



Mark Scheme (Results)

June 2022

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) B comet (ii) C galaxy	(1) (1)

Question number	Answer	Mark
1(b)	(i) B corona (ii) A aurora (iii) C nebula	(1) (1) (1)

Question number	Answer	Mark
1(c)	Any indication of rings or (symmetrical) bulges at the sides. Further detail, e.g. divisions in rings, horizontal bands on disc, moons.	(1) (1)

Question number	Answer	Mark
2(a)	(i) A main sequence (ii) B neutron star	(1) (1)

Question number	Answer	Mark
2(b)	(i) A asteroids (ii) A a comet	(1) (1)

Question number	Answer	Mark
2(c)	A absolute magnitude and spectral class	(1)

Question number	Answer	Mark
2(d)	C is expanding	(1)

Question number	Answer	Mark
2(e)	C radio waves	(1)

Question number	Answer	Mark
3(a)	B geocentric	(1)

Question number	Answer	Mark
3(b)	(i) Moons orbit Jupiter Moons do not orbit the Earth (Accept: not all objects orbit the Earth)	(1) (1)
	(ii) Changing size (ignore phase/shape) (means) changing distance (from Earth)	(1) (1)
	(iii) Identified mountains, valleys etc (which are) terrestrial features	(1) (1)

Question number	Answer	Mark
3(c)	Any one from: Higher magnification Higher resolution (Accept: sharper) Brighter/can image fainter objects (Ignore: light grasp)	(1)
	Reference to data in the table. (Accept comparative statements e.g. 'larger aperture' etc.	(1)

Question number	Answer	Mark
4(a)	(i) B Planet B (ii) C Planet C (iii) A Planet A (iv) C Planet C	(1) (1) (1) (1)

Question number	Answer	Mark
4(b)	(i) Planet passing in front of star (as seen from Earth) Causes dip in brightness (points may be conveyed via writing or diagram)	(1) (1)
	(ii) 140 000km Working: (sloped parts of graph) = 1 hour x 140 000 km/h km (only with correct answer)	(3) (1) (1) (1)

Question number	Answer	Mark
4(c)	Mention of a suitable method, e.g. astrometry, spectral shifts. Basic principle of chosen method established indicating measurement(s) to be made (by text or diagram)	(1) (1)

Question number	Answer	Mark
5(a)	(i) A fly-by (ii) A it has more craters than the near side	(1) (1)

Question number	Answer	Mark
5(b)	(i) Any two from: Stronger gravity (on the Earth) / Weaker gravity (on Moon) No air resistance (on Moon) Higher escape velocity (on Earth) /lower on Moon Lighter spacecraft (on Moon) Mass of Earth > mass of Moon.	(2)
	(ii) Any one from: Would need too much energy Both bodies are already spinning The Moon is orbiting the Earth Effect of gravity.	(1)
	(iii) (At least one) orbit of Earth Smooth curved path between Earth and Moon (orbits) <i>Reject:</i> Completely straight line (between sites)	(1) (1)
	(At least one) orbit of Moon	(1)

Question number	Answer	Mark
5(c)	Any two from: <ul style="list-style-type: none"> • Seismic measurements (of Moon's interior) • Surface rock samples • Levels of charged particles • Properties of lunar atmosphere (pressure, temperature, composition) • Temperature / heat flows • Distance to Earth (LASER ranging) • Micrometeorites • (Accurate) measurements of lunar surface gravity • (Accurate) measurements of lunar surface magnetic field strength • Moonquakes • Solar Wind • Electric potentials due to positive ions. 	(2)

Question number	Answer	Mark
6(a)	Jupiter is made (mostly) of gas (whereas) Earth is mostly rock ;different composition/density' scores one mark	(1) (1)

Question number	Answer	Mark
6(b)	(i) Shadow of another moon (not Europa) (name (Io) not required)	(1) (1)
	(ii) Any two from: Made of gas/not solid Storm Rotating High speed winds In upper cloud levels Similar size to terrestrial planets	(2)
	(iii) Telescopes not able to see it Correct property of telescope, e.g. resolution, aperture. (i.e 'Telescope not good enough' or similar scores 1)	(1) (1)

Question number	Answer	Mark
6(c)	Any two from: <ul style="list-style-type: none"> • Presence of water on Earth • Size of terrestrial planets • Current position relative to frost line • Current position compared to Jovian-sized planets in other solar systems • Formation of Asteroid Belt. 	(2)

Question number	Answer	Mark
7(a)	(i) 30 (cm) (unit not required) (ii) 50 600cm / 506m / 0.5km (Correct unit required for second mark) <i>Working:</i> calculation of 7.57×10^{12} km	(1) (2) (1)

Question number	Answer	Mark
7(b)(i)	(Mars) 1.5 0.1 (both numbers required) Ceres / Asteroid Belt / Other named asteroid (Saturn) 9.5 0.5 (both numbers required)	(1) (1) (1)
7(b) (ii)	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. 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: <ul style="list-style-type: none"> • Excellent agreement with Mercury to Jupiter • Including Asteroid Belt (former planet) • Reasonable agreement for Saturn and Uranus • Poor agreement for Neptune • (also) poor agreement for Pluto/Kuiper Belt • High number of 'tunable' parameters in no. sequence 	(6)

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	<ul style="list-style-type: none"> • Basic interpretation and evaluation of the data/information may be attempted but will be limited and narrow in scope. (AO3) • 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. (AO3)
Level 2	3–4	<ul style="list-style-type: none"> • Interpretation and evaluation of the data/information that Attempts to synthesise and integrate relevant knowledge. (AO3) • The response shows some linkages and lines of reasoning with some structure, leading to a conclusion that is partially supported. (AO3)
Level 3	5–6	<ul style="list-style-type: none"> • Comprehensive interpretation and evaluation of the data/information that demonstrates the skills of synthesising

		<p>and integrating relevant knowledge throughout the response. (AO3)</p> <ul style="list-style-type: none">• The response shows a well -developed, sustained line of scientific reasoning which is clear, coherent and logically structured, leading to a supported conclusion. (AO3)
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Question number	Answer	Mark
8(a)	<ul style="list-style-type: none"> Needs to be above (Earth's) atmosphere (Earth's) atmosphere absorbs X-rays 	(1) (1)

Question number	Answer	Mark
8(b)	(i) Any one from: High escape velocity High density (ignore: high mass) Escape velocity greater than speed of light Strong gravitational field/pull (ii) Black hole accompanied by an orbiting star (<i>Ignore:</i> binary system with two similar-mass components) Material pulled (from star) into black hole (Accretion disc) Material (not black hole) emits X-rays.	(1) (1) (1) (1)

Question number	Answer	Mark
8(c)	(i) core / centre (ii) Any two from: Most dense (mass or energy) area Black hole present Accretion disc.	(1) (2)

Question number	Answer	Mark
8(d)	Any two from: <ul style="list-style-type: none"> AGNs Seyfert galaxies stars supernova remnants neutron star systems any other named galaxy any other named black hole system. 	(2)

Question number	Answer	Mark
9(a)	<p>An answer that includes points of interpretation/evaluation to provide a reasoned account of the data.</p> <ul style="list-style-type: none"> • Small aperture telescope (although Sun quite bright) • Calculation of magnification (17.5x) • Low magnification (although Sun quite large in sky) • Use of digital camera to record images • Phone camera not designed for astronomical work • No tracking equipment • Solar filter used • Safety. 	(3)

Question number	Answer	Mark
9(b)	<p>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.</p> <p>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:</p> <ul style="list-style-type: none"> • Use repeats and averages • Observe over longer period (years) • Use Tracking telescope • Use larger magnification • Use astronomical digital eyepiece camera • Use larger aperture – higher resolution 	(6)

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	<ul style="list-style-type: none"> • Basic interpretation and evaluation of the data/information may be attempted but will be limited and narrow in scope. (AO3) • 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. (AO3)
Level 2	3–4	<ul style="list-style-type: none"> • Interpretation and evaluation of the data/information that Attempts to synthesise and integrate relevant knowledge. (AO3) • The response shows some linkages and lines of reasoning with some structure, leading to a conclusion that is partially supported. (AO3)

Level 3	5-6	<ul style="list-style-type: none"> • Comprehensive interpretation and evaluation of the data/information that demonstrates the skills of synthesising and integrating relevant knowledge throughout the response. (AO3) • The response shows a well -developed, sustained line of scientific reasoning which is clear, coherent and logically structured, leading to a supported conclusion. (AO3)
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Question number	Answer	Mark
9(c)	<p>Any two from:</p> <ul style="list-style-type: none"> • Appear in pairs • Leader and follower • Break up and disperse. <p><i>Ignore:</i> Description of apparent motions due to Sun's rotation.</p>	(2)

Question number	Answer	Mark
10(a)	<p>(i)</p> <ul style="list-style-type: none"> Raising (2.5) to the power 26 (allow 27) is an enormous number (about 20 billion). <p>Or any two from:</p> <ul style="list-style-type: none"> Link between magnitude and brightness is not linear (logarithmic) Each step on mag scale is a huge change in brightness Each step on mag scale multiplies (not adds to) brightness <p>(ii) Use of $m = -27$</p> <p>Substitution of numbers into equation</p> <p>Calculation of $d = 4.85 \times 10^{-6}(\text{pc})$</p> <p>Calculation of $M = 4.57$</p> <p>e.g</p> <p>$m = -27$</p> <p>$d = 1\text{AU}$</p> <p>$= 4.85 \times 10^{-6} \text{ pc}$</p> <p>$M = m + 5 - 5\log(d)$</p> <p>$M = -27 + 5 - 5 \times -5.31$</p> <p>$M = -27 + 5 - -26.57$</p> <p>$M = 4.57 / 4.58$</p> <p>(iii) Sun is (very) close to Earth</p> <p>Closer than 10pc (32.6ly) / distance from which absolute magnitude is defined</p>	<p>(2)</p> <p>(1)</p> <p>(1)</p> <p>(1)</p> <p>(1)</p> <p>(1)</p> <p>(1)</p>

Question number	Answer	Mark
10(b)	<p>(i) Star A</p> <p>(ii) 15 (pc)</p> <p><i>Working:</i></p> <p>(3 magnitudes means) Star A is 16 x brighter</p> <p>To appear the same brightness, Star B must be 4 x closer</p> <p>$60\text{pc} / 4 = \mathbf{15}(\text{pc})$</p> <p>(240(pc) scores 2 marks)</p>	<p>(1)</p> <p>(3)</p> <p>(1)</p> <p>(1)</p>