Mark Scheme (Results)

June 2022

Pearson Edexcel GCSE In 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)	**Sketch A – Orion** NOT sketch B – Ursa Major NOT sketch C – Cassiopeia NOT sketch D – Cygnus	**1**

Question number	Answer	Mark
1 (a)(ii)	NOT sketch A – Orion NOT sketch B – Ursa Major **Sketch C – Cassiopeia** NOT sketch D – Cygnus	**1**

Question number	Answer	Mark
1 (a)(iii)	NOT sketch A – Orion NOT sketch B – Ursa Major NOT sketch C – Cassiopeia **Sketch D – Cygnus**	**1**

Question number	Answer	Additional Guidance	Mark
1 (b)(i)	Description or clearly labelled diagram to include: • small hole in the front of projector/camera or small hole in a piece of paper/card (1) • screen for the image at the rear of projector/camera (1)	Do not allow projection with the use of a telescope/binoculars	**2**

Question number	Answer	Mark
1 (b)(ii)	(Faint) band of light	**1**

Question number	Answer	Mark
1 (b)(iii)	Milky way is too faint for the image to be seen	**1**

Question number	Answer	Mark
2 (a)(i)	NOT A crust – lower temperature than inner core **B inner core – has the greatest average temperature** NOT C mantle – lower temperature than inner core NOT D outer core – lower temperature than inner core	**1**

Question number	Answer	Mark
2 (a)(ii)	NOT A crust – does not include mantle & inner core **B crust and inner core** NOT C crust, mantle, inner core and outer core – includes mantle NOT D inner core and outer core – outer core is liquid	**1**

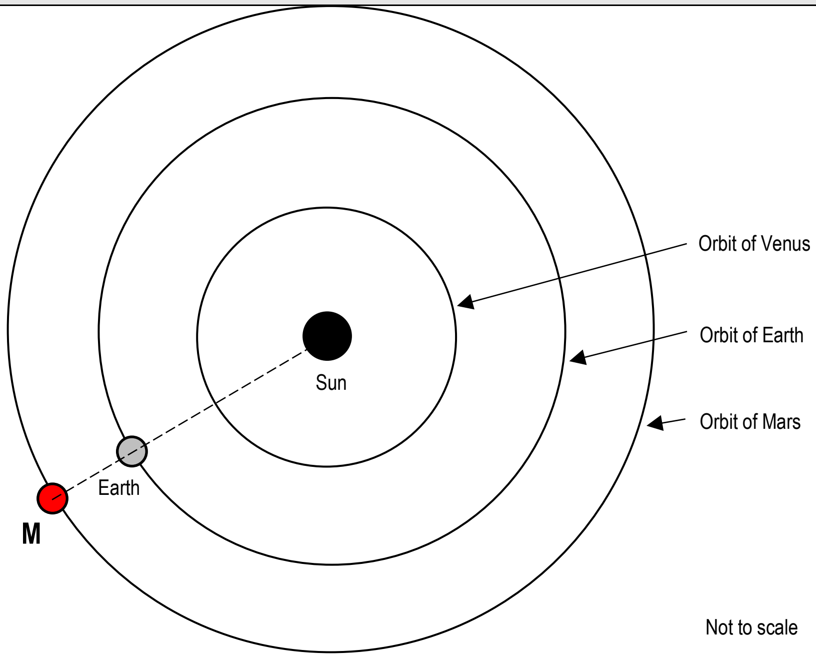
Question number	Answer	Mark
2 (a)(iii)	NOT A inner core – does not include outer core NOT B mantle and inner core – mantle not made of mainly iron and nickel NOT C mantle, inner core and outer core – mantle not made of mainly iron and nickel **D inner core and outer core**	**1**

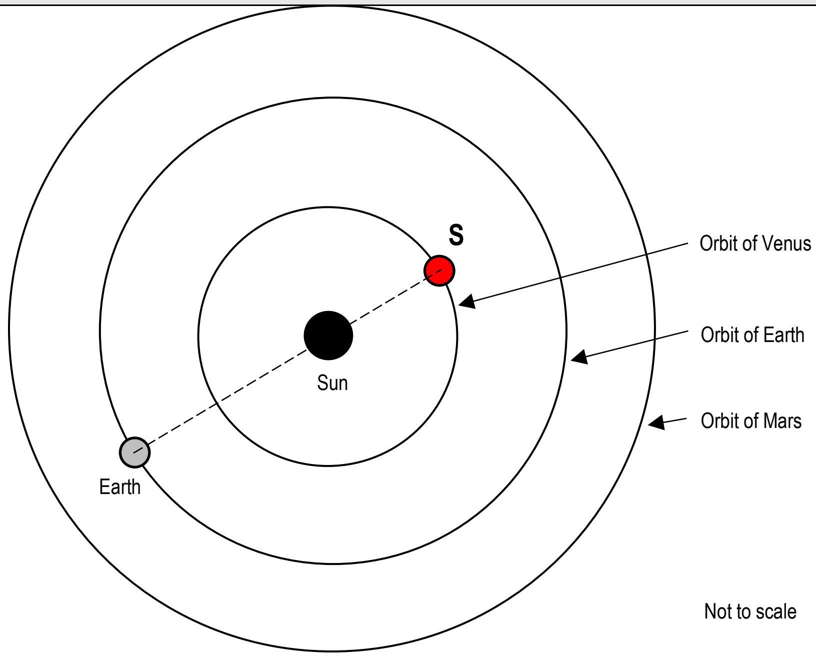
Question number	Answer	Mark
2 (a)(iv)	Pluto	**1**

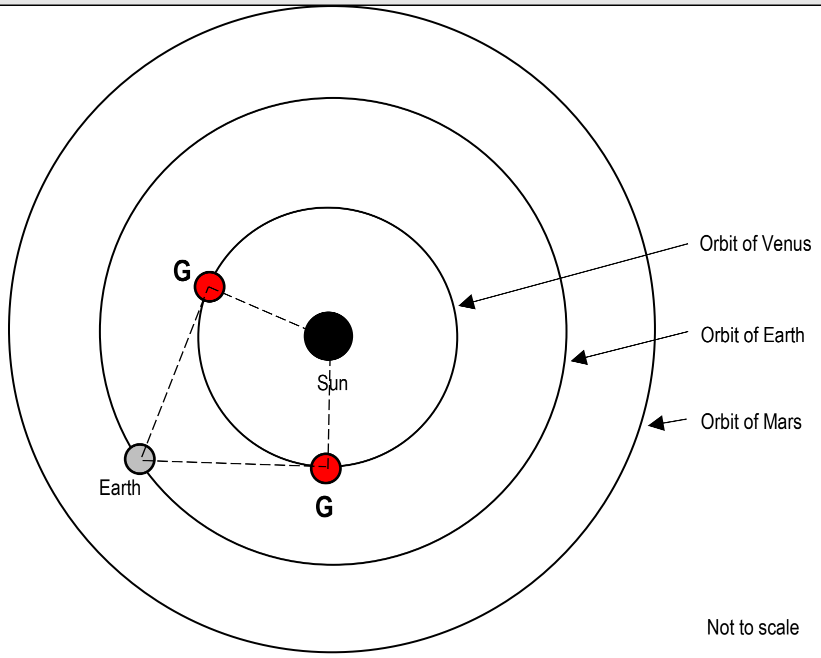
Question number	Answer	Mark
2 (b)	Drawing of a circle/squashed circle (1) Drawing of a good oblate spheroid Symmetrical on vertical and horizontal axis (1)	**2**

Question number	Answer	Mark
2 (c)(i)	NOT A Antarctic Circle – Sun does not rise above horizon on Summer Solstice **B Arctic Circle – Sun does not rise above horizon on Winter Solstice** NOT C Tropic of Cancer – incorrect answer NOT D tropic of Capricorn – incorrect answer	**1**

Question number	Answer	Mark
2 (c)(ii)	NOT A Antarctic Circle – incorrect answer NOT B Arctic Circle – incorrect answer NOT C Tropic of Cancer – Sun passes overhead on the Summer Solstice **D Tropic of Capricorn – Sun passes overhead on the Winter Solstice**	**1**

Question number	Answer	Mark
3 (a)(i)	 Sun, Earth and in a straight line (Dotted line is a marking guide and does NOT need to be drawn to gain the mark)	**1**

Question number	Answer	Mark
3 (a)(ii)	 Earth, Sun and S in a straight line (Dotted line is a marking guide and does NOT need to be drawn to gain the mark)	**1**

Question number	Answer	Mark
3 (a)(iii)	 One mark for both of the positions shown Earth, G and Sun are perpendicular (Dotted lines are a marking guide and do NOT need to be drawn to gain the mark)	1

Question number	Answer	Mark
3 (b)	Mercury (1) Venus (1)	2

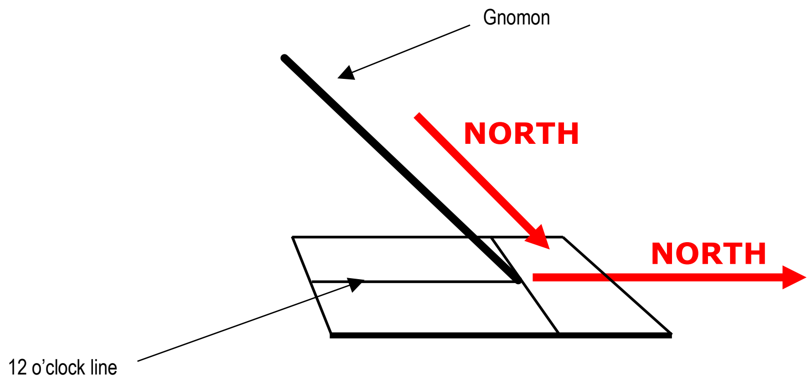
Question number	Answer	Mark
3 (c)	Mercury (1)	1

Question number	Answer	Mark
3 (d)	0.78 (AU) Calculation: 1.5(0) – 0.72	1

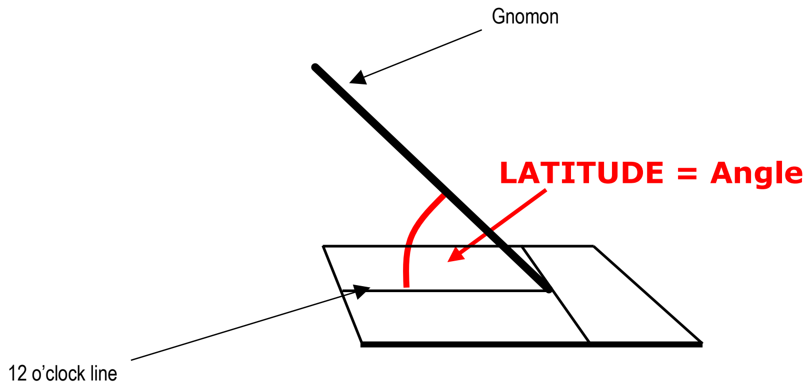
Question number	Answer	Additional Guidance	Mark
4 (a)(i)	To ensure that clock time roughly corresponds with the position of the Sun (1) For different locations on the Earth (1) or Reference to apparent and mean solar time (1)	Award one mark for reference to sunset/sunrise/noon occurring at an appropriate time	**2**

Question number	Answer	Additional Guidance	Mark
4 (a)(ii)	Calculation: (Average width of time zone in degrees) = $\frac{360}{24}$	Allow $\frac{360}{15} = 24$ Allow $25 \times 15 = 360$	**1**

Question number	Answer	Mark
4 (a)(iii)	Number of times zones = 4 (2) Calculation: Change in longitude = 107 - 45 = 62 degrees Number of time zones = $\frac{62}{15}$ (1) Number of time zones = 4.1 Therefore, aircraft will pass through 4 time zones (1)	**2**

Question number	Answer	Mark
4 (b)(i)	 (Allow either line shown in the diagram.)	**1**

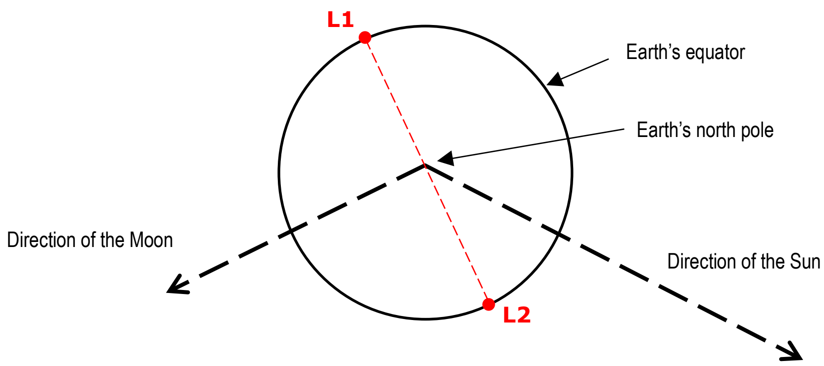
	Gnomon/Noon timelines are pointing South. Therefore, North is in the opposite direction.	

Question number	**Answer**	**Mark**
4 (b)(ii)	 Angle between gnomon and horizontal = Latitude of sundial location	**1**

Question number	**Answer**	**Mark**
4 (b)(iii)	GMT = 11:44 (2) If answer is incorrect: Correct use of Equation of time = 11:00 + 12 = 11:12 (1) OR Correct use of longitude correction = 11:00 + 32 = 11:32 (1) Calculation: (Local) MST = Sundial time – Equation of time = 11:00 – -12 = 11:12 (1) Greenwich MST (GMT) = Local MST + longitude correction = 11:12 + (8 × 4) = 11:12 + 32 (1) = 11:44	**2**

<table>
<tr><th>Question number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>5 (a)(i)</td><td>
<table>
<tr><th>Position number</th><th>Name of the Moon's Phase when seen from Earth</th><th>Time at which the Moon will cross the observer's meridian</th></tr>
<tr><td>A</td><td>Full</td><td>00:00 (midnight)</td></tr>
<tr><td>B</td><td>NEW</td><td>12:00 / midday</td></tr>
<tr><td>C</td><td>FIRST QUARTER</td><td>18:00 / 6:00pm</td></tr>
</table>
</td><td>4</td></tr>
</table>

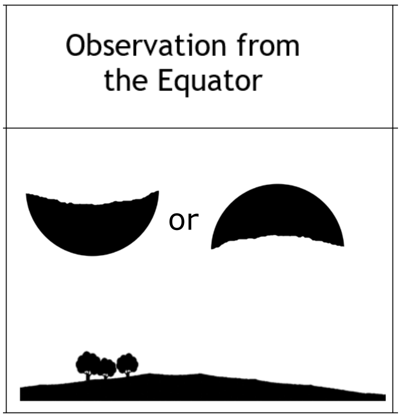
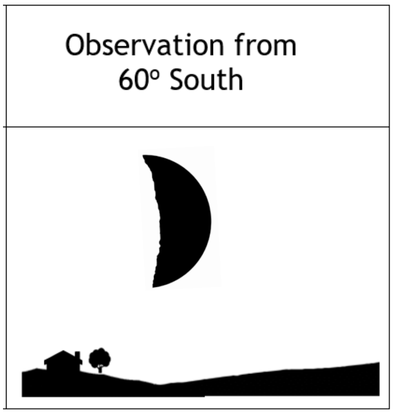
Question number	Answer	Mark
5 (a)(ii)	NOT A position A only – will cause a spring tide NOT B position B only – will cause a spring tide NOT C position A and position B – will cause spring tides **D position C and position D – Sun-Earth-Moon are perpendicular**	**1**

<table>
<tr><th>Question number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>5 (b)</td><td>


One mark for each of the positions shown (2)

One mark if positions shown are incorrect, but are shown on opposite sides of the Earth (1)

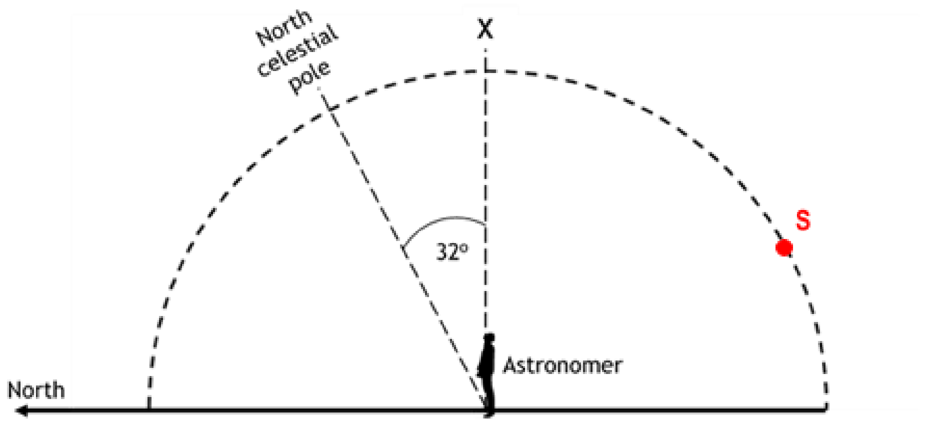
(Dotted line is perpendicular to the direction of the Moon)
(Dotted line is a marking guide and does NOT need to be drawn to gain the mark)
(L1 and L2 can be labelled either way)
</td><td>2</td></tr>
</table>

Question number	Answer		Mark
5 (c)		Moon rotated through 90 degrees either clockwise or anti-clockwise. Phase must remain the same. (1)	2
		Moon rotated through 180 degrees. Phase must remain the same. (1)	

Question number	Answer	Mark
6 (a)	A circumpolar – incorrect answer **B geocentric** C heliocentric – incorrect answer D synodic – incorrect answer	1

Question number	Answer		Mark
6 (b)(i)	Polaris / alpha (α) Ursa Minor / North star / Pole star		1

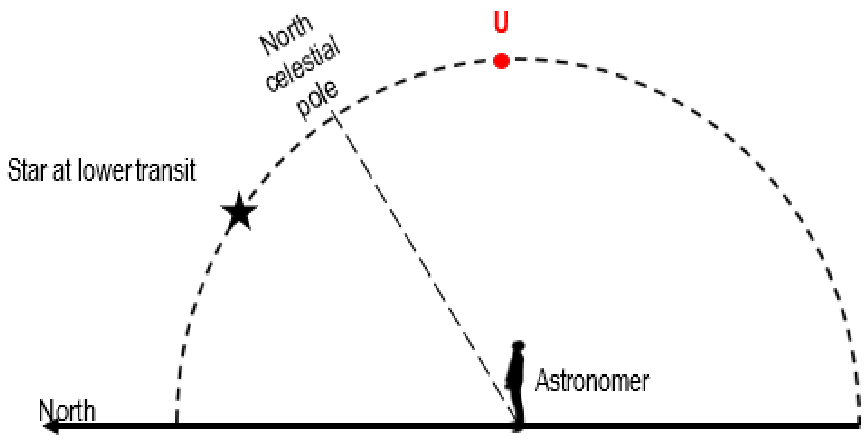
Question number	Answer	Mark
6 (b)(ii)	Zenith Allow Observer's zenith	1

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

Question number	Answer	Mark
6 (b)(iv)	Altitude = 58 degrees (1) (Calculation: Altitude = 90 – 32 = 58)	1

Question number	Answer	Mark
6 (b)(v)	Latitude = 58 (degrees) (N) (1) Allow an ecf mark – award the mark if the answer is the same as 6 (a)(iv)	1

Question number	Answer	Mark
6 (b)(vi)	(+) 58 degrees (1) (Calculation: Declination of X = Declination of North celestial pole – 32 Declination of X = 90 - 32 Declination of X = 58)	**1**

Question number	Answer	Mark
6 (c)(i)	U approximately equidistant from NCP 	**1**

Question number	Answer	Mark
6 (c)(ii)	Altitude = 88^{o} (2) Calculation Evidence of 90 – 70 = 20 degrees (1) Altitude = 68 + (90 – 70) Altitude = 68 + 20 Altitude = 88 (1)	**2**

Question number	Answer	Mark
6 (d)	The asterism of The Plough OR The constellation of Ursa Major (1)	**1**

Question number	Answer	Additional guidance	Mark
7 (a)(i)	Any **one** from: • Streetlights • Source of artificial lighting • Satellites • Aircraft • Moon • Cities • Sun	Do NOT allow (too vague) • Lights • Skyglow	**1**

Question number	Answer	Mark
7 (a)(ii)	Any **one** from: • limiting magnitude reduced • Skies not black in photographs • Milky Way not visible • Objects look/seem dimmer • Reduces contrast • Fewer objects are visible	**1**

Question number	Answer	Mark
7 (a)(iii)	Any **one** from: • Fewer/no **artificial** light sources • No electricity/light bulbs • Urban areas were poorly/not lit at night • Primary source of light was candles/flame.	**1**

Question number	Answer	Mark
7 (b)(i)	Any **two** from: • Can determine what celestial objects are visible/above the horizon on a given date/time (allow shows the horizon) (1) • Can determine the rising/setting/culmination times for celestial objects (1) • Can determine the local position/orientation of celestial object (in the sky) • Can be adjusted to the time/month/year of the observation	**2**

Question number	Answer	Mark
7 (b)(ii)	Any **one** from: • Planisphere designed for a specific latitude on Earth/star chart can be used anywhere on Earth. • Planisphere's only show part of the celestial sphere	**1**

7 (c)	**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.	**6**

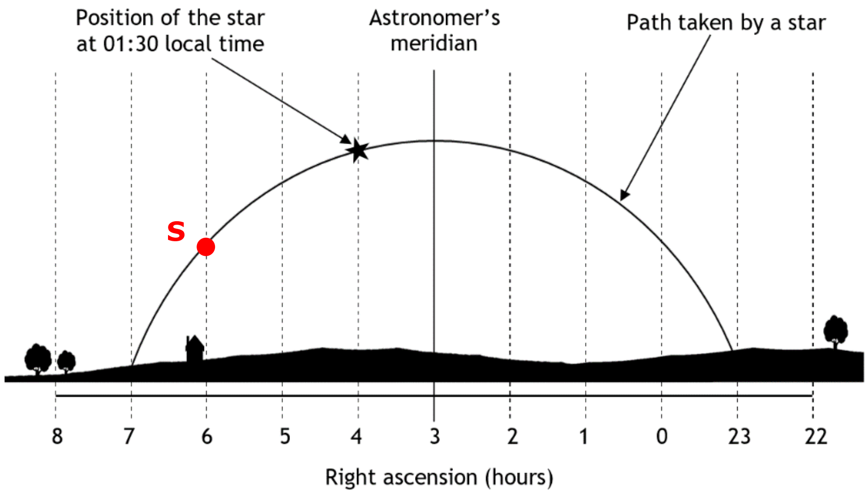
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	Lacks clarity. Basic interpretation and evaluation of suggest objects which is limited and narrow in scope. Response contains basic information with little linkage between points. Alternatives may be suggested.
Level 2	3-4	Some structure. Interpretation and evaluation of suggested objects attempts to synthesise and integrate relevant knowledge. Alternatives are suggested.
Level 3	5-6	Coherent and logically structured. Comprehensive interpretation and evaluation of suggest objects that demonstrates skills of synthesis and integrating relevant knowledge throughout the response. Well developed, sustained lines of scientific reasoning leading to supported alternatives.

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:

Description of observation	Suggested object
• a bright streak of light that travelled across the sky in under one second	a meteor is a suitable suggestion
• a faint fuzzy blob of light about half the size of the full Moon	a galaxy is a suitable suggestion However, it could also be a nebula, globular cluster, or comet.
• a very bright star (visible before all the other stars in the sky) seen on the western horizon just after sunset	the planet Uranus is not a suitable suggestion – it is not visible to the naked eye. However, it could be Venus due its westerly location at sunset. It could also be Mars, Jupiter, or Saturn
• about 6 or 7 faint stars tightly clustered together	a star cluster is a suitable suggestion. This object is likely to be an open cluster
• a steady, faint point of light moving quite quickly across the sky in about 2 minutes. It disappeared before it reached the horizon	likely to be a satellite because it disappears into the Earth's shadow before it reaches the horizon

Question number	Answer	Mark
8 (a)(i)	right ascension = 4 hours	**1**

Question number	Answer	Mark
8 (a)(ii)	 Intersection between path taken by the star and the 6 hour line of right ascension.	**1**

Question number	Answer	Mark
8 (a)(iii)	8 (hours)	**1**

Question number	Answer	Mark
8 (a)(iv)	NOT A 02:00 – incorrect answer **B 02:30 – star will culminate 1 hour later (01:30 + 1:00)** NOT C 03:00 – incorrect answer NOT D 03:30 – incorrect answer	**1**

Question number	Answer	Mark
8 (a)(v)	NOT A 01:00 – the star will cross the meridian in 1 hour NOT B 03:00 – incorrect answer NOT C 04:00 – incorrect answer **D 23:00 – star last crossed the observer's meridian 23 hours ago**	**1**

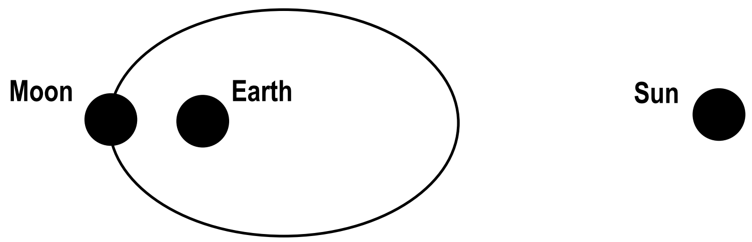
Question number	Answer	Mark
8 (a)(vi)	NOT A 01:00 – incorrect answer **B 03:00 - the First Point of Aires (0h RA) crossed the meridian 3 hours ago.** **Also, LST = HA + RA** **= 23:00 + 04:00** **= 03:00** NOT C 04:00 – incorrect answer NOT D 23:00 – incorrect answer	**1**

Question number	Answer	Mark
8 (b)(i)	Bob is south of London (1) Bob is east of London (1) Any **one** of the following reasons: • Bob is south of London because change/range of day lengths from Feb to May is smaller compared to London (1) • Bob is east of London because sunrise occurs earlier than London (1)	**3**

Question number	Answer	Mark
8 (b)(ii)	The Sun may not be visible (1) due to bad weather/obstructions/night (1) or The Sun is very bright (and should not be looked at directly) (1) thus requiring specialised equipment/filters/projection method etc. (1)	**2**

Question number	Answer	Mark
9 (a)(i)	1st (January) or 2nd (January)	**1**

Question number	Answer	Mark
9 (a)(ii)	Moon would appear larger / brighter than usual in the sky (1) because it is at its closest distance to Earth/perigee (1)	**2**

Question number	Answer	Mark
9 (a)(iii)	 Moon in an elliptical orbit around the Earth (1) Moon at perigee (closest point to Earth) (1) Sun/Sun's rays in correct position forming a straight-line Sun-Earth-Moon (1)	**3**

Question number	Answer	Mark
9 (b)	At winter solstice the Sun's altitude is at its greatest below the horizon / at summer solstice the Sun's altitude is at its smallest below the horizon (1) Moon is illuminated from different angles (1)	**2**

Question number	Answer	Mark
9(c)	(see tables below)	(6)

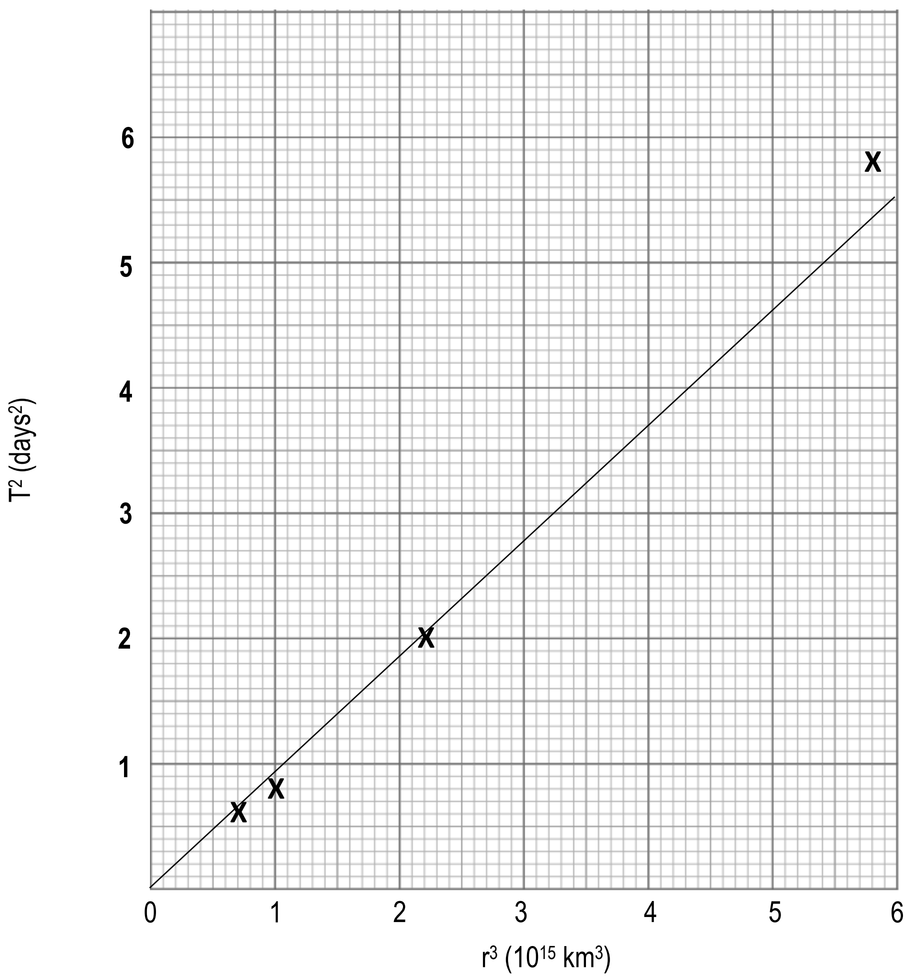
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	Lacks clarity. Basic plan attempted but with limited analysis of scientific ideas. Generalised comments made. Plan is incomplete and contains basic information with some links to lunar phase, shadows and suitable features to observe.
Level 2	3-4	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 with lunar phase, shadows and how this can help or hinder the observation of surface features.
Level 3	5-6	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 observation of all the named features. Appropriate dates selected and correct reasons given.

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:

Feature	Lunar Phase	Possible dates	Suitability
Sea of Tranquility (mare)	full	13th	(Mare) is a flat feature which does not cast shadows. Observed due to its difference in colour. Best observed at a full moon.
Tycho (crater)	last quarter and/or full	20th and/or 13th	(Crater) has height and depth and cast shadows. Best observed in shadow during last quarter. and/or Tycho has bright rays which are a difference in colour and have no height/depth. Best observed during full moon.
Apennine mountain range	first quarter	6th	Mountain range has height and depth and cast shadows. Best observed at first quarter.

A clear and correct link between lunar phase/date and the relief of the feature being observed.

<table>
<tr><th>Question number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>10 (a)(i)</td><td>

T^2 axis (y-axis) correctly labelled (1)

Four points plotted correctly to nearest small square (1)

Suitable best fit line (1)
Allow a best fit line that does not pass through the origin</td><td>3</td></tr>
</table>

Question number	Answer	Mark
10 (a)(ii)	Orbital period = 1.9 days (allow a range 1.8 to 2.0) (3) Calculation: $r^3 = (1.6 \times 10^5)^3$ (km^3) (1) $r^3 = 4.1 \times 10^{15}$ (km^3) T^2 measured from the graph $T^2 = 3.8$ (days^2) Allow a range of 3.5 to 4.1 (1) $T = 1.9$ (days) Allow a range of 1.8 to 2.0 (1) Award one mark if T^2 is determined from the graph without first calculating r^3 i.e., $T^2 = 1.6$ (days^2) or $T = 1.26$ (days)	**3**

Question number	Answer	Mark
10 (b)(i)	Measurement of the gradient (of the line of best fit) Or Take values (from the line of best fit/table/data point) and substitute into the equation.	**1**

Question number	Answer	Mark
10 (b)(ii)	$\frac{T^2}{r^3}$ has a different constant/does not equal 0.91 (1) because Saturn has a different mass/gravitational field to Uranus (1)	**2**

Question number	Answer	Mark
10 (b)(iii)	Any **one** of the calculations for the $\frac{mass\ of\ Saturn}{mass\ of\ Uranus}$ shown: $\frac{95\ (mass\ of\ Earth)}{15\ (mass\ of\ Earth)}$ $\frac{95}{15}$ $\frac{5.7 \times 10^{26}}{9.0 \times 10^{25}}$ 95:15	**1**

Question number	Answer	Mark
10 (b)(iv)	Constant for Saturn = 0.14 ($\times 10^{-15}$ days^2/ km^3) (2) Calculation: Constant in Kepler's third law depends inversely on the mass of the central body $Constant\ for\ Saturn = \frac{constant\ for\ Uranus}{6.3}$ $Constant\ for\ Saturn = \frac{0.91\ (\times 10^{-15})}{6.3}$ (1) $Constant\ for\ Saturn =\ 0.14\ (\times 10^{-15})$ (1)	**2**