Pearson Edexcel

Mark Scheme (Results)

November 2020

Pearson Edexcel GCSE In Astronomy (1AS0)
Paper 2: Telescopic astronomy

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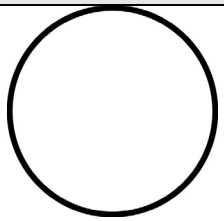
General Marking Guidance

- 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) **D** sunspot (ii) **B** comet (iii) **D** open cluster	**(1)** **(1)** **(1)**

Question number	Answer	Mark
1(b)	(i) **D** Saturn (ii) **D** planetary nebula	**(1)** **(1)**

Question number	Answer	Mark
1(c)	 Accept any roughly circular shape. Ignore any shading.	**(1)**

Question number	Answer	Mark
2(a)	(i) **B** Mercury (ii) **D** Venus (iii) **C** Uranus (iv) **A** Jupiter	**(1)** **(1)** **(1)** **(1)**

Question number	Answer	Mark
2(b)	(i) **C** main sequence – red giant – white dwarf (ii) **B** main sequence – red giant – supernova	**(1)** **(1)**

Question number	Answer	Mark
3(a)	**A** a Cassegrain reflector	(1)

Question number	Answer	Mark
3(b)	(i) **D** secondary mirror (ii) **B** finder scope	(1) (1)

Question number	Answer	Mark
3(c)	*a telescope with an aperture of 25cm* This is a large aperture Gives high resolution for detailed image of small object. (*Or:* high light grasp/statements related to brightness of image) *a telescope with a focal length of 200cm* This is a long focal length Allows appropriate magnification/field of view	 (1) (1) (1) (1)

Question number	Answer	Mark
3(c) iii	suitable focal length in the range of 4mm to 50mm Reason: lower end of range provides high magnification **OR** higher end of range provides better detail.	(1) (1)

Question number	Answer	Mark
4(a)	Points established by writing or diagram: • (apparent) **size** of Venus' disc changes (*Accept:* 'Venus changes size' or similar) • Distance between Earth and Venus must be changing.	**(1)** **(1)**

Question number	Answer	Mark
4(b)	Any valid comparison between agular size and reolutionj figures. Any **two** points from: • At crescent phase, Venus is (theoretically) large enough for its shape to be seen (resolved) • This assumes perfect seeing/no atmosphere • Clear and unpolluted skies in ancient times • No light pollution in ancient times • 'horned' is very vague (may refer to something else) • Variation in human eye may improve on quoted average figure.	**(1)** **(2)**

Question number	Answer	Mark
4(c)	Any **two** from: Points established by writing or diagram: • Telescope/binoculars pointed towards the Sun • Card/screen placed in line with telescope's eyepiece • Card placed around the tube to make a shadow. *Reject:* use of filters/solar telescopes	 **(1)** **(1)**

Question number	Answer	Mark
4(d)	(i) **160 000 000** (km) [Allow: 156 000 000] Incorrect answers may gain up to one mark for either of the following: • Use of 13 000km (from F&D Sheet) • Attempt at multiplication. (ii) • Alice and Bob are further apart (than the 1761 observers) • Larger **difference** in their measurements (of angle/time/position of transit).	**(2)** **(1)** **(1)**

Question number	Answer	Mark
5(a)	(i) **D** longer wavelength (ii) **C** is expanding	**(1)** **(1)**

Question number	Answer	Mark
5(b)	• Earlier telescopes had smaller apertures • Insufficient light grasp / galaxies too faint • Only the more distant/outside Local Group galaxies show large enough red-shift. *Reject:* • Statements related to insufficient magnification/'power' • Technology to measure red-shift did not exist.	**(1)** **(1)** **(1)**

Question number	Answer	Mark
5(c)	• They are part of our Local Group • They are moving towards us.	**(1)** **(1)**

Question number	Answer	Mark
5(d)	Any **two** from: • Objects appear fainter • Objects appear with distorted shape • Objects appear in different position • Colour of object is changed.	**(2)**

Question number	Answer	Mark
6(a)	Metal reflects radio waves (Glass does not)	**(1)**

Question number	Answer	Mark
6(b)	• Radio waves have longer wavelength (than light waves) *Accept:* 'longer' • (Large diameter gives) large aperture • (Large aperture gives sufficient) resolution.	**(1)** **(1)** **(1)**

Question number	Answer	Mark
6(c)	(i) • This is an aperture-synthesis/virtual aperture system • Dishes spread out over large distance/area • Giving large aperture/high resolution/large (effective) collecting area. (ii) Any **two** from: • Larger dishes • More dishes (in same area) • Shorter operating wavelength • Increase baseline.	 **(1)** **(1)** **(1)** **(2)**

Question number	Answer	Mark
7(a)	(i) **B** Main Sequence star (ii) **D** White Dwarf star (iii) **C** Neutron star	**(1)** **(1)** **(1)**

Question number	Answer	Mark
7(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: • Stars A, C and D are too massive to be dwarf stars • Stars B and E are of a suitable mass to be dwarf stars • Star B's spectral class is in the 'red' part of the spectrum rather than the 'white' • Star B is probably a red dwarf star • Star E is the most likely to be a white dwarf star • Star A has the correct spectral class but is much too luminous to be a white dwarf star • Apparent magnitude is irrelevant.	**(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 info rmation 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(c)	(i) • At least one ray drawn from a point on Earth's orbit, to/through the nearby star • A possible angle P correctly marked on diagram. (ii) **13**(.04) (light years) **4** Other incorrect answers may obtain a single consolation mark if there is evidence of <u>division</u> by 0.25.	 **(1)** **(1)** **(3)** **(2)** **(1)**

Question number	Answer	Mark
8(a)	• Gravity is weaker near edge of galaxy / stronger near core • (Stars must move slower) to stay in a stable orbit	**(1)** **(1)**

Question number	Answer	Mark
8(b)	(i) • Light cannot penetrate areas towards core of galaxy (whereas 21cm radio waves can) • Due to dust/scattering. (ii) • Speed of stars increases with distance from core • Decreasing rate of increase.	 **(1)** **(1)** **(1)** **(1)**

Question number	Answer	Mark
8(c)	An answer that combines points of interpretation/evaluation to provide a reasoned explanation. • Theory suggests that stars near the edge of the galaxy should travel more slowly but observation shows that they do not • Stars near the edge of the galaxy are travelling fastest. • Suggests the existence of some invisible matter whose gravity attracts stars further from core • Evidence for existence of Dark Matter • Provides additional force to allow outer stars to rotate quickly enough to explain Observation results. • All Theory speeds are lower than the Observation speeds.	**(4)**

Question number	Answer	Mark
8(d)	**479.6** (nm) Incorrect answers may obtain a maximum of two marks from the following: • Galaxy A is moving at 0.2c away from Earth • Galaxy B is moving at 0.001c towards Earth • Galaxy B is moving at 0.199c away from Galaxy A.	**(3)**

Question number	Answer	Mark
9(a)	An answer that includes points of interpretation/evaluation to provide a reasoned account of the data. • No evidence of repeats/averaging • No details of reference stars • No data on seeing conditions • Observations taken close to streetlights • Observations taken close to a large Moon • Agreement between values is generally within one magnitude • Accuracy decreases with fainter stars • Under-estimated bright stars • Over-estimated dim stars.	**(3)**

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: • Repeat observations to find an average • Clearer indication of reference stars • Make observations in an area away from streetlights • Make observations on a Moon-less night • Make observations when Moon is not near Orion • Make observations when Orion has a higher altitude.	**(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 info rmation 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)	Any **two** from: • First stage in formation of a star • Cloud of hydrogen 'gas'/plasma • Inward pull of gravity causes it to contract • High temperatures and pressures at centre • Gas becomes ionised and emits (EM) waves such as light	**(2)**

Question number	Answer	Mark
10(a)	(i) Any **two** from: • Can't view objects simultaneously • Can't view objects against a similar background • No reference stars available when viewing Sun • Human eye is not very reliable measuring instrument for magnitudes • Sun is too bright/unsafe (ii) • Brightness reduces in proportion to distance squared • √400 000 000 (= 20 000) (iii) Sun and Sirius have the same luminosity/absolute magnitude **or** they are the same type of star. (*Insufficient:* they are the same brightness) (iv) **3 x 10^{12}**(km) *Incorrect answers may score **one** mark for **either** of:* • Use of 150 000 000km (1AU) • Multiplying by 20 000 [20 000AU (*unit required*) scores **one** mark.]	**(2)** **(1)** **(1)** **(1)** **(2)**

Question number	Answer	Mark
10(b)	(i) • Apparent magnitude is measured from the star's actual distance • Absolute magnitude is measured from the same distance for all stars (10pc/32.6ly) **or** Absolute magnitude depends on luminosity/total power output/surface temperature and area of star (ii) **-1.47** Incorrect answers may obtain up to two marks from the following: • Correct substitution into equation • Correct evaluation of log d (= 0.42).	**(1)** **(1)** **(3)**

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