



# **Mark Scheme (Results)**

Summer 2017

Pearson Edexcel GCSE  
In Astronomy (5AS01) Paper 1  
Unit 1: Understanding the Universe

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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	Acceptable Answers	Marks
1 (a)	<p><b>A</b> Jupiter</p> <p><b>The only correct answer is A</b></p> <p>B is not correct because Mars is smaller than Jupiter</p> <p>C is not correct because Neptune is smaller than Jupiter</p> <p>D is not correct because Saturn is smaller than Jupiter.</p>		1
(b)	<p><b>B</b> Full</p> <p><b>The only correct answer is B</b></p> <p>A is not correct because the Moon is not opposite the Sun at this phase</p> <p>C is not correct because the Moon is not opposite the Sun at this phase</p> <p>D is not correct because the Moon is not opposite the Sun at this phase</p>		1
(c)	<p><b>D</b> Perihelion</p> <p><b>The only correct answer is D</b></p> <p>A is not correct because Aphelion is the point where the Earth is furthest from the Sun</p> <p>B is not correct because Elongation is a point in the orbit of another planet, as viewed from Earth</p> <p>C is not correct because it refers to the days of the year when day and night are of equal length</p>		1
(d)	<p><b>B</b> Neptune</p> <p><b>The only correct answer is B</b></p> <p>A is not correct because Jupiter can be seen with the naked eye</p> <p>C is not correct because Neptune can be seen with the naked eye</p> <p>D is not correct because Saturn can be seen with the naked eye</p>		1

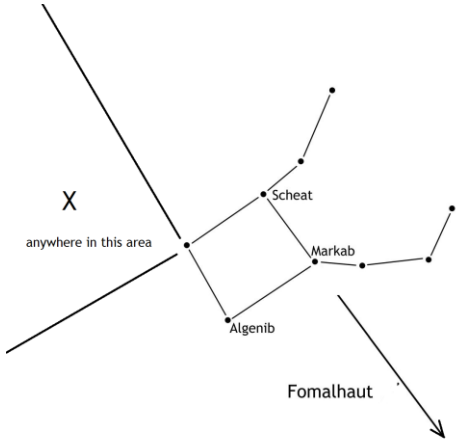
Question number	Answer	Acceptable Answers	Marks
2 (a)	<p><b>B</b> Ceres</p> <p><b>The only correct answer is B</b></p> <p>A is not correct because Callisto is a satellite of Jupiter</p> <p>C is not correct because Moon is a satellite of the Earth</p> <p>D is not correct because Triton is a satellite of Neptune</p>		1
(b)	<p><b>B</b> Galaxy</p> <p><b>The only correct answer is B</b></p> <p>A is not correct because the LMC is not a cluster</p> <p>C is not correct because the LMC is not a nebula</p> <p>D is not correct because the LMC is not a nova</p>		1
(c)	<p><b>C</b> 380 000 km</p> <p><b>The only correct answer is C</b></p> <p>A is not correct because the average distance between the Earth and the Moon is 380 000km</p> <p>B is not correct because the average distance between the Earth and the Moon is 380 000km</p> <p>D is not correct because the average distance between the Earth and the Moon is 380 000km</p>		1
(d)	<p><b>B</b> 13 000 km</p> <p><b>The only correct answer is B</b></p> <p>A is not correct because the average diameter of the Earth is 13 000km</p> <p>C is not correct because the average diameter of the Earth is 13 000km</p> <p>D is not correct because the average diameter of the Earth is 13 000km</p>		1

(e)	<p><b>D Venus</b></p> <p><b>The only correct answer is D</b></p> <p>A is not correct because Earth has a satellite system</p> <p>B is not correct because Jupiter has a satellite system</p> <p>C is not correct because Neptune has a satellite system</p>		1
(f)	<p><b>B Corona</b></p> <p><b>The only correct answer is B</b></p> <p>A is not correct because the Chromosphere has a lower temperature than the Corona</p> <p>C is not correct because the Photosphere has a lower temperature than the Corona</p> <p>D is not correct because the a Sunspot has a lower temperature than the Corona</p>		1
(g)	<p><b>D X ray</b></p> <p><b>The only correct answer is D</b></p> <p>A is not correct because Infra-red telescopes can be sited on the Earth's surface</p> <p>B is not correct because Radio telescopes can be sited on the Earth's surface</p> <p>C is not correct because Visible Light telescopes can be sited on the Earth's surface</p>		1

Question number	Answer	Acceptable Answers	Marks
3 (a) (i)	<p><b>C</b> Neptune</p> <p><b>The only correct answer is C</b></p> <p>A is not correct because Jupiter is not the closest to Pluto</p> <p>B is not correct because Mars is not the closest to Pluto</p> <p>D is not correct because Saturn is not the closest to Pluto</p>		1
(ii)	<p><b>D</b> Clyde Tombaugh</p> <p><b>The only correct answer is D</b></p> <p>A is not correct because Galileo Galilei did not discover Pluto</p> <p>B is not correct because William Herschel did not discover Pluto</p> <p>C is not correct because Isaac Newton did not discover Pluto</p>		1
(b)	<p>Any <b>two</b> of:</p> <ul style="list-style-type: none"> <li>• More eccentric/elliptical</li> <li>• Greater variation in speed</li> <li>• Greater tilt (to the ecliptic)</li> <li>• Pluto has not cleared its orbit.</li> </ul>	<p><i>Reject:</i></p> <p>Larger</p> <p>Slower</p> <p>Takes longer</p>	2
(c)	<p>Any <b>one</b> of:</p> <ul style="list-style-type: none"> <li>• Has not cleared its orbit of other bodies</li> <li>• Is part of the Kuiper Belt</li> <li>• Is not alone in its orbit</li> <li>• Similar/larger bodies in its orbit/Kuiper Belt, e.g. Eris</li> </ul>	<p><i>Reject:</i></p> <p>Too small</p> <p>Not spherical</p>	1

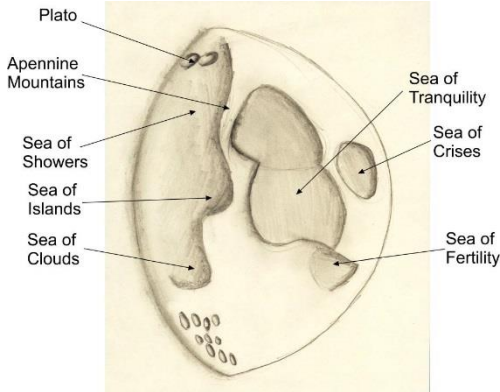
Question number	Answer	Acceptable Answers	Marks
4 (a)	<p>Clear labelled diagram showing curved Earth with two locations marked.</p> <p><i>Explanation or diagram establishes that:</i>            Light rays from Sun are parallel            So differing angles at two locations can only happen on a curved Earth.</p>		<p>1</p> <p>1</p> <p>1</p>
(b) (i) & (ii)	<p><i>Any 1 of:</i></p> <ul style="list-style-type: none"> <li>• Angle of Sun (in Alexandria)</li> <li>• Difference in angles of Sun</li>   <li>• Distance between towns (Alexandria and Syene)</li> </ul>	<p><i>Accept:</i></p> <ul style="list-style-type: none"> <li>• Length of shadow</li> <li>• Difference in shadow length</li> </ul>	<p>1</p> <p>1</p>
(c)	<p><i>Any one of:</i></p> <ul style="list-style-type: none"> <li>• Ship hulls disappearing over the horizon before their masts or sails</li> <li>• Curved shadow on Moon during lunar eclipse</li> <li>• Existence of horizon</li> <li>• Different stars visible at different latitudes.</li> </ul>	<p><i>Reject:</i></p> <p>Any modern evidence, e.g. satellite images, plane/space travel etc.</p>	<p>1</p>



Question number	Answer	Acceptable Answers	Marks
<b>5</b> (a) (i) (ii)	Fomalhaut marked in the direction shown. Andromeda galaxy marked within the indicated area. 	Projection of the line downwards	1 1
(b)	'Pegasus' comes from Greek mythology/legend.		1
(c)	It appears as a fuzzy patch / is not star-like. <b>or:</b> Because it is a galaxy.	<i>Accept:</i> To avoid confusion with comets.	1
(d) (i)	<b>B</b> greater than 10pc  <b>The only correct answer is B</b>  A is not correct because the Absolute magnitude is brighter than the Apparent magnitude  C is not correct because the Absolute magnitude is brighter than the Apparent magnitude  D is not correct because the Absolute magnitude is brighter than the Apparent magnitude		1
(ii)	Apparent magnitude is dimmer than absolute magnitude or <i>vice versa</i> .	Accept mathematical symbols	1

Question number	Answer	Acceptable Answers	Marks
6 (a)	<p><b>D</b> Its atmosphere is almost entirely carbon dioxide</p> <p><b>The only correct answer is D</b></p> <p>A is not correct because Venus is not the closest planet to the Sun.</p> <p>B is not correct because its temperature is not directly caused by its size</p> <p>C is not correct because light reflected by its clouds does not directly affect its temperature</p>		1
(b)	<p><b>C</b> Is 2.2 days longer than the Moon's orbital period</p> <p><b>The only correct answer is C</b></p> <p>A is not correct because the phase cycle is 2.2 days longer than the Moon's orbital period</p> <p>B is not correct because the phase cycle is 2.2 days longer than the Moon's orbital period</p> <p>D is not correct because the phase cycle is 2.2 days longer than the Moon's orbital period</p>		1
(c)	<p><b>B</b> Arctic Circle</p> <p><b>The only correct answer is B</b></p> <p>A is not correct because the Sun is not visible on the 21<sup>st</sup> June at the Antarctic Circle</p> <p>C is not correct because the Sun is never above the horizon for 24 hours at the Tropics</p> <p>D is not correct because the Sun is never above the horizon for 24 hours at the Tropics</p>		1

(d)	<p><b>D</b> Longer wavelength</p> <p><b>The only correct answer is D</b></p> <p>A is not correct because the Doppler Effect increases the wavelength of light received from an object moving away from the Earth</p> <p>B is not correct because the Doppler Effect increases the wavelength of light received from an object moving away from the Earth</p> <p>C is not correct because the Doppler Effect increases the wavelength of light received from an object moving away from the Earth</p>		1
(e)	<p><b>B</b> It is directly opposite the Sun in the sky.</p> <p><b>The only correct answer is B</b></p> <p>A is not correct because Opposition means an object is directly opposite the Sun in the sky</p> <p>C is not correct because Opposition means an object is directly opposite the Sun in the sky</p> <p>D is not correct because Opposition means an object is directly opposite the Sun in the sky</p>		1

Question number	Answer	Acceptable Answers	Marks
7 (a)	<p>Any 3 correctly named and located from those indicated below:</p> 	<p>Accept: Equivalent Latin names</p> <p>Allow some latitude in exact positioning as this is not a photograph.</p> <p>Reject: Sea of Serenity</p>	3
(b)	<p>Any <b>two</b> of: Angle of sunlight is now much lower/closer to terminator Producing better contrast/relief/shadows for raised features</p>		2
(c)	<p>Diagram and/or text establish that: Moon rotates whilst orbiting the Earth Rotation period of Moon = its orbital period about Earth</p>		1 1

Question number	Answer	Acceptable Answers	Marks
8 (a)	Show (perceived) order of brightness in a constellation.	<p>Accept: Show relative brightness</p> <p>Reject: Show brightness Order of luminosity or power of stars</p>	1
(b)	Plough, Big Dipper, Saucepan, Charles' Wain, Little Dipper, Ladle etc.	<p>Reject: Great or Little Bear Ursa Major or Minor</p>	1
(c)	<p>Neither star would set from Egypt/both are circumpolar</p> <p>High declination of stars Declinations greater than co-latitude of Egypt (established by statement, diagram or inequality, e.g. <math>72^\circ</math> (or <math>74^\circ</math>) <math>&gt; 60^\circ</math> (<math>90^\circ - 30^\circ</math>))</p>	<p>Accept: High declination</p>	1 1 1

Question number	Answer	Acceptable Answers	Marks															
9	Each correct explanation (see table below)		4 x 1															
<table border="1"> <thead> <tr> <th data-bbox="352 338 655 443">Incorrect word/phrase</th> <th data-bbox="655 338 959 443">Correct word/phrase</th> <th data-bbox="959 338 1262 443">Explanation</th> </tr> </thead> <tbody> <tr> <td data-bbox="352 443 655 667"><i>beyond our Solar System</i></td> <td data-bbox="655 443 959 667">from the Asteroid Belt/Mars/Comets</td> <td data-bbox="959 443 1262 667">Meteors come from the Asteroid Belt/Mars/Comets which are all within our Solar System</td> </tr> <tr> <td data-bbox="352 667 655 864"><i>This meteor shone even more brightly than the Sun.</i></td> <td data-bbox="655 667 959 864">Fireball / bolide  Apparen magnitude</td> <td data-bbox="959 667 1262 864">If it shone so brightly it would be a fireball/bolide.  Improved term.</td> </tr> <tr> <td data-bbox="352 864 655 1043"><i>shooting star</i></td> <td data-bbox="655 864 959 1043">meteor/fireball</td> <td data-bbox="959 864 1262 1043">Meteors are pieces of rock from our Solar System and nothing to do with distant stars.</td> </tr> <tr> <td data-bbox="352 1043 655 1227"><i>collect meteors that may have landed</i></td> <td data-bbox="655 1043 959 1227">meteorites</td> <td data-bbox="959 1043 1262 1227">Any rocks surviving to impact the Earth's surface would be called meteorites.</td> </tr> </tbody> </table>				Incorrect word/phrase	Correct word/phrase	Explanation	<i>beyond our Solar System</i>	from the Asteroid Belt/Mars/Comets	Meteors come from the Asteroid Belt/Mars/Comets which are all within our Solar System	<i>This meteor shone even more brightly than the Sun.</i>	Fireball / bolide  Apparen magnitude	If it shone so brightly it would be a fireball/bolide.  Improved term.	<i>shooting star</i>	meteor/fireball	Meteors are pieces of rock from our Solar System and nothing to do with distant stars.	<i>collect meteors that may have landed</i>	meteorites	Any rocks surviving to impact the Earth's surface would be called meteorites.
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<p><b>QWC:</b> Minimum of <b>two</b> astronomical terms correctly spelt, e.g. meteor, meteorite, meteoroid, bolide, magnitude etc.</p>			1															

Question number	Answer	Acceptable Answers	Marks
10 (a)	Aurora Borealis	<i>'Northern Lights'</i> <i>scores 1</i>	1 1
(b)	Clearly-labelled diagram showing Earth and its magnetic field <i>Any two from:</i> Solar wind particles Deflected by Earth's magnetic field/magnetosphere Excite atoms over the Earth's poles (to produce light)	<i>Reject: Sun's rays</i> <i>Reject: deflected by atmosphere</i>	1 2
(c)	<b>Rotation</b> of the Earth (on its axis) Long exposure needed to record aurora	<i>Reject: Orbital motion of Earth</i> <i>Unspecified motion of the Earth, e.g. 'the Earth has moved'.</i>	1 1

Question number	Answer	Acceptable Answers	Marks
<p><b>11</b> (a) (i)</p> <p>(ii)</p>	<p>Recognisable sketch of Milky Way (plan or side view) Globular clusters located around central hub.</p> <p><i>Any one from:</i></p> <ul style="list-style-type: none"> <li>• Older</li> <li>• Contain lower proportions of heavier elements, esp. Iron</li> <li>• Contain lower proportions of metals</li> <li>• Colder</li> <li>• Redder</li> </ul>	<p><i>Reject: Answers related to star's location.</i></p>	<p>1</p> <p>1</p> <p>1</p>
(b)	<p>Each difficulty correctly identified</p> <p>Each appropriate solution</p> <p><i>Any 2 from:</i></p> <ul style="list-style-type: none"> <li>• Very low in sky or not circumpolar / move south or await culmination</li> <li>• Quite faint for small binoculars / use larger aperture equipment</li> <li>• Small angular size / use larger magnification/aperture equipment.</li> </ul>		<p>1</p> <p>X</p> <p>2</p> <p>1</p>

Question number	Answer	Acceptable Answers	Marks
12 (a) (i)	<p><b>C</b> 10 parsecs</p> <p><b>The only correct answer is C</b></p> <p>A is not correct because it would not give a parallax angle of one tenth of a second</p> <p>B is not correct because it would not give a parallax angle of one tenth of a second</p> <p>D is not correct because it would not give a parallax angle of one tenth of a second</p>		1
(ii)	<p><b>D</b> 16 times</p> <p><b>The only correct answer is D</b></p> <p>A is not correct because a magnitude difference of three indicates a brightness difference of sixteen</p> <p>B is not correct because a magnitude difference of three indicates a brightness difference of sixteen</p> <p>C is not correct because a magnitude difference of three indicates a brightness difference of sixteen</p>		1
(iii)	<p><b>B</b> 3.7 years</p> <p><b>The only correct answer is B</b></p> <p>A is not correct because it is not the square root of 2.4 cubed</p> <p>C is not correct because it is not the square root of 2.4 cubed</p> <p>D is not correct because it is not the square root of 2.4 cubed</p>		1
(b) (i)	<p><b>C</b> 50°</p> <p><b>The only correct answer is C</b></p> <p>A is not correct because it is not equal to the observer's latitude</p> <p>B is not correct because it is not equal to the observer's latitude</p> <p>D is not correct because it is not equal to the observer's latitude</p>		1



(ii)	<p data-bbox="373 194 941 230"><b>B</b> 40°</p> <p data-bbox="373 257 807 293"><b>The only correct answer is B</b></p> <p data-bbox="373 322 935 389">A is not correct because it is not equal to the observer's co-latitude</p> <p data-bbox="373 418 935 486">C is not correct because it is not equal to the observer's co-latitude</p> <p data-bbox="373 515 935 582">D is not correct because it is not equal to the observer's co-latitude</p>		1
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Question number	Answer	Acceptable Answers	Marks
13 (a)	<p><i>Any <b>two</b> from:</i>            Much smaller than Mars            Less reflective / lower albedo            Moons are close to planet (as viewed from Earth).</p>	<i>Reject:</i> Further away	2
(b)	Captured from Asteroid Belt		1 1
(c)	<p><i>Any <b>three</b> from:</i>            Moons appear to move across background of stars            Moons appear to move at different speeds            Moons appear to move in opposite directions or moons appear to move in same direction.</p> <p>Explanation of above based on rotation period of Mars and orbital periods of moons.[Allow ecf from erratum on paper]</p>	<i>Reject:</i> appearance or size and brightness	3  (due to erratum in paper)  1

Question number	Answer	Acceptable Answers	Marks
14	Up to six marks available using the table below:		6

	Difficulties	Advantages
<b>Simple points:</b>	<i>Any one from:</i> Long journey time Need to return Life support issues Inhospitable Venusian conditions	<i>Any one from:</i> Can bring back samples Can do more complicated things
<b>Astronomical points:</b>	<i>Any one from:</i> Boredom / fatigue from long period in space Very hot / high air pressure on Venus No oxygen to breathe	<i>Any one from:</i> Humans are controlling the mission directly
<b>Detailed astronomical points:</b>	<i>Any one from:</i> Mission will take months Surface temperature well over Earth's maximum Air pressure 90 times that of Earth	<i>Any one from:</i> Can respond to unexpected events without delay time of radio signals to/from Earth.

Question number	Answer	Acceptable Answers	Marks
15 (a)	Any <b>three</b> of: (Nuclear) fusion in the core of hydrogen (nuclei) / protons Proton-proton chain Due to very high temperatures/pressures or densities		3
(b)	Any <b>two</b> from: Red Giant White Dwarf Planetary Nebula	<i>Reject:</i> (Super)nova Neuron star Black hole	2

Question number	Answer	Acceptable Answers	Marks
16 (a)	Another body (Theia) impacting Earth debris ejected from Earth Into an orbit around Earth  <b>QWC:</b> <i>Correct spelling, punctuation and grammar so that meaning is clear on first reading.</i>		1 1 1 1
(b)	<i>Describing any 2 from in detail:</i> <ul style="list-style-type: none"> <li>• Chemical (isotopic) composition of lunar rocks (from Apollo missions), e.g. oxygen, KREEP, zinc etc</li> <li>• Extremely improbable dynamics of capture hypothesis</li> <li>• Density/magnetic evidence for unusually small iron core of Moon</li> <li>• Analysis of meteorites created by impact.</li> </ul>		4

Question number	Answer	Acceptable Answers	Marks
17 (a)	<i>Diagram or explanation establishes:</i> Neutron star is spinning Radio waves are emitted from poles only Creating 'lighthouse' style rotating beam.		1 1 1
(b)	Any <b>two</b> from: They are regular/repeating With highly constant time period With constant intensity Sharpness of pulses		2

Question number	Answer	Acceptable Answers	Marks
18 (a)	7 days	Allow: 6.5-7.5 Incorrect number scores 0 (even with 'days' attached)	1 1
(b) (i)	1	Allow: 0.8 – 1.2 Allow: ECF from their (a).	1
(ii)	40 pc 40  <i>Incorrect answers may be awarded up to 2 marks from the following:</i> <ul style="list-style-type: none"> <li>• App and Abs magnitudes differ by <b>3</b></li> <li>• Brightness is <b>16</b> times lower than at 10pc</li> <li>• Hence star is <b>4</b> times further from Earth than 10pc.</li> </ul>		3 2

Question number	Answer	Acceptable Answers	Marks
19 (a)	<i>Any 1 from:</i> Rotational speeds of galaxies Gravitational lensing Variations in CMBR		1
(b)	Doesn't emit light or other EM radiation Very weakly interacting with other matter		1 1
(c)	<i>Any 2 from:</i> <ul style="list-style-type: none"> <li>• Energy which expands universe</li> <li>• Currently stronger than gravity</li> <li>• Causing acceleration in expansion of universe</li> </ul> <p><b>QWC:</b> Multiple-clause sentences used to produce clear flowing English.</p>		2  1
(d)	May cause universe to expand forever / 'heat death' of the universe		1

Question number	Answer	Acceptable Answers	Marks
20 (a)	<p><i>Any two from:</i></p> <ul style="list-style-type: none"> <li>• Sufficient gravity</li> <li>• Temperature between 0°C and 100°C (Goldilocks' Zone)</li> <li>• Sufficient atmospheric pressure</li> </ul>	<p><i>Reject: 'atmosphere'</i></p>	2
(b)	<p>Correct theory identified/stated Explanation of theory</p> <p><i>Any theory from:</i></p> <ul style="list-style-type: none"> <li>• Brought to Earth by comets, asteroids, meteorites or TNOs</li> <li>• Water vapour from volcanoes</li> <li>• Outgassing from rocks as the Earth cooled</li> <li>• Leakage of water from hydrate minerals.</li> </ul> <p><b>QWC:</b> <i>Correct use of specific scientific terms, e.g. comet, vapour, outgassing, hydrate etc.</i></p>		1 1  1
(c)	<p>Measurements of hydrogen isotope proportions in meteorites, comets and Moon rocks (compared with those in Earth's water).</p>		1



