



Mark Scheme (Results)

Summer 2025

Pearson Edexcel GCSE
In Astronomy (1AS0)
Paper 2: Telescopic Astronomy

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Mark
1 (a)(i)	The only correct answer is D: Saturn A is not correct because this is not an image of Jupiter B is not correct because this is not an image of Mars C is not correct because this is not an image of Neptune	1

Question number	Answer	Mark
1 (a)(ii)	The only correct answer is A: Jupiter B is not correct because this is not an image of Mars C is not correct because this is not an image of Neptune D is not correct because this is not an image of Saturn	1

Question number	Answer	Mark
1 (a)(iii)	The only correct answer is B: Mars A is not correct because this is not an image of Jupiter C is not correct because this is not an image of Neptune D is not correct because this is not an image of Saturn	1

Question number	Answer	Mark
1 (b)(i)	The only correct answer is C: planetary nebula A is not correct because this is not an image of a globular cluster B is not correct because this is not an image of an open cluster D is not correct because this is not an image of a protostar	1

Question number	Answer	Mark
1 (b)(ii)	The only correct answer is B: globular cluster A is not correct because this is not an image of an emission nebula C is not correct because this is not an image of an open cluster D is not correct because this is not an image of a protostar	1

Question number	Answer	Mark
1 (b)(iii)	The only correct answer is A: emission nebula B is not correct because this is not an image of a globular cluster C is not correct because this is not an image of an open cluster D is not correct because this is not an image of a protostar	1

Question number	Answer	Mark
2 (a)	The only correct answer is A: comets B is not correct because this is not thought to be the origin of the Earth's water C is not correct because this is not thought to be the origin of the Earth's water D is not correct because these are not thought to be the origin of the Earth's water	1

Question number	Answer	Mark
2 (b)	The only correct answer is D: structure of our galaxy A is not correct because this is not investigated using 21cm radio waves B is not correct because these are not investigated using 21cm radio waves C is not correct because these are not investigated using 21cm radio waves	1

Question number	Answer	Additional Guidance	Mark
2 (c)	Seyfert / Quasar / Blazar (1)	Do not accept a named galaxy/object	1

Question number	Answer	Mark
2 (d)(i)	escape (velocity) (1)	1

Question number	Answer	Mark
2 (d)(ii)	Image B is an image of the far side of the Moon (1) which can <u>only</u> be viewed by spacecraft / which cannot be viewed from Earth (1)	2

Question number	Answer	Mark
3 (a)	Local Group (1)	1

Question number	Answer	Mark
3 (b)	Galaxies are moving away from us / receding (1) and any one point from: - galaxies appear redshifted / light from galaxies appears to shift to longer wavelengths - Hubble's Law - velocity increases with distance - galactic distances obtained from supernova light curves	2

Question number	Answer	Mark
3 (c)	(age of Universe) = $1/\text{Hubble constant}$ (1)	1

Question number	Answer	Mark
3 (d)	Any two points from: - image shows (information about) the early Universe - image shows temperature is not uniform - non-uniformity linked to distribution of galaxies, e.g. - hotter regions formed (clusters of) galaxies - galaxies (today) are not uniformly distributed throughout the Universe - fluctuations have helped determine Universe's (changing) composition, including existence of dark matter / dark energy (which effects its evolution)	2

Question number	Answer	Mark														
4 (a)	<table><tr><td></td><td></td></tr><tr><td>Solid rocky surface</td><td>T</td></tr><tr><td>Mean surface temperature below -100 °C</td><td>G</td></tr><tr><td>Ring system</td><td>G</td></tr><tr><td>Few or no moons</td><td>T</td></tr><tr><td>Low density (similar to water)</td><td>G</td></tr><tr><td>Diameter less than 20 000 km</td><td>T</td></tr></table> two correct rows (1) four correct rows (2)			Solid rocky surface	T	Mean surface temperature below -100 °C	G	Ring system	G	Few or no moons	T	Low density (similar to water)	G	Diameter less than 20 000 km	T	2
Solid rocky surface	T															
Mean surface temperature below -100 °C	G															
Ring system	G															
Few or no moons	T															
Low density (similar to water)	G															
Diameter less than 20 000 km	T															

Question number	Answer	Mark
4 (b)(i)	(Orbit:) B (1)	1

Question number	Answer	Mark
4 (b)(ii)	(Orbit:) D (1)	1

Question number	Answer	Mark
4 (b)(iii)	(Orbit:) A (1)	1

Question number	Answer	Mark
4 (b)(iv)	(Orbit:) C (1)	1

Question number	Answer	Mark
4 (c)(i)	(the) Van Allen belt(s) (1)	1

Question number	Answer	Mark
4 (c)(ii)	(the) Oort Cloud (1)	1

Question number	Answer	Mark
4 (c)(iii)	(the) heliosphere (1)	1

Question number	Answer	Mark
5 (a)	(the) constellation (in which the star is located) (1)	1

Question number	Answer	Mark
5 (b)(i)	(Star:) B (1)	1

Question number	Answer	Additional Guidance	Mark
5 (b)(ii)	Any three from: (higher mass stars have...) • greater inward gravitational pressure • higher temperature / pressure (in their core) • {brighter/lower} absolute magnitude / more powerful • burn their fuel more quickly / run out of fuel faster / have a higher rate of fusion	Allow reverse argument throughout	3

Question number	Answer	Mark
5 (b)(iii)	10 (2) calculation: $M = m + 5 - 5 \log d$ $0 = m + 5 - 5 \log 1000$ $m = 10$ Award one mark for: • $0 = m + 5 - 5 \log 1000$ • $m = M - 5 + 5 \log d$	2

Question number	Answer	Mark
5 (c)	-22 (2) calculation: intensity of Sun decreases by $10^2 = 100$ This corresponds to a change in magnitude of 5 (1) apparent magnitude of Sun = $-27 + 5$ = -22 (1) notes: -32 scores 1 mark M = 4.57... scores 1 mark	2

Question number	Answer	Mark
6 (a)	telescope/binoculars (with shadow caster) (1) projecting image onto a card/screen (1) OR telescope with H-alpha/solar filter (1) with filter correctly attached to telescope (1) OR glasses with solar filter (1) covering both eyes (1)	2

Question number	Answer	Mark
6 (b)	core (1)	1

Question number	Answer	Mark
6 (c)(i)	Correct scale added to horizontal axis (1) Both points plotted correctly (1) Suitable smooth, continuous best fit line drawn through the data points (1)	3
	The graph shows the temperature profile of the Sun. The vertical axis is logarithmic, with major ticks at 1×10^3, 1×10^4, 1×10^5, 1×10^6, 1×10^7, and 1×10^8. The horizontal axis is linear, ranging from 0.0 to 1.0 with ticks every 0.1. The graph is divided into three regions by vertical dashed lines: Core (0.0 to 0.25), Radiative zone (0.25 to 0.7), and Convective zone (0.7 to 1.0). Data points are plotted at (0.0, 1.5×10^7), (0.1, 1×10^7), (0.2, 6×10^6), (0.4, 2.5×10^6), (0.6, 2.5×10^6), (0.8, 1×10^6), and (1.0, 5×10^3). A smooth red curve is drawn through these points, showing a general decrease in temperature from the core to the surface, with a slight increase in the radiative zone.	

Question number	Answer	Mark
6 (c)(ii)	3×10^6 (K) (1) allow range 2×10^6 (K) to 5×10^6 (K) (large range due to logarithmic axis)	1

Question number	Answer	Mark
6 (c)(iii)	convective (zone / region)	1

Question number	Answer	Mark
6 (c)(iv)	Any three from: • yes / there is a relationship (between the Sun's temperature profile and the Sun's density profile) (1) • as temperature decreases, density decreases (as distance increases) (1) • the temperature and density are a maximum/highest at the centre of the Sun / core (1) OR the temperature and density are a minimum/lowest at the surface of the Sun / convective zone (1) • the lines have a similar shape, e.g. the temperature and density decrease rapidly (with distance) in the convective zone / near the Sun's surface (1)	3

Question number	Answer	Mark
7 (a)(i)	The only correct answer is C: 330 days A is not correct because this is too short to be the period of a long-period variable star B is not correct because this is too short to be the period of a long-period variable star D is not correct because is too long to be the period of a long-period variable star	1

Question number	Answer	Mark
7 (a)(ii)	Any two points from: - planetary nebula - white dwarf - black dwarf	2

Question number	Answer	Mark
7 (a)(iii)	(drop in temperature results in a) reduction in brightness / is dimmer (1) because infrared light is not visible (to unaided eye) (1)	2

Question number	Answer	Mark
7 (a)(iv)	4.0 pc (3.97 pc) (3) calculation: convert 30 000 years into seconds (1) $\text{time} = 30\,000 \times 365 \times 24 \times 60 \times 60 = 9.46 \times 10^{11}$ calculation of tail length (1) $\begin{aligned} \text{length of tail} &= 130 \times 9.46 \times 10^{11} \\ &= 1.23 \times 10^{14} \end{aligned}$ convert length from km to pc (1) $\text{length of tail} = 1.23 \times 10^{14} \div 3.1 \times 10^{13} = 4.0 \text{ (pc)}$ accept 1.3×10^{-7} (pc) for 2 marks	3

Question number	Answer	Mark																							
7 (b)	Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. <table><tr><th>Level</th><th>Mark</th><th>Descriptor</th></tr><tr><td></td><td>0</td><td>No rewardable material.</td></tr><tr><td>Level 1</td><td>1-2</td><td>Lacks clarity. Basic interpretation and evaluation of the data/information may be attempted but will be limited and narrow in scope. The response will contain basic information with little linkage between points made. Lines of reasoning may be attempted but are incomplete or lack clarity. A conclusion may be attempted but lacks support.</td></tr><tr><td>Level 2</td><td>3-4</td><td>Some structure. Interpretation and evaluation of the data/information that attempts to synthesise and integrate relevant knowledge. The response shows some linkages and lines of reasoning with some structure, leading to a conclusion that is partially supported.</td></tr><tr><td>Level 3</td><td>5-6</td><td>Comprehensive and well structured. Comprehensive interpretation and evaluation of the data/information that demonstrates the skills of synthesising and integrating relevant knowledge throughout the response. The response shows a well-developed, sustained line of scientific reasoning which is clear, coherent and logically structured, leading to a supported conclusion.</td></tr></table> Indicative content guidance The indicative content below is not prescriptive, and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include links between: • type of star and period length • type of star and shape of light curve • type of star and range of apparent magnitudes <table><tr><th>Star</th><th>Type of variable star</th></tr><tr><td>A</td><td>Eclipsing Binary</td></tr><tr><td>B</td><td>Supernova</td></tr><tr><td>C</td><td>Cepheid variable</td></tr></table>	Level	Mark	Descriptor		0	No rewardable material.	Level 1	1-2	Lacks clarity. Basic interpretation and evaluation of the data/information may be attempted but will be limited and narrow in scope. The response will contain basic information with little linkage between points made. Lines of reasoning may be attempted but are incomplete or lack clarity. A conclusion may be attempted but lacks support.	Level 2	3-4	Some structure. Interpretation and evaluation of the data/information that attempts to synthesise and integrate relevant knowledge. The response shows some linkages and lines of reasoning with some structure, leading to a conclusion that is partially supported.	Level 3	5-6	Comprehensive and well structured. Comprehensive interpretation and evaluation of the data/information that demonstrates the skills of synthesising and integrating relevant knowledge throughout the response. The response shows a well-developed, sustained line of scientific reasoning which is clear, coherent and logically structured, leading to a supported conclusion.	Star	Type of variable star	A	Eclipsing Binary	B	Supernova	C	Cepheid variable	6
Level	Mark	Descriptor																							
	0	No rewardable material.																							
Level 1	1-2	Lacks clarity. Basic interpretation and evaluation of the data/information may be attempted but will be limited and narrow in scope. The response will contain basic information with little linkage between points made. Lines of reasoning may be attempted but are incomplete or lack clarity. A conclusion may be attempted but lacks support.																							
Level 2	3-4	Some structure. Interpretation and evaluation of the data/information that attempts to synthesise and integrate relevant knowledge. The response shows some linkages and lines of reasoning with some structure, leading to a conclusion that is partially supported.																							
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Star	Type of variable star																								
A	Eclipsing Binary																								
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Question number	Answer	Mark
8 (a)(i)	2.7 (1)	1

Question number	Answer	Mark
8 (a)(ii)	7.3 (1)	1

Question number	Answer	Mark
8 (a)(iii)	Any two points from: - easier to construct - cheaper to make - larger mirror would deform more - reduces space when launching / is able to fit into a rocket	2

Question number	Answer	Mark
8 (b)(i)	unable to observe ultra-violet radiation from the Earth's surface / (Earth's) atmosphere absorbs (most) ultra-violet radiation	1

Question number	Answer	Mark
8 (b)(ii)	P2 – suitable for telescope because above Earth's atmosphere / in space / in orbit (1) P3 – NOT suitable for telescope – cannot observe the Sun each day (1) P4 – NOT suitable for telescope – cannot observe the Sun each day / cannot communicate with Earth (1)	3

Question number	Answer	Mark																										
8 (c)(i)	one mark for each correct answer <table><tr><th colspan="2">Focal length</th><th rowspan="2">Magnification</th><th rowspan="2">Field of view (°)</th></tr><tr><th>Eyepiece (mm)</th><th>Objective element (cm)</th></tr><tr><td>10</td><td>50.0</td><td>50.0</td><td>0.90</td></tr><tr><td>15</td><td>50.0</td><td>33.3</td><td>1.35</td></tr><tr><td>20</td><td>50.0</td><td>25.0</td><td>1.80</td></tr><tr><td>30</td><td>50.0</td><td>16.7</td><td>2.70</td></tr><tr><td>50</td><td>50.0</td><td>10 OR 10.0</td><td>4.50</td></tr></table>	Focal length		Magnification	Field of view (°)	Eyepiece (mm)	Objective element (cm)	10	50.0	50.0	0.90	15	50.0	33.3	1.35	20	50.0	25.0	1.80	30	50.0	16.7	2.70	50	50.0	10 OR 10.0	4.50	2
Focal length		Magnification	Field of view (°)																									
Eyepiece (mm)	Objective element (cm)																											
10	50.0	50.0	0.90																									
15	50.0	33.3	1.35																									
20	50.0	25.0	1.80																									
30	50.0	16.7	2.70																									
50	50.0	10 OR 10.0	4.50																									

Question number	Answer	Additional Guidance	Mark
8 (c)(ii)	Advantage, any one from: - increased magnification / Saturn appears larger - smaller field of view Disadvantages, any two from: - dimmer image - smaller field of view / harder to locate in sky {lower / worse / poorer} {image quality / resolution} - requires more stable mounting / image moving around - eye relief issues	Accept smaller field of view as one marking point only.	3

Question number	Answer	Additional Guidance	Mark
9 (a)(i)	Any two points from: - radio telescope has a larger {objective / aperture / reflector / diameter} - radio telescope {objective / reflector} is made with lower precision - radio telescopes can have a {reflector / dish} made of mesh - radio telescopes do not need to be located at high altitude - radio telescope {objective / reflector / dish} made from metal / is not silvered OR optical telescope {objective / reflector} made from glass / lenses / is silvered.	Accept reverse arguments	2

Question number	Answer	Mark
9 (a)(ii)	(mobile phone signal will) interfere / create noise / affect observations (1)	1

Question number	Answer	Mark
9 (b)(i)	Any one from: CCDs cannot detect radio waves (1) CCDs cannot detect waves longer than infrared (1) quantum efficiency of CCD's falls to zero beyond infrared (1)	1

Question number	Answer	Mark
9 (b)(ii)	CCDs have a greater sensitivity / can see a greater proportion of light (than the human eye) (1) CCDs are able to observe a greater range of wavelengths / frequencies / able to observe into the ultraviolet and infrared (1)	2

Question number	Answer			Mark
9(c)	Level	Mark	Descriptor	6
		0	No rewardable material.	
	Level 1	1-2	Lacks clarity. Basic interpretation and evaluation of the method but is limited and narrow in scope. Appraisal of potential improvements is unsupported.	
	Level 2	3-4	Some structure. Interpretation and evaluation of the method that attempts to synthesise and integrate knowledge. Potential improvements are partially supported by evidence of analysis of the method.	
	Level 3	5-6	Comprehensive and well structured. Interpretation and evaluation of the method demonstrates synthesising and integrating knowledge throughout the response. Potential improvements supported throughout showing well developed scientific reasoning that is clear, coherent and logically structured.	
	Indicative content guidance The indicative content below is not prescriptive, and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include:			
	Comment on photograph		Improvement	
	Radiant not located in the photograph		Increase field of view / observe to the left of image	
	Not many meteors		Increase exposure time / take multiple photographs	
	Only small part of the sky photographed / observed		Increase field of view / reduce magnification / use wide angle lens	
	Photograph suffers from exposure light pollution		Change location / reduce time	
	Constellations difficult to identify due to long star trails		Reduce exposure time (and take more images)	
	Foreground takes up large fraction of photograph		Horizon at bottom of frame horizon in frame	

Question number	Answer	Mark
10 (a)(i)	SB / SBa / SBb / SBc / barred spiral (1)	1

Question number	Answer	Mark
10 (a)(ii)	unable to determine shape / structure of spiral arms / central bulge / bar (1) because galaxy is viewed (nearly) edge on (1)	2

Question number	Answer	Mark
10 (b)(i)	All galaxies are the same size (1)	1

Question number	Answer	Mark
10 (b)(ii)	4.5 Mpc (3) calculation: convert apparent angular diameter of galaxy into degrees (1) $40 \div 60 = 0.67^\circ$ calculate distance to galaxy (1) $\frac{50\,000}{0.67} \times 60 = 4.5 \times 10^6 \text{ (pc)}$ convert distance to Mpc (1) $4.5 \times 10^6 \div 10^6 = 4.5 \text{ (pc)}$ allow a range of answers if given to 3sf due to rounding errors an answer of 7.5 scores 2 marks an answer of 7 500 000 scores 1 mark an answer of 75 000 scores 1 mark an answer of 0.075 scores 2 marks	3

Question number	Answer	Mark
10 (c)(i)	light is passed through a diffraction grating / spectrometer (1) Any one point from: • an image of spectrum is taken • positions / wavelengths of dark / light bands measured	2

Question number	Answer	Additional Guidance	Mark
10 (c)(ii)	Any two points from: • <u>wavelength</u> of spectral / absorption line from galaxy (spectra) (is measured) (1) • and compared to a standard / laboratory / 'stationary' spectra (1) • measure change / increase in wavelength (which can be used to determine redshift) (1) • equation $\frac{\lambda - \lambda_0}{\lambda_0} = \frac{v}{c}$ correctly referenced (1)	Note: if equation is stated AND λ (wavelength of spectral / absorption line) or λ_0 ('stationary' wavelength) defined – 2 marks	2

Question number	Answer	Mark
10 (c)(iii)	Graph of: galactic redshift / recession velocity on vertical axis (1) straight line through the origin (1) Hubble constant = gradient of straight line (1)	3