Pearson Edexcel

Mark Scheme (Results)

Summer 2024

Pearson Edexcel
GCSE 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.

Paper 2 Telescopic Astronomy

Question number	Answer	Mark
1(a)(i)	**The only correct answer is B - comet** A is incorrect because Figure 1 shows a comet C is incorrect because Figure 1 shows a comet D is incorrect because Figure 1 shows a comet	**(1)**

Question number	Answer	Mark
1(a)(ii)	**The only correct answer is C - galaxy** A is incorrect because Figure 2 shows a galaxy B is incorrect because Figure 2 shows a galaxy D is incorrect because Figure 2 shows a galaxy	**(1)**

Question number	Answer	Mark
1(b)(i)	**The only correct answer is A - Mars** B is incorrect because it does not appear as a reddish-coloured disc C is incorrect because it does not appear as a reddish-coloured disc D is incorrect because it does not appear as a reddish-coloured disc	**(1)**

Question number	Answer	Mark
1(b)(ii)	**The only correct answer is C - globular cluster** A is incorrect because it is not a ball-shaped group of stars B is incorrect because it is not a ball-shaped group of stars D is incorrect because it is not a ball-shaped group of stars	**(1)**

Question number	Answer	Mark
1(b)(iii)	**The only correct answer is D - planetary nebula** A is incorrect because it is not a rapidly-expanding shell of gas B is incorrect because it is not a rapidly-expanding shell of gas C is incorrect because it is not a rapidly-expanding shell of gas	**(1)**

Question number	Answer	Mark
1(c)	Indication of a <u>blank</u> (planetary) disc Indication of a satellite Up to four aligned satellites.	**(1)** **(1)** **(1)**

Question number	Answer	Mark
2(a)(i)	**The only correct answer is A - Earth** B is incorrect because it has smaller mass than the Earth C is incorrect because it is not a terrestrial planet D is incorrect because it is not a terrestrial planet	(1)

Question number	Answer	Mark
2(a)(ii)	**The only correct answer is D - Uranus** A is incorrect because it is not a gas giant planet B is incorrect because it is not a gas giant planet C is incorrect because it has a larger mass than Uranus	(1)

Question number	Answer	Mark
2(b)(i)	**The only correct answer is A - Apollo** B is incorrect because it did not visit the Moon C is incorrect because it did not visit the Moon D is incorrect because it did not visit the Moon	(1)

Question number	Answer	Mark
2(b)(ii)	**The only correct answer is C - New Horizons** A is incorrect because it did not visit Pluto B is incorrect because it did not visit Pluto D is incorrect because it did not visit Pluto	(1)

Question number	Answer	Mark
2(c)(i)	**The only correct answer is D - Oort Cloud** A is incorrect because it does not contain long-period comets B is incorrect because it does not contain long-period comets C is incorrect because it does not contain long-period comets	(1)

Question number	Answer	Mark
2(c)(ii)	**The only correct answer is A - Asteroid Belt** B is incorrect because it does not contain Ceres C is incorrect because it does not contain Ceres D is incorrect because it does not contain Ceres	(1)

Question number	Answer	Mark
2(d)(i)	**The only correct answer is D - timing a beam of light reflected from its surface** A is incorrect because it is not an accurate way of determining the distance to the Moon B is incorrect because it is not an accurate way of determining the distance to the Moon C is incorrect because it is not an accurate way of determining the distance to the Moon	**(1)**

Question number	Answer	Mark
2(d)(ii)	**The only correct answer is C - measuring the luminosity of a Cepheid variable** A is incorrect because it is not an accurate way of determining the distance to the Andromeda galaxy B is incorrect because it is not an accurate way of determining the distance to the Andromeda galaxy D is incorrect because it is not an accurate way of determining the distance to the Andromeda galaxy	**(1)**

Question number	Answer	Mark
3(a)(i)	*Any **one** from:* • to keep the two lenses (A and B) aligned / in line with each other / pointing in the same direction • to keep the two lenses (A and B) the same/a constant distance apart	**(1)**

Question number	Answer	Mark
3(a)(ii)	**49** (x) (ignore units) *Any **one** from:* • 64m / 130cm (i.e. attempt to divide f_O by f_E) • 0.49	**(2)** *(1)*

Question number	Answer	Mark
3(a)(iii)	*Any **3** from:* • Long focal length allows for high magnification • Chromatic aberration • Aperture may be unsuitable for detailed observation of relatively faint object (light grasp) • Aperture may be unsuitable for detailed observation of relatively small object (resolution) • Telescope cannot track objects (easily)	**(3)**

Question number	Answer	Mark
3(b)	*Any **one** from:* • Lighter/easier to use/move for the same aperture size • Reflecting telescopes are more compact for the same aperture size • Reflectors do not suffer from chromatic aberration • Reflectors can provide better image quality/brighter images esp. when observing faint objects. • Mirrors are less susceptible to temperature and environmental changes than lenses.	**(1)**

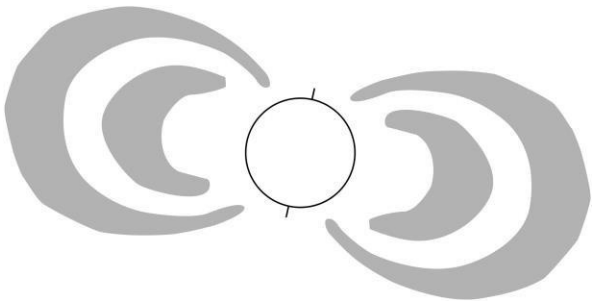
Question number	Answer	Mark
4(a)(i)	*Any **3** from:* • LH view shows more of lunar surface • RH view (at quarter phase) giving better relief, esp. craters • LH view at full phase showing some features more clearly • Specific comment on detail shown ("more detailed"= 0) • Similarity in terms of common features shown in both drawings (e.g. mare, craters etc.) • Both distinguish between highlands and lowlands (mare / terrae) • LH image shows more information about craters	**(3)**

Question number	Answer	Mark
4(a)(ii)	Earth-like features on Moon (mountains, valleys etc) Suggested Earth was not unique (in the universe).	**(1)** **(1)**

Question number	Answer	Mark
4(b)(i)	Changing **size** of Venusian disc (*Ignore:* comments on changing phase) Suggests varying distance from Earth.	**(1)** **(1)**

Question number	Answer	Mark
4(b)(ii)	Two (or more) simultaneous observations From different latitudes. Timing of length of transit	**(1)** **(1)** **(1)**

Question number	Answer	Mark
5(a)(i)	Dipole (“bar magnet”) shape, approximately aligned with Earth’s axis. Clear asymmetry correctly related to Solar Wind direction.	(1) (1)

Question number	Answer	Mark
5(a)(ii)	Label placed within shaded regions. 	(1)

Question number	Answer	Mark
5(a)(iii)	Label placed on/near Earth’s surface with latitude greater than 45° (N or S).	(1)

Question number	Answer	Mark
5(b)(i)	Link between sunspot cycle and solar activity Link between solar activity and strength of solar wind Solar Wind particles creating auroral displays.	(1) (1) (1)

Question number	Answer	Mark
5(b)(ii)	*Any **two** from:* (Stream of) charged particles / ions Disrupts radio signals Affects power lines/grids Due to effect on upper atmosphere/ ionosphere Damage instruments / electronics On satellites / space stations	(2)

Question number	Answer	Mark
5(b)(iii)	*Any **one** from:* • Cometary tails • Aurorae on other planets • Lack of atmosphere on Mercury etc.	(1)

Question number	Answer	Mark
6(a)	*Any **three** from:* • Radio waves have longer wavelength than light • Resolution reduces with wavelength • (Larger dish needed) to achieve useful resolution. • (Astronomical) radio sources are fainter (than optical sources) • (Large aperture needed) to collect sufficient energy • (Some) radio waves more strongly absorbed by atmosphere (than light)	(3)

Question number	Answer	Mark
6(b)(i)	76m / 25m = 3.04 (*or:* 38 / 12.5) 3.04^2 = **9.24** (*or:* equivalent method using ratio of r^2 or πr^2)	**(1)** **(1)**

Question number	Answer	Mark
6(b)(ii)	Multiple dishes are spread out over/cover a large area/distance. <u>Aperture synthesis / virtual aperture / interferometry</u> (or equivalent specific name) Creates (effective) aperture much greater than 76m.	**(1)** **(1)** **(1)**

Question number	Answer	Mark
6(b)(iii)	**0.11"** 0.0018' 91.2'' *Or: any **one** from:* 21km / 76m = 21 000 / 76 = **276** 0.5' / 276 = 0.0018 = 0.11"	**(2)** *(1)* *(1)* *(1)*

Question number	Answer	Mark
7(a)	**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: • Red giant has large diameter and cool surface temperature (spectral class K, M etc) • 61 Virginis is similar to the Sun • Proxima Centauri is correct spectral class but much too small • Rigel is a very large star but surface temperature is much too high (Spectral class B8) • Aldebaran is a red giant star • Sirius A has too high a surface temperature • Apparent magnitude is irrelevant • Mass is not directly linked to red giant status • Stars of similar mass to the Sun tend to evolve into red giants.	**(6)**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• 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	• 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	• 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)

Question number	Answer	Mark
7(b)(i)	Show **relative/order of** brightness/magnitude.	**(1)**

Question number	Answer	Mark
7(b)(ii)	**0.79** (allow 0.8) *Correct substitution into equation*	**(2)** *(1)*

Question number	Answer	Mark
7(b)(iii)	**80** (pc) *Or any **two** from:* ▪ Magnitude difference of 3 = 16x brightness difference ▪ γ must be 4x further away than α. *(Accept square root of their brightness difference)* ▪ γ must be 4 x 20 = 80pc away. *(Accept their difference ratio times 20)*	**(3)** *(2)*

Question number	Answer	Mark
8(a)	*Any **two** from:* • Inward gravitational pull of Saturn • Tidal effect of gravity • Objects pulled apart (to form ring system) • Gravitational action of Shepherd Moons.	**(2)**

Question number	Answer	Mark
8(b)	*Any t**wo** from:* • Complex gravitational field around Saturn. • Produces chaotic/unstable spinning of Hyperion • Irregular shape • Tidal interactions of Hyperion	**(2)**

Question number	Answer	Mark
8(c)	*Any **three** from:* • Gravitational field between (Mars and) Jupiter • Produces resonances where orbits are unstable • Produces tidal forces that move asteroids to another orbital radius • Occur where orbital radii are multiples of Mars/Jupiter's orbital radii *Allow: mention of Kirkwood Gaps.* *Ceres orbits at 2.8AU*	**(3)**

Question number	Answer	Mark
8(d)(i)	Stable orbital positions *(Allow: mention of Lagrangian Points)* No (total/radial) forces out of orbit.	**(1)** **(1)**

Question number	Answer	Mark
8(d)(ii)	*Any **one** from:* • No need for constant adjustment to maintain position. • Stable orbital positions • Requires minimal energy to remain in position. • (Some positions) allow uninterrupted contact with Earth *(Allow: mention of Lagrangian Points)*	**(1)**

Question number	Answer	Mark
8(d)(iii)	*Any **one** from:* • Distant from bright lights / heat sources of Sun, Moon or Earth • Above the Earth's atmosphere • Constant distance from Sun	**(1)**

Question number	Answer	Mark
9(a)	**23h 20m** (allow 23h 21m) *Or any **two** from:* • Average trail angle = ***25.2°.*** • 360 / 25.2 = **14.3** • 14.3 x 98 minutes = **1401 mins**	**(3)** *(2)*

Question number	Answer	Mark
9(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. **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: • Use more bright stars • Use longer exposure time – longer star trails, reducing percentage error • Move away from light pollution – darker sky as background • Avoid obstructions, such as at bottom of photograph.	**(6)**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• 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	• 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	• 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)

Question number	Answer	Mark
9(c)	*Diagram or text to show:* • Synodic day is time for Earth to return to same orientation relative to Sun / time between successive noon/sunrise/sunsets • Sidereal day is time for Earth to return to same orientation relative to the distant stars / time for star to return to a given position in sky, e.g. rise/set/transit/culmination/cross meridian.	**(1)** **(1)**

Question number	Answer	Mark
9(d)	Pole Star not exactly at north (celestial) pole. (Appears to) move around pole (during exposure).	**(1)** **(1)**

Question number	Answer	Mark
10(a)(i)	Exoplanets More examples/data/evidence (about planetary systems)	**(1)** **(1)**

Question number	Answer	Mark
10(a)(ii)	All habitable planets in Solar System (i.e. Earth) have life.	**(1)**

Question number	Answer	Mark
10(a)(iii)	Only one data point (Earth) Means small sample size/little data/evidence	**(1)** **(1)**

Question number	Answer	Mark
10(b)(i)	Calculation of fraction **with** planets (f_P = 1 – 0.6 = 0.4) Multiplication of f_l, f_i, f_c and L (1.1 x 0.4 x 2) (= **0.88)** *Correct calculation of 0.88 with no explanation of origin of 0.4 scores 1.* *(2- 1.1 = 0.9 scores zero)*	**(1)** **(1)**

Question number	Answer	Mark
10(b)(ii)	**6 800 000** (*accept* 6 600 000 – 6 800 000) *Or any **one** from:* 0.88 x 1 x 1 x 0.15 x 50 000 000 0.9 x 1 x 1 x 0.15 x 50 000 000 1.1 x 0.4 x 2 x 1 x 1 x 0.15 x 50 000 000	**(2)** *(1)*

Question number	Answer	Mark
10(c)	*Any **two** from:* • These radio waves pass through the Earth's atmosphere • These radio waves are not absorbed by (interstellar) dust. • These radio waves are a likely wavelength for intelligent communication.	**(2)**