Pearson Edexcel

Mark Scheme (Results)

Summer 2024

Pearson Edexcel
GCSE Astronomy (1AS0)
Paper 1: Naked-Eye 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 A – crater** B is not the correct answer because it is not a crater C is not the correct answer because it is not a crater D is not the correct answer because it is not a crater	1

Question number	Answer	Mark
1 (a)(ii)	**The only correct answer is C – terra** A is not the correct answer because it is not a terra B is not the correct answer because it is not a terra D is not the correct answer because it is not a terra	1

Question number	Answer	Mark
1 (a)(iii)	**The only correct answer is B – mare** A is not the correct answer because it is not a mare C is not the correct answer because it is not a mare D is not the correct answer because it is not a mare	1

Question number	Answer	Mark
1 (b)(i)	**The only correct answer is A – aurora** B is not correct because it is not a galaxy C is not correct because it is not a meteor D is not correct because it is not a supernova	1

Question number	Answer	Mark
1 (b)(ii)	**The only correct answer is D – supernova** A is not correct because it is not an aurora B is not correct because it is not a galaxy C is not correct because it is not a meteor	1

Question number	Answer	Mark
1 (b)(iii)	**The only correct answer is C – meteor** A is not correct because it is not an aurora B is not correct because it is not a galaxy D is not correct because it is not a supernova	1

Question number	Answer	Mark
2 (a)(i)	**The only correct answer is C – occultation** A is not correct because it is not at apogee B is not correct because it is not at elongation D is not correct because it is not in transit	1

Question number	Answer	Mark
2 (a)(ii)	**The only correct answer is D – transit** A is not correct because it is not at apogee B is not correct because it is not at elongation C is not correct because it is not in occultation	1

Question number	Answer	Mark
2(a)(iii)	**The only correct answer is B – elongation** A is not correct because it is not at apogee C is not correct because it is not in occultation D is not correct because it is not in transit	1

Question number	Answer	Mark
2 (b)(i)	**The only correct answer is A – averted vision** B is not correct because it is not dark adaptation C is not correct because it is not indirect sight D is not correct because it is not night vision	1

Question number	Answer	Mark
2 (b)(ii)	**The only correct answer is B – dark adaptation** A is not correct because it is not averted vision C is not correct because it is not indirect sight D is not correct because it is not night vision	1

Question number	Answer	Mark
2(b)(iii)	Star is not bright enough (to project an image) / image would be too faint to see.	1

Question number	Answer	Mark
3 (a)	**The only correct answer is D – less than 3 475 km** A is not correct because the diameter must be less than 3475km B is not correct because the diameter must be less than 3475km C is not correct because the diameter must be less than 3475km	1

Question number	Answer	Mark
3 (b)(i)	**The only correct answer is B – craters** A is not correct because it is not caused by impacts C is not correct because it is not caused by impacts D is not correct because it is not caused by impacts	1

Question number	Answer	Mark
3 (b)(ii)	**The only correct answer is C – maria** A is not correct because it is not caused by magma which has turned solid B is not correct because it is not caused by magma which has turned solid D is not correct because it is not caused by magma which has turned solid	1

Question number	Answer	Mark
3 (c)(i)	**The only correct answer is B – sidereal month** A is not correct because this does not take 27.3 days C is not correct because this does not take 27.3 days D is not correct because this does not take 27.3 days	1

Question number	Answer	Mark
3 (c)(ii)	0.55 degrees (1) Allow 0.5 degrees or 0.6 degrees (1 sig fig) Calculation: Angle = 360 ÷ 27.3 ÷ 24	1

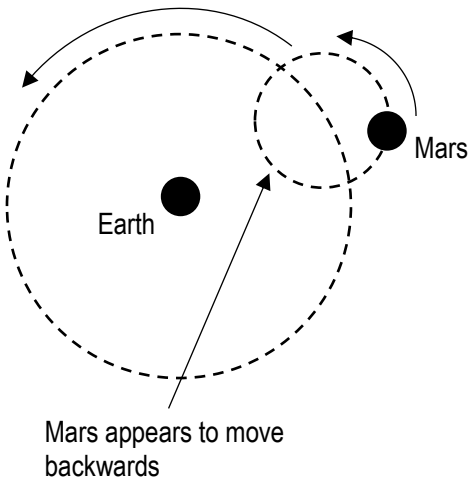
Question number	Answer	Additional guidance	Mark
3 (c)(iii)	*Any **two** from:* • Motion of Moon is slow/angle moved (each night) is small • Would need to observe the Moon for some time • Difficult to see the stars / there may be no (visible) stars near the Moon (during time of observation) • Moon is not visible • New or crescent phase of the Moon	Do **not** allow: • Angle is too difficult to measure • Poor weather / seeing conditions • Stars are (also) moving	**2**

Question number	Answer	Mark
4 (a)	**The only correct answer is A – all planets orbit the Earth** B because this is not the correct description for geocentric C because this is not the correct description for geocentric D because this is not the correct description for geocentric	**1**

Question number	Answer	Mark
4 (b)(i)	Right ascension = 6 (h) 10 (m) (1) Allow a range between 6h:05m – 6h:15m Declination = (+)27^{o} (1) Allow a range between 26^{o} – 28^{o}	**2**

Question number	Answer	Mark
4 (b)(ii)	(The) Ecliptic	**1**

Question number	Answer	Mark
4 (b)(iii)	2 (months)	**1**

Question number	Answer	Mark
4 (c)	Diagram shows Mars in orbit around Earth AND Mars having epicycles. Earth and Mars must be labelled. (1) Direction of rotation for Mars orbit AND epicycle shown. Condone clockwise / anticlockwise for either orbit (orbits do not need to be in the same direction) (1) Position where Mars appears to move backwards (retrograde) is labelled/explanation as to why Mars appears to move backwards (1)  	**3**

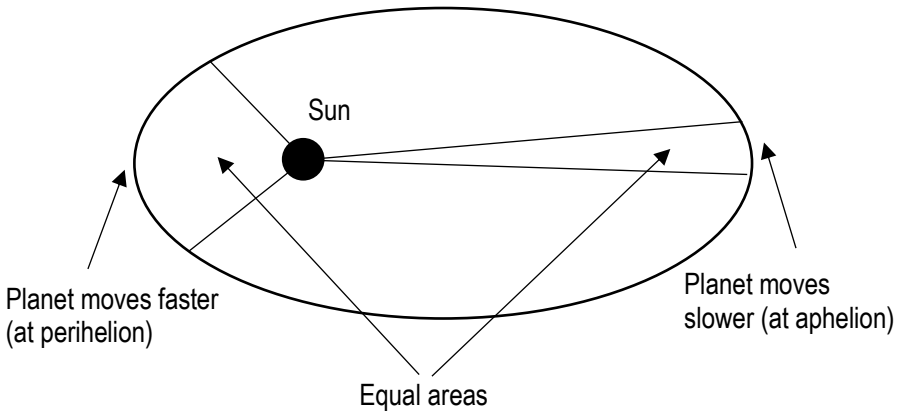
Question number	Answer	Mark
5 (a)(i)	The Earth has two tidal bulges / diagram to show two high tides on the opposite sides of the Earth in alignment with the Moon (1) The Earth will rotate through these two tidal bulges (in one day) (1)	**2**

Question number	Answer	Mark
5 (a)(ii)	23 October (1) Allow 22 – 24 October Any **one** from: There is a neap tide (on this date) The high tide is at its lowest / the low tide is at its highest (on this date) The range between high and low tide is at its smallest (on this date) This is 6/7 days before spring tide when the Moon is Full/New	**2**

Question number	Answer	Mark
5 (b)	3 700 (km) to 3 800 (km) (3) Calculation: Time taken between U1 and U2 (or U3 and U4) = 40 minutes (1) Time taken between U1 and U3 (or U2 and U4) = 137 minutes (1) $\frac{Diameter\ of\ Moon}{Diameter\ of\ Earth} = \frac{Time\ between\ U1\ and\ U2\ (or\ U3\ and\ U4)}{Time\ between\ U1\ and\ U3\ (or\ U2\ and\ U4)}$ $= \frac{40}{137}\ or\ 0.292$ $Diameter\ of\ Moon = \frac{40}{137}\ or\ 0.292\ \times 13\ 000$ $= 3\ 800\ km$ (1)	**3**

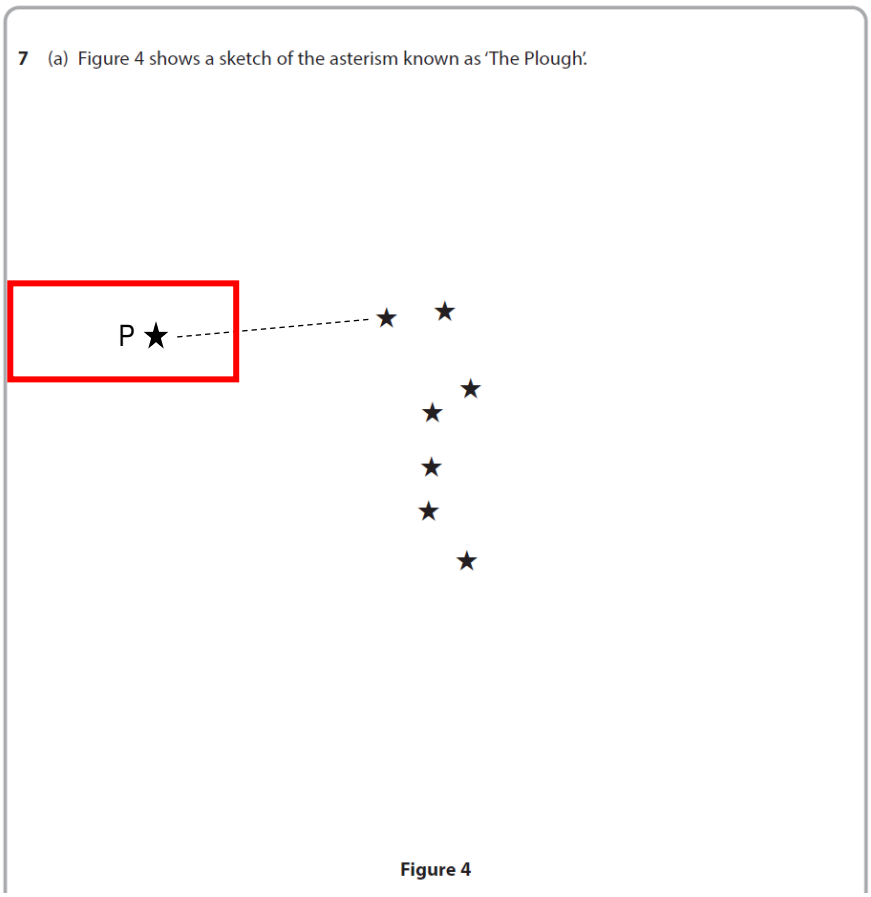
Question number	Answer	Mark
5 (c)	*Any **two** from:* • Earth's shadow/umbra is larger than Moon's shadow/umbra (do not accept Earth is larger than Moon) • Solar eclipses are short because the Moon's shadow only just reaches the Earth • Speed of Moon's movement through Earth's shadow is low compared to the speed of Earth's rotation • Solar eclipses are short in duration due to Earth's rotation (on its axis) Allow reverse argument	**2**

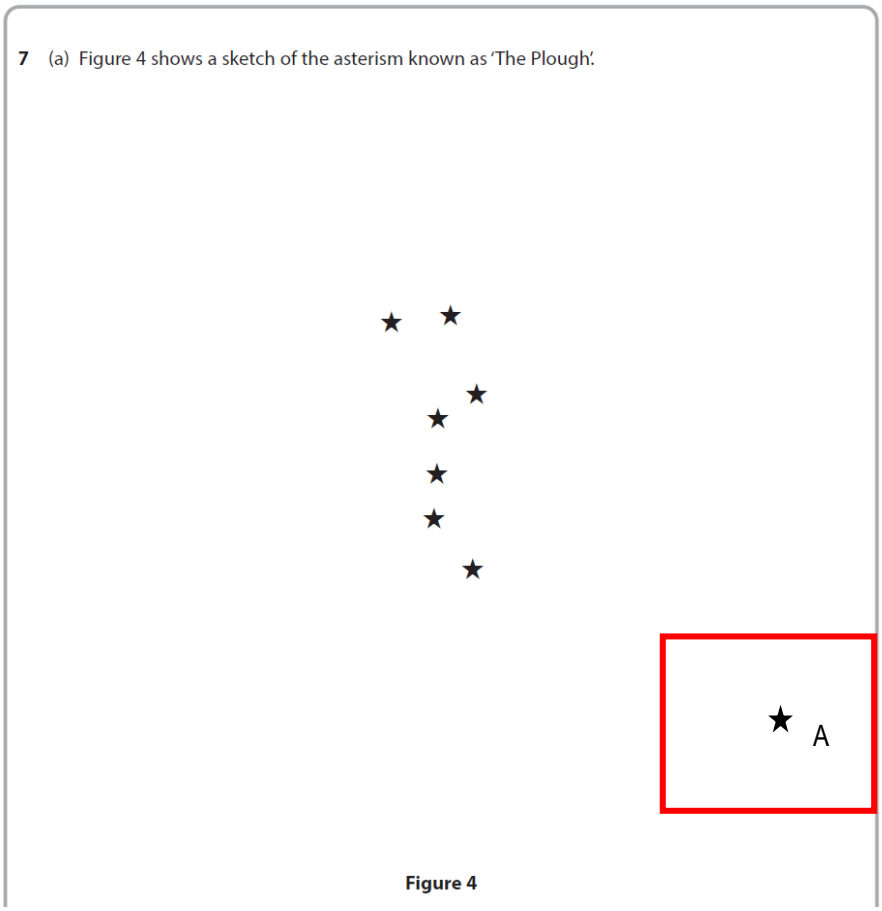
Question number	Answer	Mark
6 (a)	*Any **two** from:* • Tycho Brahe measured the <u>position/movement/motion</u> of the planets over a long period of time • Johannes Keppler used Brahe's data/observations to develop a mathematical model of their motion • Kepler was a student of Tycho Brahe • Tycho Brahe's data was recorded to a sufficiently high quality/precision/was sufficiently accurate	**2**

Question number	Answer	Mark
6 (b)	Diagram showing a planet in an elliptical orbit around the Sun. The Sun is located at one focus. (1) Diagram showing two equal areas at different points in the planetary orbit (1) Planet moves faster when located nearer the Sun (perihelion)/slower when located further from the Sun (aphelion) (1)  	**3**

Question number	Answer	Mark
6 (c)	7.1 to 7.2 (days) (3) Calculation: $constant = \frac{T^2}{r^3}$ calculated for either Io or Europa $= \frac{1.76^2}{0.422^3}$ or $\frac{3.52^2}{0.670^3}$ (1) [substitution] $constant = 41.2$ (1) [constant calculated] or $\left(\frac{T^2}{r^3}\right)_{Io} = \left(\frac{T^2}{r^3}\right)_{Ganymede}$ (1) [T^2/r^3 is the same for all moons] To calculate orbital period of Ganymede, $T^2 = 41.2 \times r^3$ $T^2 = 41.2 \times 1.075^3$ $T^2 = 51.2$ Note: a value of 51.2 is awarded 2 marks even if the constant 41.2 is not shown. $T = 7.16$ (1) [answer]	**3**

Question number	Answer	Additional guidance	Mark
6 (d)	(Kepler's third law) constant for Saturn is different to Jupiter's (1) Because mass/gravity of Saturn is different to the mass/gravity of Jupiter (1)	Inverse relationship between planets mass and constant does NOT need to be stated to gain first mark Do NOT accept Jupiter is bigger/Saturn is smaller	**2**

Question number	Answer	Mark
7 (a)(i)	(Dotted arrow does not need to be shown)  	1

Question number	Answer	Mark
7 (a)(ii)	(Dotted arrow does not need to be shown)  	1

Question number	Answer	Mark
7 (a)(iii)	*Any **one** of:* • Group of stars making a pattern in the sky • (A pattern/group of) stars that form part of a constellation • (A pattern/group of) stars that are located in more than one constellation	1

Question number	Answer	Mark
7 (b)(i)	Conclusion inaccurate / worst night is the 13 March (1) because number of observed twinkles per second was not at its greatest on 12 March/was at its greatest on 13 March (1) Allow: Frequency of twinkles is not at its greatest on the 12 March	**2**

Question number	Answer	Mark
7 (b)(ii)	*Any **two** from:* • Polaris is circumpolar (from London)/does not set below the horizon/always visible in the night sky • Polaris has a suitable brightness/apparent magnitude • Polaris remains 'fixed/stationary' in the sky • Altitude (above horizon) does not change • Altitude (above horizon) is sufficiently large / Polaris not located near the horizon. • Easy to locate in the sky Allow bright star, but do not allow brightest star	**2**

<table>
<tr><th>Question number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>7 (c)</td><td>
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:

Number of observable stars also depends on which part of the sky is being observed/stellar density is not constant.
Use of a tube will guarantee that a constant area of sky is being observed
Method should work if there is skyglow – number of observed stars will reduce as the angle approaches the horizon
Angle could be measured rather than approximated
Angle could be measured from horizon (not zenith) thus measuring stars altitude
Suitable graph suggested – this could demonstrate if skyglow near the horizon affects number of observed stars.
Student could repeat experiment by looking in other directions
Student should avoid looking near other bright light sources e.g., the full Moon

<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 suggested objects which is limited and narrow in scope.
Response contains basic information with little linkage between points.
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 suggested objects attempts to synthesise and integrate relevant knowledge.
Conclusion is partially supported.</td></tr>
<tr><td>Level 3</td><td>5-6</td><td>Coherent and logically structured.
Comprehensive interpretation and evaluation of suggested objects that demonstrates skills of synthesis and integrating relevant knowledge throughout the response.
Well developed, sustained lines of scientific reasoning leading to a supported conclusion.</td></tr>
</table>
</td><td>6</td></tr>
</table>

Question number	Answer	Mark
8 (a)	*Any **one** from:* • Distances are very large • Help to visualise the distances • A scale model helps show the relative distance between the Earth, Moon and Sun	**1**

Question number	Answer	Mark
8 (b)(i)	39.5 (m) (3) Calculation: $\frac{Earth\ Sun\ distance}{Earth\ Moon\ distance} = \frac{1.5\times10^{8}}{380\ 000}$ $\frac{Earth\ Sun\ distance}{Earth\ Moon\ distance} = 394.7$ (1) allow reciprocal $\frac{Earth\ Moon\ distance}{Earth\ Sun\ distance} = 0.00253$ For the scale model, $Earth\ Sun\ distance = 394.7\ \times Earth\ moon\ distance$ $Earth\ Sun\ distance = 394.7\ \times 10.0\ cm$ $Earth\ Sun\ distance = 39.5\ m$ (1) Answer given to 3 significant figures (1) Note: Correct answer required to award sig fig mark	**3**

Question number	Answer	Mark
8 (b)(ii)	Scale model will be too large or Sun/Earth – star distance is too large to represent in this scale (1) Calculation: $\frac{Sun\ Star\ distance}{Earth\ Moon\ distance} = \frac{4.2\times9.5\times10^{12}}{380\ 000} = 1.05\times10^{8}$ For the scale model, $Sun\ Star\ distance = 1.05\times10^{8}\ \times 10.0\ cm$ $Sun\ Star\ distance = 1.05\times10^{9}\ cm\ (1.05\times10^{7} m\ or\ 10\ 500\ km)$ (1)	**2**

Question number	Answer	Mark
8 (c)	Mars (2) Calculation: 54% ×13 000 = 7 020 (km) (1) accept 6 912 (km) or equivalent units Mars (1) (Diameter of Mars is 6 900 km)	**2**

<table>
<tr><th>Question number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>8 (d)</td><td>
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:

The two astronomers should be located on the same line of longitude/will need to make corrections for different longitudes
Distance between the two astronomers must be measured
Astronomers should record the length of their shadow at the same time (e.g., local noon)
Astronomers should measure the length of their shadow stick
Astronomers should calculate the altitude of the Sun (above their local horizon)
The difference between these two altitudes must be calculated
Calculate Earth’s circumference based on –
$$\frac{distance\ between\ astronomers}{circumference\ of\ Earth} = \frac{difference\ between\ Sun's\ altitude}{360}$$
Calculate Earth’s diameter/radius from the circumference of the Earth

<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 plan attempted but with limited analysis of scientific ideas.
Generalised comments made.
Plan is incomplete and contains basic information with some links to shadow length, altitude of the Sun and distance between astronomers.</td></tr>
<tr><td>Level 2</td><td>3-4</td><td>Some structure.
Plan is given with occasional evidence of analysis of scientific ideas and attempts to synthesise and integrate relevant knowledge.
Plan is adequate and shows many links to shadow length, altitude of the Sun and distance between astronomers.</td></tr>
<tr><td>Level 3</td><td>5-6</td><td>Comprehensive and well structured.
Plan is given which is supported throughout by evidence from the analysis of the scientific ideas and demonstrates the skills of synthesising and integrating knowledge.
Plan is well-developed and shows a sustained line of scientific reasoning which could successfully result in the calculation of the Earth’s diameter.</td></tr>
</table>
</td><td>6</td></tr>
</table>

Question number	Answer	Additional guidance	Mark
9 (a)	Similarity- any **one** from: • Use a gnomon/shadow caster • Gnomon/shadow caster will point North/South • Angle of the gnomon/shadow caster (for the same latitude) Difference- any **one** from: • Spacing/angle between timelines/hour marks • Orientation of the dial face/timelines	Similarity- Do not accept both cast a shadow/use the Sun/measure AST Difference – Vertical/horizontal orientation without reference to dial face/ timelines/hour mark gains no mark	**2**

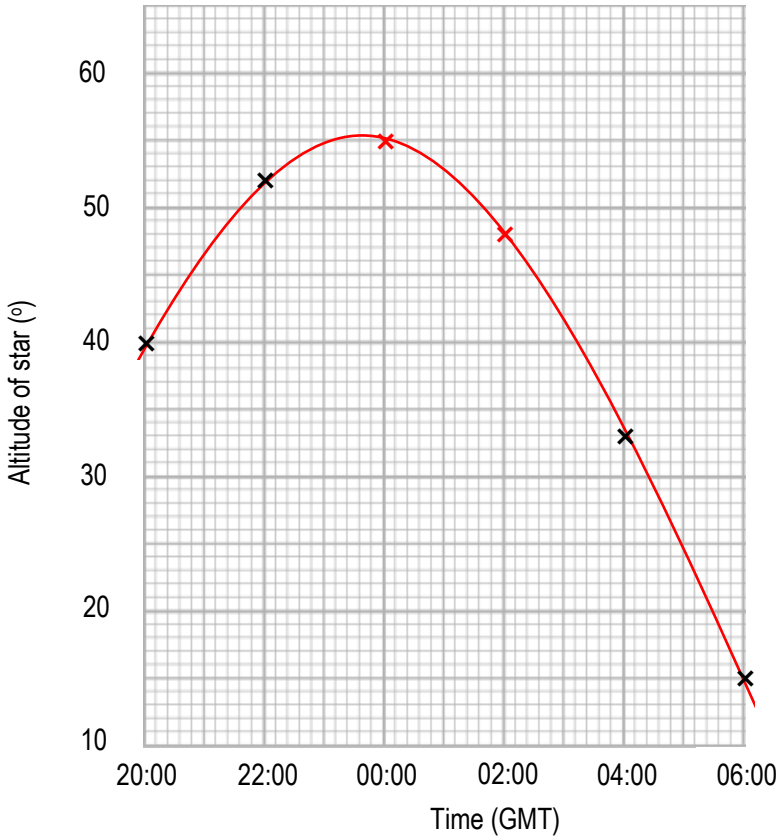
Question number	Answer	Mark
9 (b)(i)	15 April (1) (Allow 14 April – 16 April)	**1**

Question number	Answer	Mark
9 (b)(ii)	Equation of time is at its largest value / 15-17 minutes in November (1) and therefore, the sundial time (apparent solar time) will be at its greatest/15-17 minute difference from mean solar time (1)	**2**

Question number	Answer	Mark
9 (c)	(±)3 (Minutes) (4) Calculation: Value for equation of time on 15 December = (+) 5 (1) local MST = AST – ET = 14:00 – 5 (1) = 13:55 Greenwich MST = local MST + longitude correction = 13:55 – (2.5 × 4) = 13:55 – 10 (1) = 13:45 Accuracy = 13:45 – 13:42 = 3 (minutes) (1) Note: Accuracy = 3, scores 4 marks Accuracy = 13, scores 2 marks (EOT correctly applied) Accuracy = 8, scores 1 mark (Longitude correction correctly applied)	**4**

Question number	Answer	Mark
9 (d)(i)	*Any **two** from:* • (On certain dates) the two causes have the same magnitude • (On certain dates) one is positive, and the other is negative • (On certain dates) the average is zero • they cancel each other • they add up to zero Allow: the resultant is zero	**2**

Question number	Answer	Mark
9 (d)(ii)	The Earth's axial tilt (gives the greater contribution to the annual variation for the equation of time) (1) because it has the highest and lowest values / greater range (1) Allow: largest amplitude	**2**

Question number	Answer	Mark
10 (a)	y-axis labelled with the range of at least 20 to 60 and linear (1) Both points plotted corrected (within half a square) (1) Suitable best fit single line (1)  Figure 7	**3**

Question number	Answer	Mark
10 (b)	23:30 (1) Allow range 23:15 to 00:00	**1**

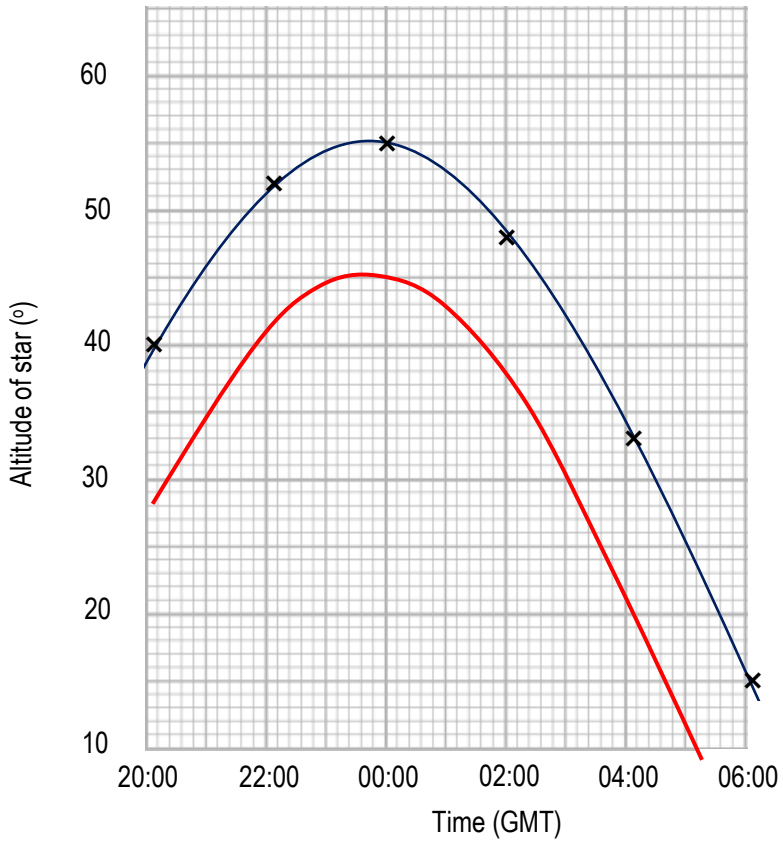
Question number	Answer	Mark
10 (c)	2h30m (1) Calculation: Hour angle = Difference in time between 02:00 and time at which star culminated Hour angle = 02:00 – Answer to 10 (b) Allow ecf Do not accept negative values	**1**

Question number	Answer	Mark
10 (d)	**The only correct answer is C – south-west** A is not correct because stars do not set in the north-east B is not correct because stars do not set in the south-east D is not correct because stars do not set in the north-west	**1**

Question number	Answer	Mark
10 (e)	The Earth is spinning on its axis (1) and all stars appear to move / revolve (around the north celestial pole) (1)	**2**

Question number	Answer	Mark
10 (f)	*Any **one** from:* • Star A will set below the observer's horizon • Altitude of star A will fall below zero • Star A does not reach an altitude of 90^{o} prior to upper transit *Any **one** from:* • Circumpolar stars are always above the observer's horizon • Never set below the horizon • Always have an altitude greater than zero	**2**

Question number	Answer	Mark
10 (g)	Declination = (+)61° (2) Calculation Altitude of star at culmination = 55° (1) Allow 56° $Alt\ at\ culmination = Lat + (90 - dec\ of\ star)$ $55 = 26 + (90 - declination)$ $90 - \ declination = 29$ declination = 61° (1) Allow 60°	**2**

Question number	Answer	Mark
10 (h)	Curve drawn with a similar shape and below the points for answer to Q 10(a)(i) (1) Turning point must be: • at the same time (allow ±30 minutes) as previous drawn line **and** • 10° (allow ±2°) below previous drawn line (1)  Figure 7	**2**