension **or** measure <u>difference</u> in length **Or:** **Set ruler to zero** at low weight / band taut but not extended **and read extension directly** [or equivalent]	3			3		3
	(b)	(i)	Substitution: $E = \frac{(5 \times 0.12)}{(3.2 \times 10^{-3} \times 0.6 \times 10^{-3} \times 0.1)}$ (1) E = 3.125 × 10^6 [N m^{-2}] (1) accept 3.1 **Alternatives:** Substituting 3 values correctly (1) to determine / confirm 4th (1) **Accept:** $\frac{F}{e} = \frac{EA}{l}$ so $\frac{5}{0.1} = \frac{3 \times 10^6 \times (3.2 \times 10^{-3} \times 0.6 \times 10^{-3})}{0.12}$ (1) (50 ≈ 48) (1)			2	2	2	

Question			Marking details	AO1	AO2	AO3	Total	Maths	Prac
				Marks available					
		(ii)	BC: **molecules unravel** (accept untangle or C-C bond rotation or chains straightening) [under the action of a force] (1) CD: molecules become fully stretched / strong forces between atoms within molecule (1)	2			2		
		(iii)	Area BC determined: $(5 \times 0.2) + (0.5 \times 0.2 \times 2.5) = 1.25$ [J] (1) Area CD determined: $(7.5 \times 0.15) + (0.5 \times 0.15 \times 10) = 1.875$ [J] (1) $\frac{1.875}{1.25} = 1.5$ (1) **ecf** Accept counting squares method Deduct 1 mark for power of 10 slips		3		3	3	
	(c)		Hysteresis is energy lost [as heat] in cycles of stretching and unstretching or loading and unloading (1) Large cycle of stretching / unstretching with underinflated tyres or more hysteresis or large changes in shape (1) Leading to large energy loss / tyre becomes hot / additional fuel loss / added rolling resistance / tyres more easily damaged (1)			3	3		
			Question 5 total	**5**	**3**	**5**	**13**	**5**	**3**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6	(a)		Both required: • **unit or coulomb** (positive charge…) • …. **from infinity** to that point….	1			1		
	(b)	(i)	E at P due to A = 2160 [N C^{-1}] (to the right) (1) E at P due to B = 240 [N C^{-1}] (to the left) (1) Net E = 1920 [N C^{-1}] **to the right or to B** (magnitude and direction required) (1) **Alternative:** Correct algebraic application of intensity equation i.e. subtraction seen (below) (1) $E = 9 \times 10^9 \times (9.6 \times 10^{-19}) \left[\dfrac{1}{[(2 \times 10^{-6})^2 - (6 \times 10^{-6})^2]}\right]$ (1) E = 1920 [N C^{-1}] **to the right or to B** (1) Deduct 1 mark for power of 10 slips		3		3	3	
		(ii)	Potential at R and S are the same **or** $\Delta V = 0$ (1) $W = Q\Delta V$ must be seen, therefore $W = 0$ (1) **Accept:** R to mid-point (or halfway to S) work done against field (1) Mid-point to S equivalent work done by field (1)		2		2		

Question			Marking details	AO1	AO2	AO3	Total	Maths	Prac
				Marks available					
		(iii)	Net V at mid-point calculated = 0.00432 [V] (1) Net V at S calculated = 0.00576 [V] (1) ΔV = 0.00144 [V] (**ecf** on net Vs) (1) $W = 1.6 \times 10^{-19} \times 0.00144$ (**ecf**) $= 2.3 \times 10^{-22}$ [J] (1) Deduct 1 mark for power or 10 slips **Alternative: Use of potential equations to determine ΔV directly – award first 3 marks.** **Alternative:** calculate the electric potential energies at these points and take the difference.		4		4	4	
			Question 6 total	**1**	**9**	**0**	**10**	**7**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
7	(a)		As star orbits the centre of mass it moves towards and away from Earth **or** at A towards Earth at B away from Earth (1) At A blue shift / shorter wavelength (1) accept negative $\Delta\lambda$ At B red shift / longer wavelength (1) accept positive $\Delta\lambda$	1	1 1		3		
	(b)	(i)	$\Delta\lambda$ from graph = 0.72×10^{-12} [m] (1) Substitution and rearrangement: $v = \dfrac{(0.72 \times 10^{-12} \textbf{ ecf} \times 3 \times 10^{8})}{598 \times 10^{-9}}$ (1) v = 361 [m s^{-1}] seen (1)	1	1 1		3	2	
		(ii)	T = 320 days from graph (1) 27648000 seconds Substitution and rearrangement into $v = \dfrac{2\pi r_s}{T}$ (or $v = \omega r$ and $\omega = \dfrac{2\pi}{T}$) e.g. $r_s = \dfrac{361 \times 320 \textbf{ ecf} \times 24 \times 3600}{2\pi}$ (1) $r_s = 1.59 \times 10^{9}$ [m] seen (1)	1	1 1		3	2	

Question			Marking details	AO1	AO2	AO3	Total	Maths	Prac
				Marks available					
		(iii)	Substitution into $T = 2\pi\sqrt{\dfrac{d^3}{G(m_1+m_2)}}$ (1)	1					
			$d = \left(\dfrac{T^2GM}{4\pi^2}\right)^{\frac{1}{3}}$ = 5.91 × 10^{10} [m] (1)		1				
			r_p = 5.91 × 10^{10} **(ecf)** – 1.59 × 10^9 = 5.751 × 10^{10} [m] (1)		1				
			Substitution and rearrangement into $m_p r_p = m_s r_s$ e.g. $m_p = 1.6 \times 10^{29} \times \dfrac{1.59 \times 10^9}{5.75 \times 10^{10}\,\textbf{ecf}}$ (1)		1				
			m_p = 4.4 × 10^{27} k[g] (or 4.5 × 10^{27} k[g] if r_s = 1.6 × 10^9 used) (1)		1				
			Alternative for the last 2 marks: $(m_p + m_s)r_1 = m_p d$ so $(m_p + 1.6 \times 10^{29})(1.6 \times 10^9) = m_p(5.91 \times 10^{10})$ $1.6 \times 10^{29} m_p + 2.56 \times 10^{38} = 5.91 \times 10^{10} m_p$ (1) $m_p = \dfrac{2.56 \times 10^{38}}{5.75 \times 10^{10}}$ = 4.45 × 10^{27} k[g] (1)				5	4	

Question			Marking details	Marks available AO1	AO2	AO3	Total	Maths	Prac
	(c)		Correct expressions for ρ_{planet} and ρ_{Saturn} (1) Expressions equated and manipulation to show $r^2_{\text{planet}} = (8)^{\frac{2}{3}} r^2_{\text{Saturn}}$ or inverse or similar (1) Correct application of $g = \frac{GM}{r^2}$ to both planets **ecf** e.g. $\frac{g_{\text{planet}}}{g_{\text{Saturn}}} = \frac{(8GM_{\text{Saturn}}\left(\frac{1}{8}\right)^{\frac{2}{3}} r^2_{\text{planet}})}{r^2_{\text{planet}} GM_{\text{Saturn}}}$ (1) $\frac{g_{\text{planet}}}{g_{\text{Saturn}}} = 2$ (1) **Alternative:** ρ same and Mass of planet = 8 $\times$ mass of Saturn (from question – no mark) Therefore radius of planet = 2 $\times$ radius of Saturn (Award 2 marks if this seen and qualified with some algebra. Award 1 mark if this seen without supporting algebra) Hence: $\frac{g_{\text{planet}}}{g_{\text{Saturn}}} = \frac{8GM(r_{\text{Saturn}})^2}{4GM(r_{\text{Saturn}})^2}$ (1) $\frac{g_{\text{planet}}}{g_{\text{Saturn}}} = 2$ (1) **Alternative: award 4 marks** If ρ same then M increased $\times$ 8 then r^3 must be $\times$ 8 so $r_{\text{planet}} = 2r_{\text{Saturn}}$ So $g = \frac{GM}{r^2} = \frac{8}{4} = 2$		4		4	3	
			Question 7 total	**4**	**14**	**0**	**18**	**11**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)	A {body / surface} which **absorbs all** the **electromagnetic radiation** that falls upon it Accept perfect absorber and emitter of em radiation but not just emitter	1			1		
		(ii)	Inverse square law seen (1) Substitution and rearrange to show $P = 5.7 \times 10^{28}$ [W] (1) Substitution and rearrange Stefan law to show $T = 11\,606$ [K] (1) Use of Wien's law to confirm $\lambda_{max} = 250$ n[m] (1) **Alternative:** Use λ to confirm intensity of radiation at Earth surface: $T = \frac{2.9 \times 10^{-3}}{250 \times 10^{-9}} = 11\,600$ [K] (1) $P = 5.54 \times 10^{19} \times 5.67 \times 10^{-8} \times (11600)^4 = 5.687 \times 10^{28}$ (1) Inverse square law seen (1) Intensity at Earth surface shown to be 1.36×10^{-15} [W m^{-2}] (1) **Alternative:** $T = \frac{2.9 \times 10^{-3}}{250 \times 10^{-9}} = 11\,600$ [K] (1) Inverse square law used to find / confirm luminosity (1) e.g. $P = 1.37 \times 10^{-15} \times 4\pi \times (1.82 \times 10^{21})^2$ seen (1) Stefan's Law to confirm either A or σ or T (1) **Alternative:** $T = \frac{2.9 \times 10^{-3}}{250 \times 10^{-9}} = 11\,600$ [K] (1) $P = 5.687 \times 10^{28}$ (1) Inverse square law seen (1) Compare d (1)			4	4	3	

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)	Observing {space / celestial objects / universe} across … {whole / entire / multiple / range} of em wavelengths	1			1		
		(ii)	Galaxy Evolution Explorer (GALEX) (1) 250 nm is in the UV **or** the star emits in the UV (1)			2	2		
			Question 8 total	**2**	**0**	**6**	**8**	**3**	**0**

A LEVEL COMPONENT 2: ELECTRICITY AND THE UNIVERSE

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

QUESTION	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	6	6	0	12	8	0
2	1	5	8	14	8	14
3	5	4	3	12	8	0
4	6	4	3	13	7	0
5	5	3	5	13	5	3
6	1	9	0	10	7	0
7	4	14	0	18	11	0
8	2	0	6	8	3	0
TOTAL	**30**	**45**	**25**	**100**	**57**	**17**