Mark Scheme (Results)

November 2021

Pearson Edexcel GCSE In Astronomy (1AS0)
Paper 1: Naked eye Astronomy

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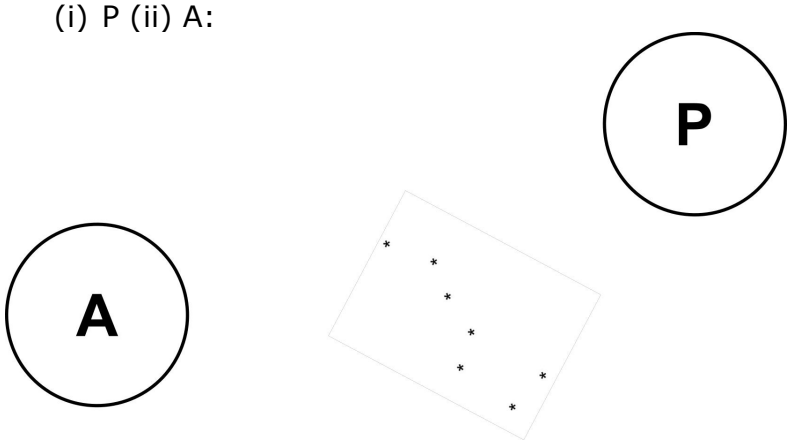
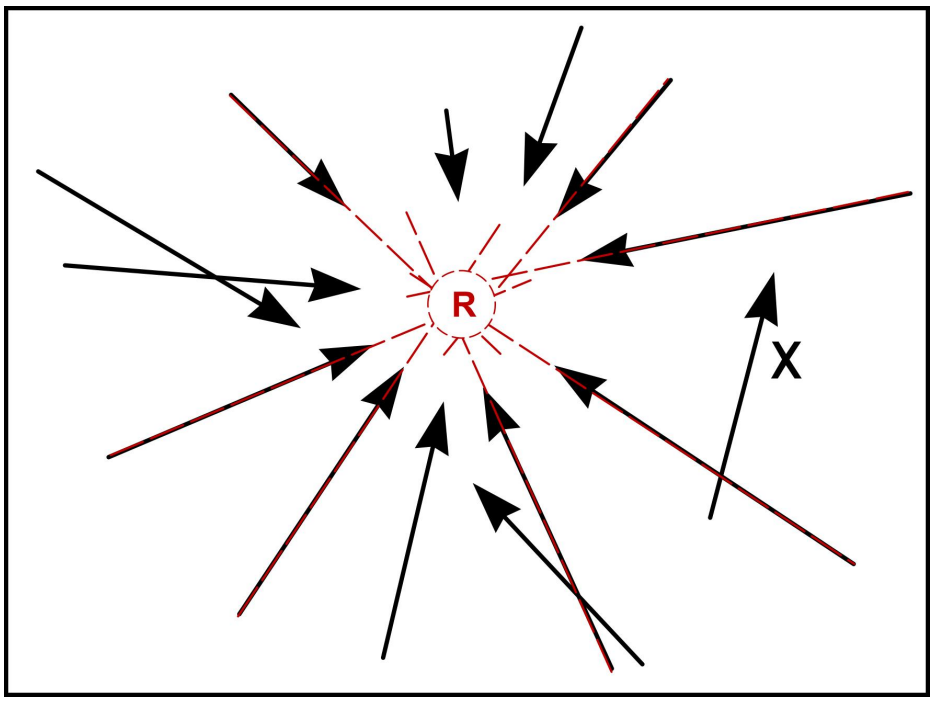
General Marking Guidance

- 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) P (ii) A:  (ii) **A** Plough (iv) **D** Ursa Major	**(1) (1)** **(1)** **(1)**

Question number	Answer	Mark
1(b)	(i) **C** Orion (ii) **D** Pegasus	**(1)** **(1)**

Question number	Answer	Mark
2 (a)	**A** crust	**(1)**
(b)	**D** perihelion	**(1)**
(c)	**C** terrae	**(1)**
(d)	**D** superior conjunction	**(1)**
(e)	**B** Arctic Circle	**(1)**
(f)	**D** halve	**(1)**
(g)	**C** all stars rise and set	**(1)**

Question number	Answer	Mark
3(a)	 **R** within circle. At least three construction lines within circle.	**(1)** **(1)**

Question number	Answer	Mark
3(b)	Sporadic / not part of this (meteor) shower.	**(1)**

Question number	Answer	Mark
3(c)	**D** its radiant is in the constellation of Leo	**(1)**

Question number	Answer	Mark
3(d)	*Points established by writing or diagram:* Entry into (Earth's) atmosphere Heat (and light) produced	 **(1)** **(1)**

Question number	Answer	Mark
4(a)	Shadow is curved Curvature of shadow is **different** to curvature of Moon.	**(1)** **(1)**

Question number	Answer	Mark
4(b)	(i) **4700** (4683) (km) *Correct time gap(s):* 2nd Contact – 1st Contact = 20:47 – 19:14 = *1h 33m* 3rd Contact – 1st Contact = 23:52 – 19:14 = *4h 38m* *Correct ratio:* Moon/Earth ratio = 4h 38m / 1h 33m = *2.99* or 0.334 (allow 3 or 0.33) (Hence, Moon's diameter = 2.99 x 14 000km = 4683km) (ii) **34% (0.34)** (F&DS gives Moon's diameter as 3500km) Error = 4700 – 3500 = 1200km (accept 1183, allow ECF from (i)) Percentage Error = 1200km / 3500km = 34% (0.34) (allow 1183/3500 = 33.8%) *(ii) Any **one** of:* • hard to estimate exact time of contacts • slow progress of eclipse • fuzzy edges of shadow regions • weather conditions • compound error from diameter of Earth.	**(3)** *Either of:* *(1)* *(1)* *(1)* **(2)** *(1)* ***(1)***

Question number	Answer	Mark
4(c)	*Points established by writing or diagram:* • use of pinhole/small aperture • projection of solar image	 **(1)** **(1)**

Question number	Answer	Mark
5(a)	*Points established through writing or diagram:* • rotation/'wobbling' of Earth's polar/spin axis • complex gravitational field/forces/'pulls' of Sun and Moon	 **(1)** **(1)**

Question number	Answer	Mark
5(b)	(i) (Angular) size of movement is large (ii) (Angular) speed of movement is very slow	**(1)** **(1)**

Question number	Answer	Mark
5(c)	(i) **C** Vernal equinox (ii) 23rd September (Allow 20th – 23rd) (iii) **A** East (iv) Any three from: ○ 11 000BCE is 13000 years ago ○ 13 x 14º = 182º ○ Which places First Point of Aries in constellation of Leo. ○ Constellation of Leo looks similar to Sphinx	**(1)** **(1)** **(1)** **(3)**

Question number	Answer	Mark
6(a)	Points plotted correctly Smooth curves (not dot-to-dot) through points. Anomalous point(s) ignored.	**(1)** **(1)** **(1)**

Question number	Answer	Mark
6(b)	**Indicative Content:** • Shadow cast on grass • Human assessment of shadow is inaccurate • Weather and cloud can have significant effect • Results given to unwarranted precision • Differences in times are small • Selection of Midsummer's Day is inaccurate	**(6)**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• A few inadequacies in the data are noted • A few shortcomings of the method used are identified • Some mention of relevant astronomical theory is made • At least one feasible suggestion for improving the method is made.
Level 2	3–4	• The major inadequacies in the data are noted • These are each linked to a particular shortcoming of the method used are identified • Relevant astronomical theory is used • Feasible suggestions for improving the method are made.
Level 3	5–6	• All inadequacies in the data are noted • These are each linked to a particular shortcoming of the method used are identified • Relevant astronomical theory is used to justify each of the above points • Detailed suggestions for improving the method are made by systematically addressing each of the identified issues.

Question number	Answer	Mark
7(a)	*(i) Points established by writing or diagram:* Gravitational pull of Moon Creates two areas of high water level on Earth Each point on Earth rotates through these every 24 hours. (ii) **07:03** (allow +/- 2 mins) Correctly reading both times – 01:09 & 12:57 (Allow +/- 1 min)	 **(1)** **(1)** **(1)** **(2)** *(1)*

Question number	Answer	Mark
7(b)	*Points established through writing or diagram:* Use of term 'spring' tide Moon and Sun on directly opposite sides of Earth Pulls combine / extra high (and low) 'bulge' of water.	 **(1)** **(1)** **(1)**

Question number	Indicative content	Mark
7(c)	**Indicative Content:** • Measurement of time between two identical Moon phases • Accurate timing system included • Systematic system for assessing time of Moon phase • Difficulty of assessing exact time for most Moon phases • End of New Moon identified • Need for repeats to improve reliability	**(6)**

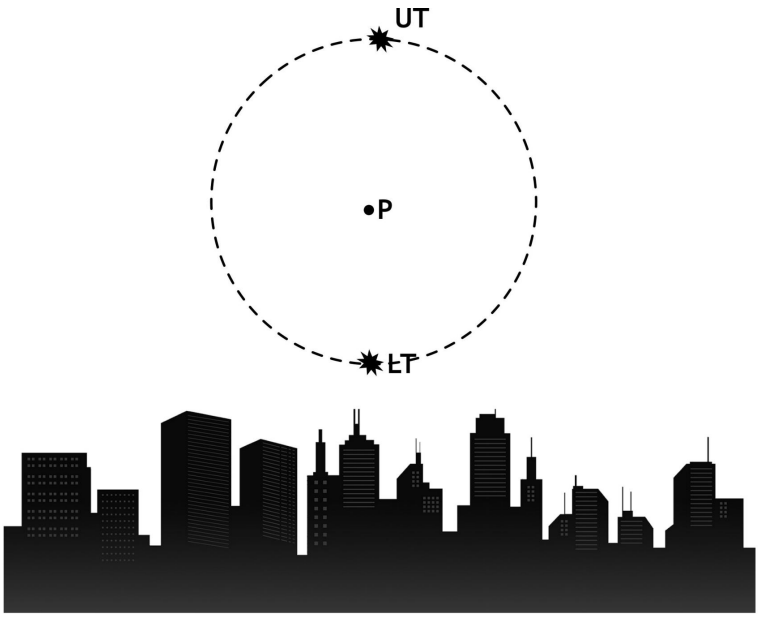
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Presents a simple observing programme showing some awareness of the phenomenon under investigation • Identifies some feasible parameters such as location, and observing times. • No evidence of awareness of need for repeated observations or observation over an extended time period to achieve reliable data.
Level 2	3–4	• Presents a sound observing programme showing clear awareness of the phenomenon under investigation • Identifies a number of feasible parameters such as location, and observing times. • Shows awareness of need for repeated observations or observation over an extended time period to achieve reliable data.
Level 3	5–6	• Presents a detailed observing programme showing a thorough understanding of the phenomenon under investigation • Identifies all relevant parameters such as location, and observing times. • Shows a clear understanding of the need for repeated observations or observation over an extended time period to achieve reliable data and reflects this clearly in their design.

Question number	Answer	Mark
8(a)	(i) (Very) large angle scales Reduces percentage/proportion of error (ii) 0.27 (allow 8/30 or any equivalent fraction)	**(1)** **(1)** **(1)**

Question number	Answer	Mark
8(b)	(i) Planetary orbits are close to circular Use of appropriate scientific terminology, e.g. low eccentricity, foci are close together, not very elliptical (ii) (Isaac) Newton	 **(1)** **(1)** **(1)**

Question number	Answer	Mark
8(c)	(i) **248 million** km (allow 249) Attempt to use Kepler's Third Law (T^2/r^3) Answer in AU - 1.65 (8) – allow 1.66 (ii) Student has used synodic (not sidereal) period (Time to return to point on Celestial Sphere) is not time to orbit the Sun.	**(3)** (1) (1) **(1)** **(1)**

Question number	Answer	Mark
9(a)	Always above horizon/never rise & set… …as the Earth/sky rotates every day/24h	**(1)** **(1)**

Question number	Answer	Mark
9(b)	 (i) Circle centred on P Indication of anti-clockwise motion (ii) UT directly above LT and same distance from P.	 **(1)** **(1)** **(1)**

Question number	Answer	Mark
9(c)	(i) **52$^{(o)}$** (ii) **24$^{(o)}$** Calculation of Dubhe's polar distance (90^{o} – 62^{o} = <u>28</u>^{o}).	 **(1)** **(2)** *(1)*

Question number	Answer	Mark
9(d)	(i) *Points established by writing or diagram:* Synodic day = time between sunrises/sets Sidereal day = time for Earth to rotate 360°. (ii) **08:58** Attempt to add half a day/12 hours Attempt to use sidereal time – use of 23h56m or 11h58m	 **(1)** **(1)** **(3)** (1) (1)

Question number	Answer	Mark
10(a)	(i) *Points established by writing or diagram:* Measuring altitude of Pole Star Latitude equal to altitude (ii) Position of Pole Star is the same… …at different longitudes. (iii) Suitable method identified Description of key quantity which determines longitude	 **(1)** **(1)** **(1)** **(1)** **(1)** **(1)**

Question number	Answer	Mark
10(b)	(i)**146º** **W** *Any **one** of:* Time difference = 4h 24m (4.4h) Longitude difference = 4.4 x 15º = 66º (Current longitude = 80ºW + 66º = 146ºW) (ii) 12s x 40days = 480s lost (8mins) 8 mins / 4 (= 2º) *(NB: the use of the 4 must be justified, i.e. 4mins of time difference is equivalent to 1º of longitude)* (iii) **7560** (km) (Clock has lost 8 mins, equivalent to losing 2º of longitude.) This means that the ship is at <u>148ºW</u>, i.e. <u>68º</u> from Ecuador. At the Equator, 1º of longitude is equivalent to 40 000km/360º = 111km. (Ship is therefore 68 x 111 = 7560 (7556) km from home.)	**(2)** **(1)** *(1)* **(1)** **(1)** **(3)** *(1)* *(1)*