Examiners' Report

Principal Examiner Feedback

November 2020

Pearson Edexcel GCSE In Astronomy (1AS0)

Paper 1: Naked eye Astronomy

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Introduction

Despite the unusually small cohort of candidates, a strong sense of their commitment to and enjoyment of the subject was still in evidence in their responses. Despite the fact that for most centres this course necessitates teaching and study outside the timetable, a genuine interest in the subject, often extending beyond the Specification, was frequently displayed.

Although this depth of understanding has been a hallmark of candidates' work in GCSE Astronomy for many years, it was very impressive to see it continuing in this extraordinarily difficult academic year.

In particular, the Examiners were pleased to see…

- An increasing proportion of candidates setting out the working for their calculations in a similar format to that recommended in the Mark Scheme. In other words, each of the following stages was made clear:
  - ✓ the **Equation** being used
  - ✓ the **Numbers** being substituted into the equation
  - ✓ the final **Answer**…
  - ✓ …along with the correct **Units**.

  This helps to ensure that any partial credit in an incorrect calculation is clearly visible.
- Many candidates were following the recommendations in some questions to include a clearly labelled diagram in their answers. This is particularly important in 'Explain…' questions since most ideas in astronomy are much more effectively explained using a diagram.
- A number of candidates whose study of the subject had obviously extended beyond the requirements of the Specification, enabling them to give additional detail in their answers. This evidenced their interest in the subject and enjoyment of the course and is a credit to both them and the teachers who have supported and inspired their learning.
- Familiarity with some of the key observations required by the Specification, clearly based on thorough revision. Examples included Eratosthenes' determination of the diameter of the Moon and Galileo's observations of the phases of Venus.

To improve performance in the future, candidates are advised the following:

- use specific astronomical terms in their answers rather than vague adjectives. For example, when describing the quality of an image, candidates should refer to specific properties such as resolution, brightness, magnification, angle of view and other specific properties.
- ensure, where possible, that they have some observational experience with basic optical equipment such as binoculars and a small telescope, as required by the Observational Tasks. It was evident from a number of questions that many candidates were not able to justify their Specification knowledge with an understanding of how the features of optical instruments affect the images produced.
  For the 2020 series, this could be done indirectly via online resources or remote observation and this provision will continue in the next series. In addition, Pearson is working on providing further resources which will help candidates to gain further insight into observational astronomy.

- look closely at the command word for each question and ensure that their answer focuses entirely upon it.
- pay close attention to the units required by a question as this may not always be the same as that delivered by an equation.
- ensure all parts of a diagram are correctly labelled and that a ruler has been used wherever necessary. Many diagrams in astronomy involve straight lines and the Examiners were a little concerned to see a high proportion drawn ‘freehand’.

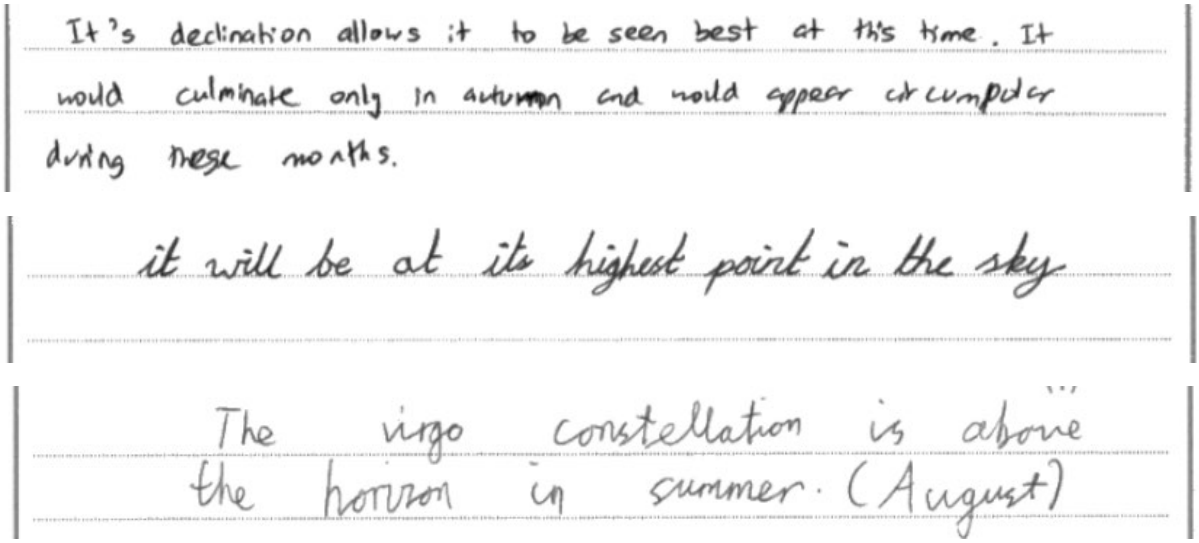
Q2b

A well answered question. Nearly all students were able to identify that the Sun lies on the ecliptic and most also knew that its hour angle is 12h or declination is zero during the autumn equinox.

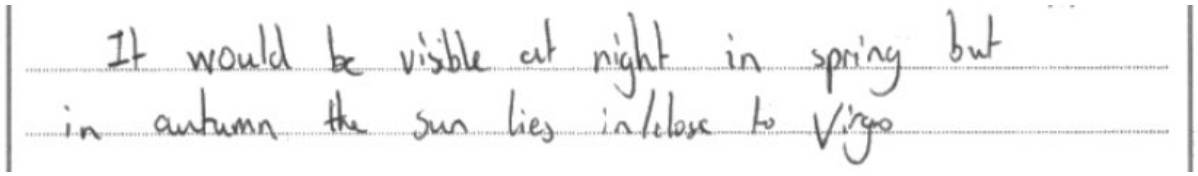
Q2(d)(ii)

Many students found this question challenging and struggled to relate the position of the Sun with the best time to observe a constellation. There were many generic responses such as, "Virgo is at its highest/culminating", or "Virgo is at its brightest".

Examples of candidate responses that were awarded no marks:



And an example of a response which gained marks:

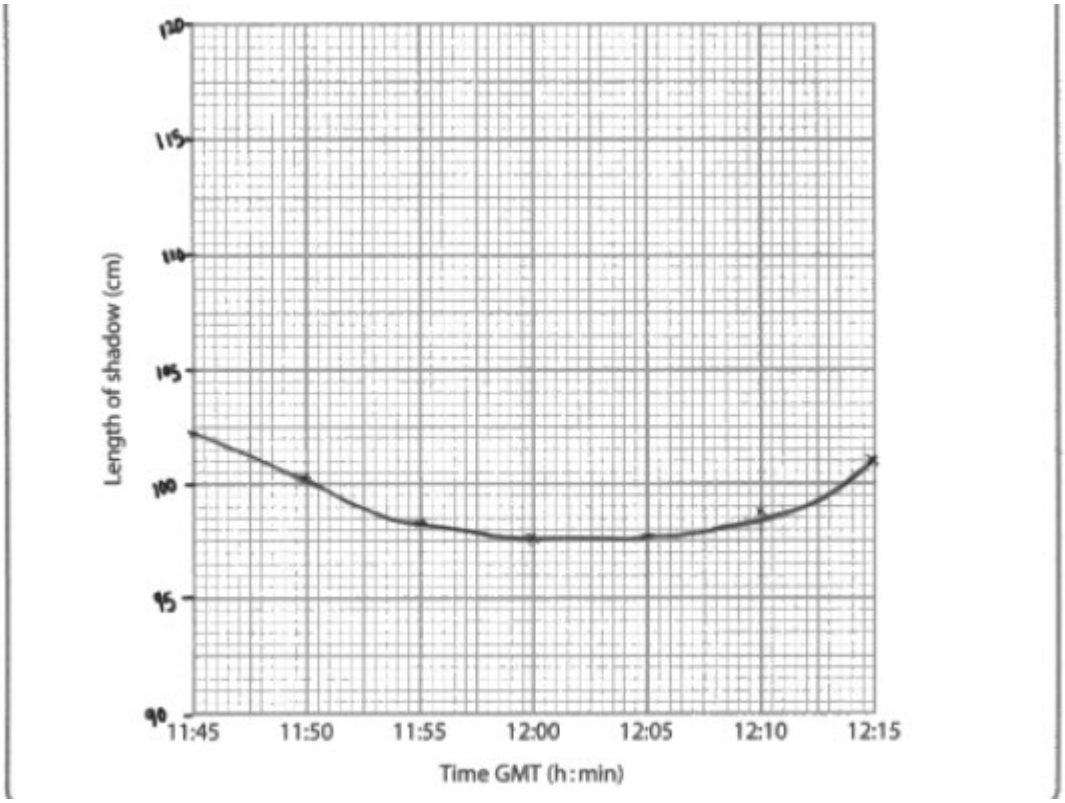


Q2(e)

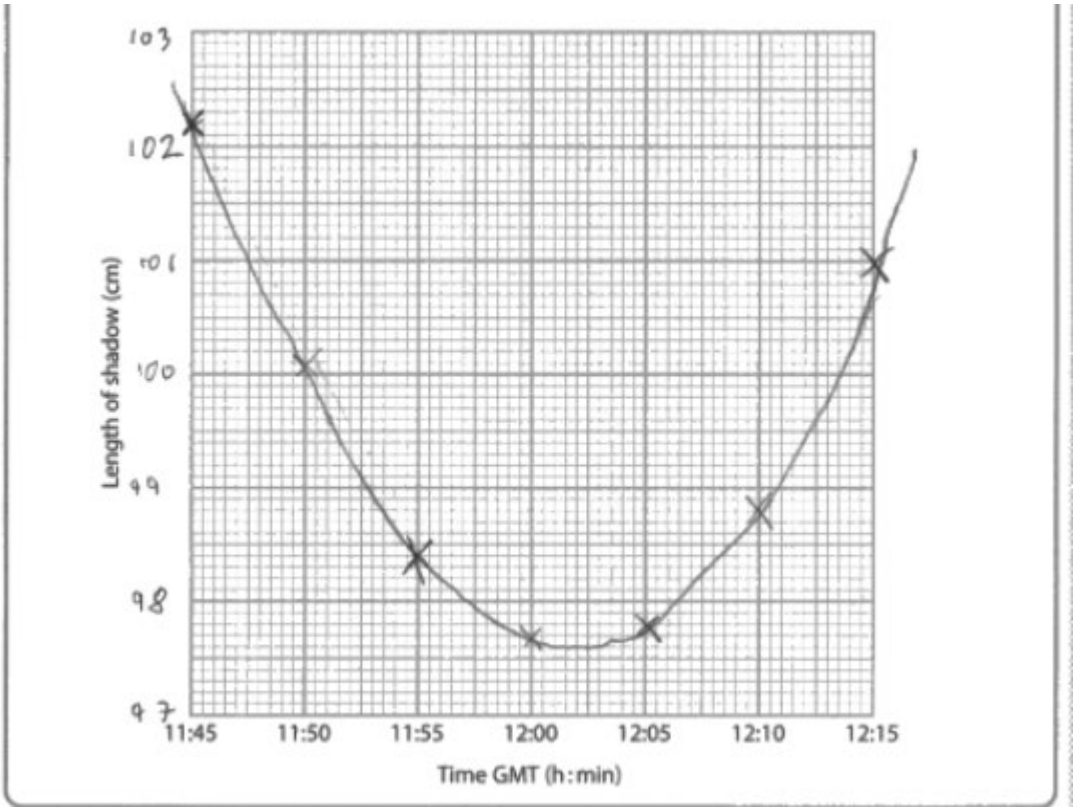
A very well answered question with the vast majority of students linking negative declination and southern hemisphere.

Q4(a)(i)

The majority of students correctly plotted a smooth curve through the data points rather than join them up with straight lines. Also, on the whole, the data points were plotted correctly provided a suitable scale was selected. Many students draw a graph without a false origin or the y-axis scale they selected was simply too large. The example below lost the scale mark but was still awarded the plotting and smooth curve marks.



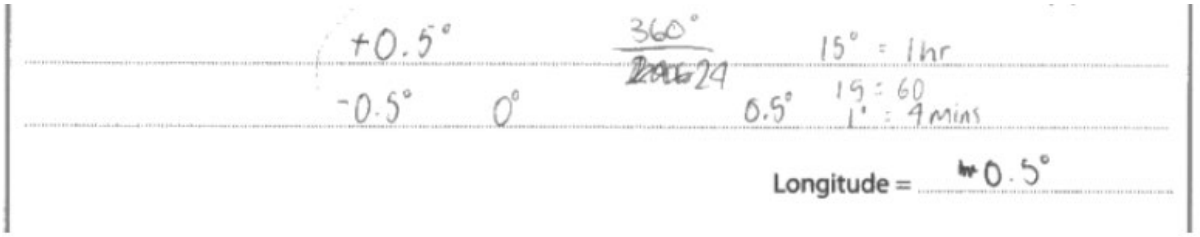
An example of a 3-mark response:



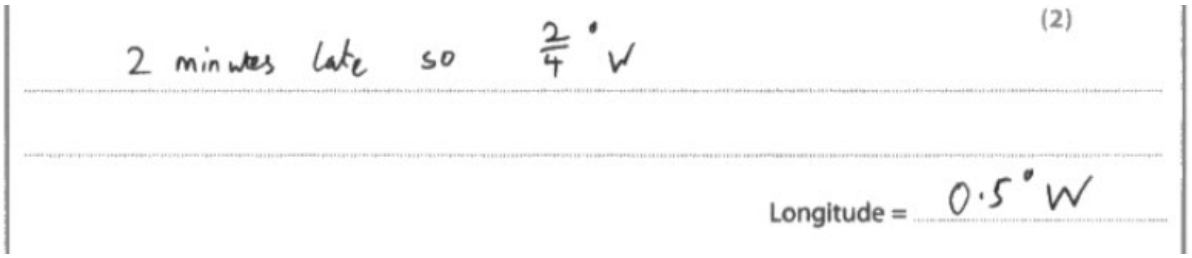
Q4(a)(iii)

This was a challenging question with many students stating a longitude of 0 degrees. This response was awarded no marks:

Of those students that correctly calculated the angle, many then neglected to state whether it was West of the Prime Meridian. This example was awarded one mark:



Students are advised to state whether a longitude is East or West of Greenwich. An example of a 2-mark response:

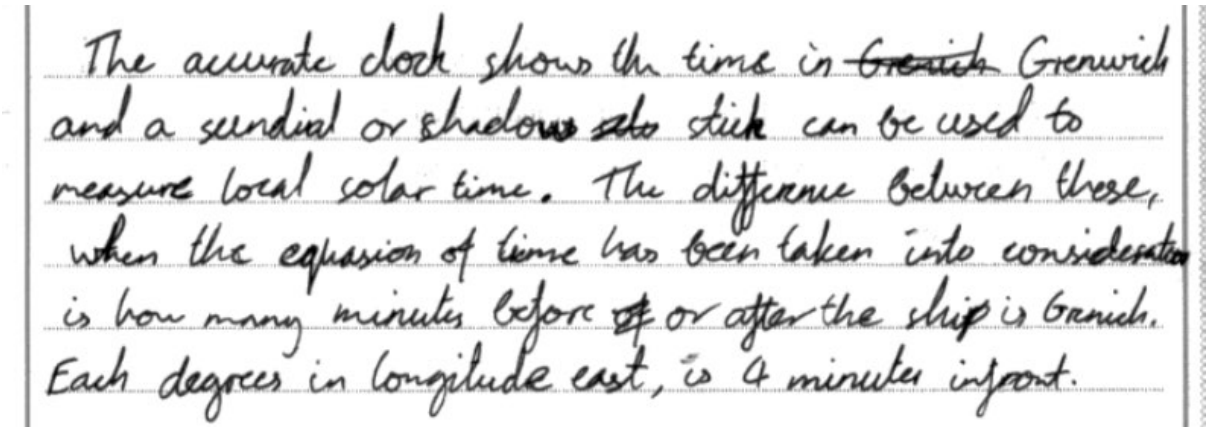


Q4(b)(ii)

In this question, the use of the equation of time was often applied to directly find the observer's longitude.

Reference to the equation of time was only awarded a mark if it was clearly shown that its function was to convert apparent solar time into mean solar time such that a direct comparison between the mean solar times at Greenwich and on board the ship can be made.

The following was awarded 3 marks

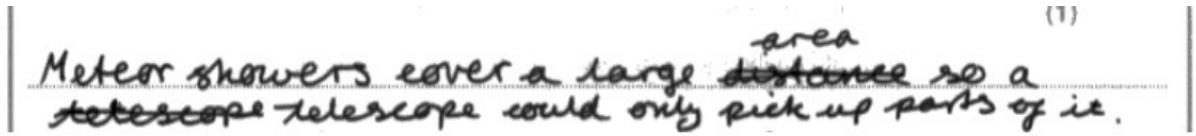


The equation of time mark was awarded in this example because it has been used in the correct context. The other correct marking points include the measuring the difference between Greenwich and local mean solar time and a difference of 4 minutes corresponding to 1 degree of longitude.

Q5(a)

Students found this question challenging and often responses were along the lines of “meteors move too fast” or “meteors only visible for a short time, thus telescopes had to track the event”.

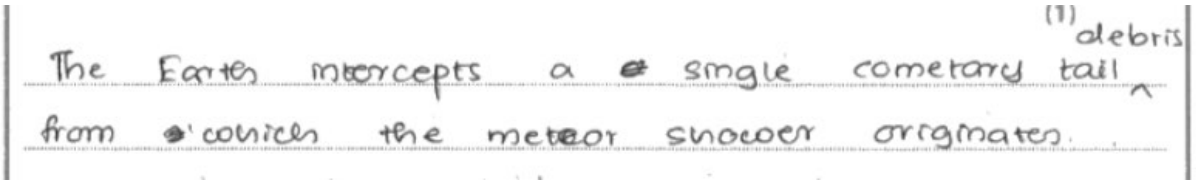
The following example was awarded the mark as there was sufficient understanding in the answer provided.



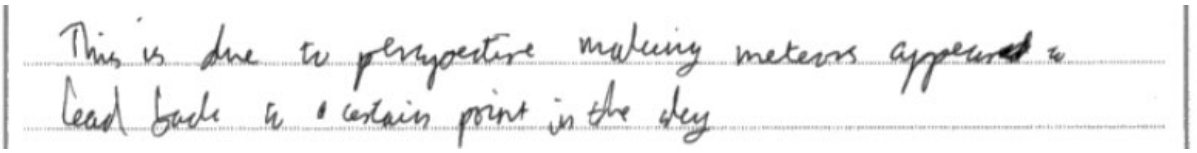
Candidates are reminded to use the correct terminology regarding “field of view” and that this is reduced when using binoculars or telescopes. A model answer which gained the mark:

Q5(b)

Students found this question very challenging and just redefined the radiant or referred to the Earth colliding into cometary debris. Thus, many students correctly stated the cause of periodic meteor showers and were awarded no marks.

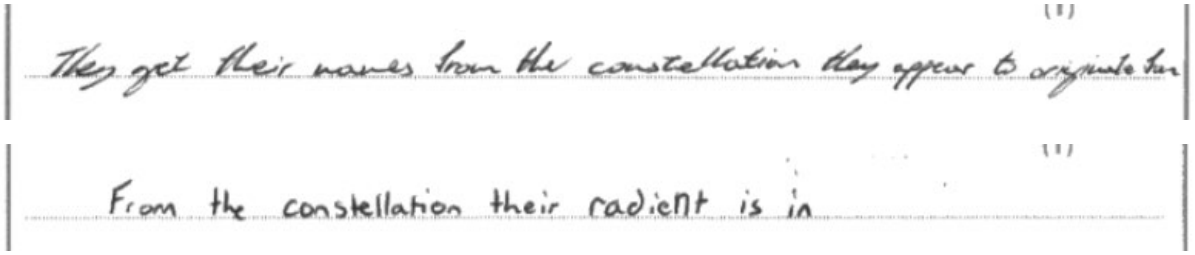


Whereas the question asked why the meteors appear to originate from one area of the sky. An example of a correct student response:



Q5(c)

Distinction needs to be made between meteors that are "seen" in a constellation and originating or radiating from that constellation. The following response gained full marks:



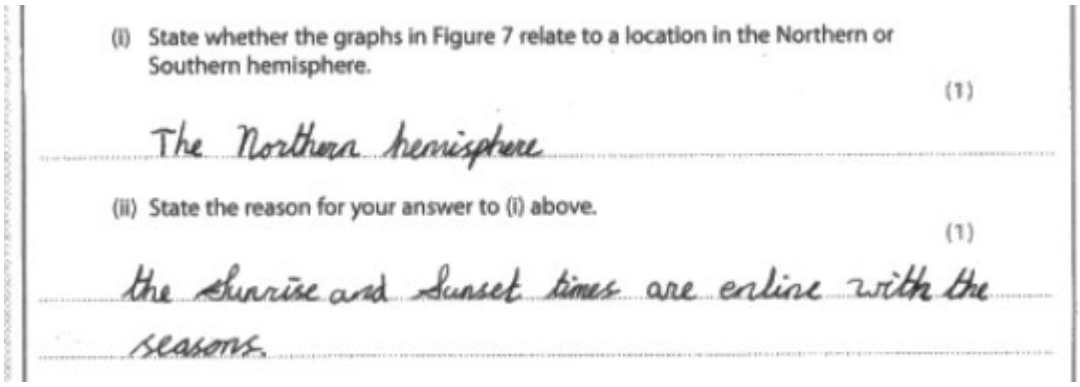
Q5(d)

Students often described in great detail observing techniques including dark adaption, warm clothes, the use of a red torch etc. This is only one of the indicative content bullet points. Level 1 students often described these techniques extensively but did not proceed to actually answer in detail how to determine the position of the radiant. Typically, a level 2 response would refer to plotting meteor trails, but it was a level 3 response that then went on to describe how these trails could be extrapolated to find the radiant.

Q6(a)(i – ii)

Both parts of this question was answered correctly by the majority of students.

In the following example, 6(a)(ii) was not awarded the mark because this statement would also be valid for the Southern hemisphere.



Q6(a)(iv)

Although there were many ways to describe the answer, this question was correctly answered by most of the students. An example of a correct response:

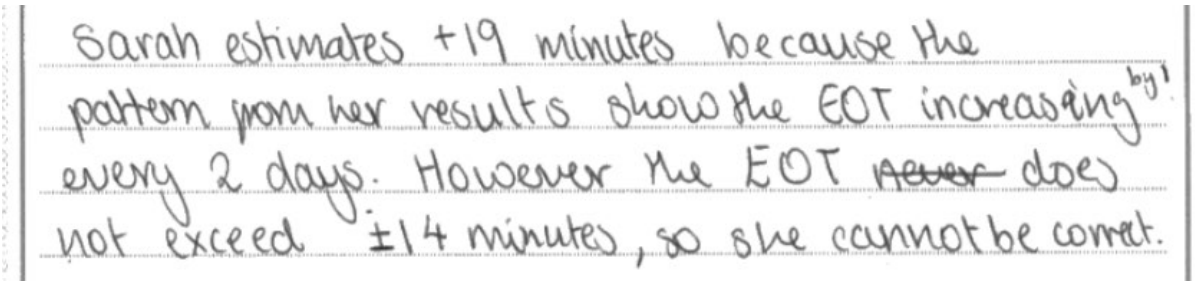
Q6(b)(i)

It was pleasing to see many students were able to determine the equation of time on 13 September would be +4 minutes.

Q6(b)(ii)

A challenging question and many students thought it reasonable to continue with the trend that the equation of time changes by one minute every two days.

There were few students who referred to the non-linear nature of the equation of time, and those that did answer the question correctly gained the marks by realising that the equation of time would exceed its maximum possible value. The example below was awarded 2 marks because the underlying understanding was present.


Sarah estimates +19 minutes because the pattern from her results show the EOT increasing by 1 every 2 days. However the EOT ~~never~~ does not exceed ±14 minutes, so she cannot be correct.

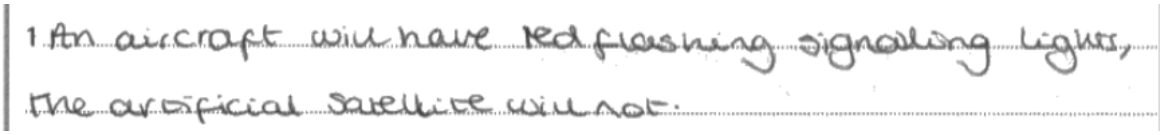
Q6(c)

The use of 'It must' rather than using the term 'The gnomon...' was a feature, although the overall concept was well understood.

Q7(a)

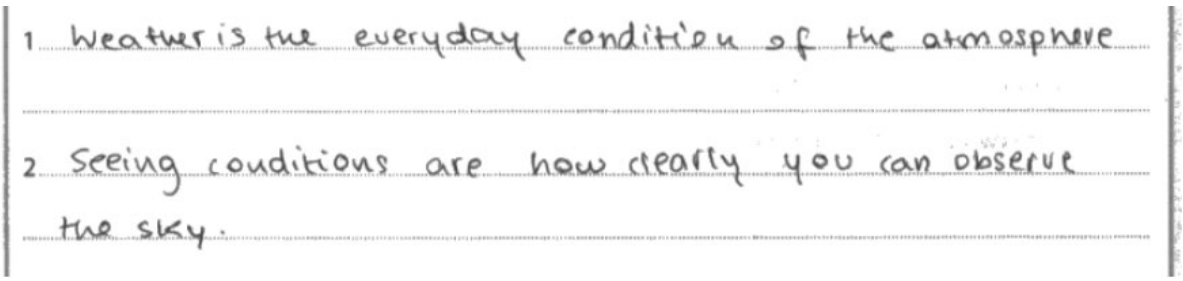
This proved to be quite a kind question and the majority of students gained both points.

It was common for students to refer to an aircraft having ‘flashing, coloured lights...’ in one sentence, and both marks were awarded for this as demonstrated in the example shown.


1 An aircraft will have red flashing signaling lights, the artificial satellite will not.

Q7(b)

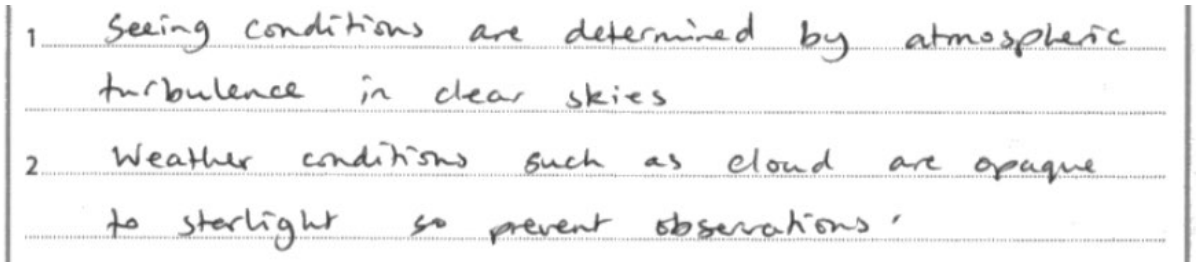
The description required for 'seeing conditions' proved very challenging to students.


1 Weather is the everyday condition of the atmosphere

2 Seeing conditions are how clearly you can observe the sky.

The example above was quite typical and was awarded no marks. The statements about weather and seeing conditions are both too vague.

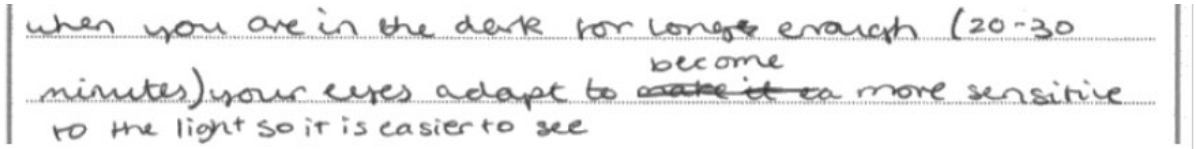
This is an example of a model answer:


1 Seeing conditions are determined by atmospheric turbulence in clear skies

2 Weather conditions such as cloud are opaque to starlight so prevent observations.

Q7(c)(i)

Provided students referred to the requirement that dark adaption takes time to occur, it was not critical that students gave an exact time. To gain marks students are required to make reference to the importance of waiting for dark adaption to occur. This student gave a range and was awarded one mark.


when you are in the dark for ~~longer~~ enough (20-30 minutes) your eyes adapt to ~~make it~~ become more sensitive to the light so it is easier to see

Q7(c)(ii)

Students often gave a biological reason why averted vision works and to gain marks students are not requirement to describe the structure of the eye.

Q7(d)

As in Q5(d), students often described in great detail observing techniques including dark adaption, warm clothes, the use of a red torch etc. However, this needs to be linked to how the limiting magnitude could be determined. Level 2 responses generally spent little time outlining the reasons why planets were not suitable, whereas level 3 responses usually gave clear reasons to their unsuitability. Also, it was common for a level 3 response to describe an alternative method using either reference stars or the use of a star chart/planisphere etc. This was often not mentioned in level 2 answers.

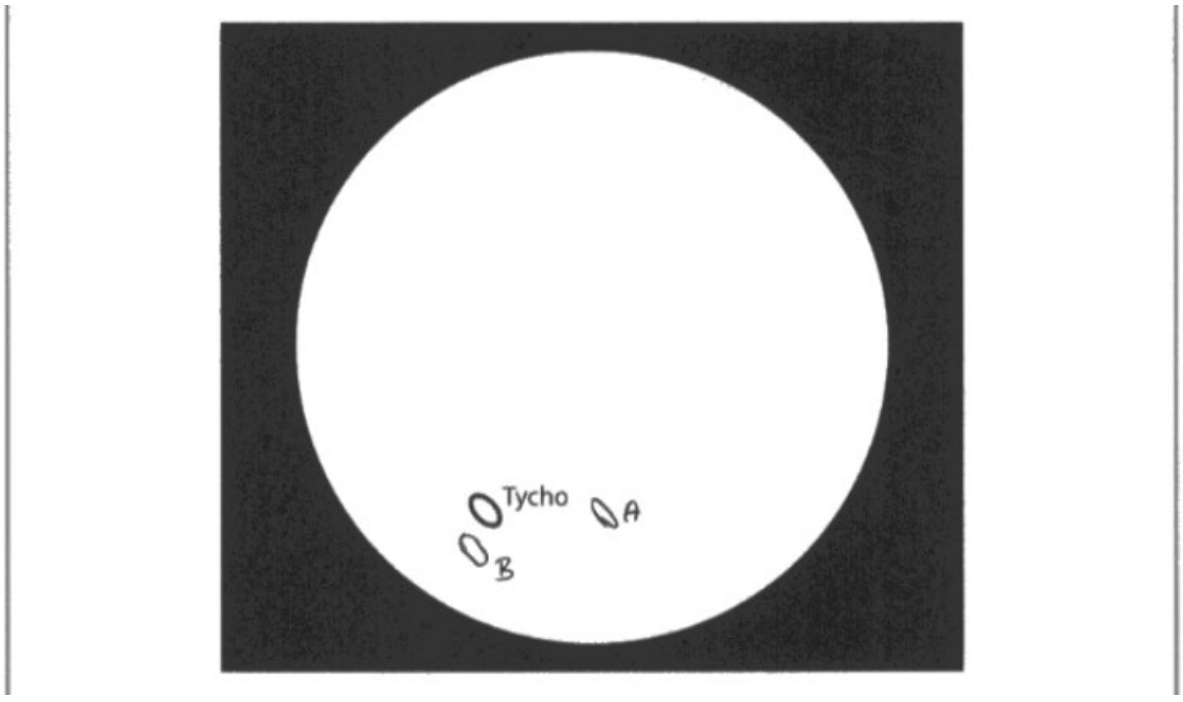
Q8(b)

This was very well answered by the students. Many alternative answers were awarded the mark including the following response.

You can see around the limbs of the moon's far side.

Q8(c)(i – ii)

The following response was awarded one mark. Students correctly positioned B correctly, but position A was too far from Tycho. This may have happened because there is more space horizontally on the diagram. The following was awarded one mark.

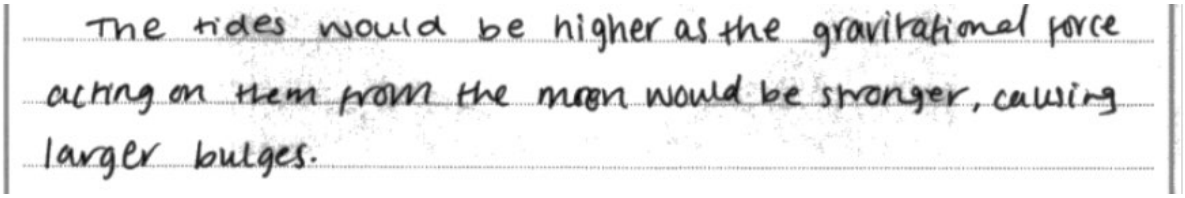


Q8(d)

The reciprocal answer was not awarded the mark for this question.

Q8(e)(i)

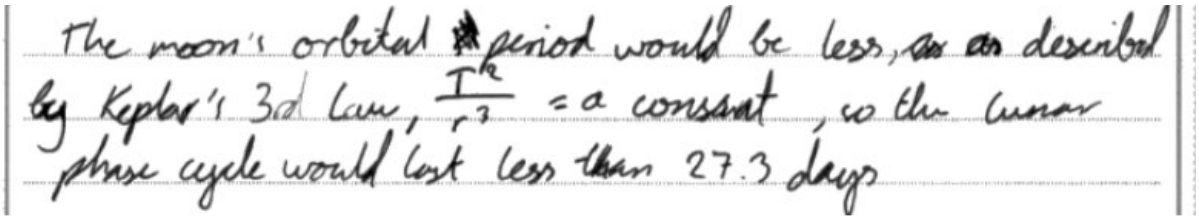
Most students correctly referred to the increase in tidal range, although answers such as "more extreme tides" or even "larger tides" were allowed. An example of a 2 mark response:



Most students then linked this with an increase in the gravitational force.

Q8(e)(ii)

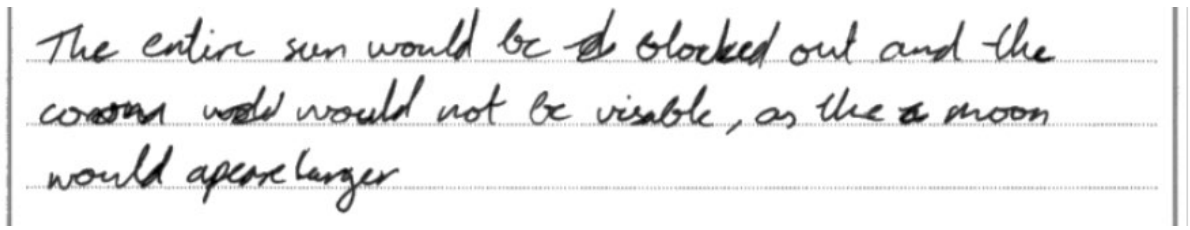
Many students appreciated that the phase cycle would be shorter gaining a mark. To gain a further second mark students needed to refer to the Moons period (around the Earth). An increase in the Moon's velocity was also accepted. An example of a 2-mark response:



Q8(e)(iii)

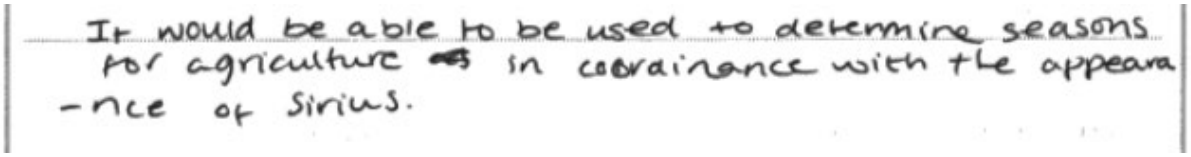
It was common for students to give a correct observational change, however found it challenging to justify why this would occur (ie the Moon would appear larger in the sky).

Examples which gained full marks:



Q9(a)(i)

The question was well answered, and the responses were equally balanced between calendar and religious significance. This is one of many good examples which was awarded 1 mark:



Q9(a)(ii)

Overall, this question was answered well by many students gaining a mark.

Q9(b)

Due to the nature of this questions, effectively all the students scored marks for this question.

Q9(c)(i)

Majority of students were able to clearly show the "pointers" pointing to Polaris. The following example has clearly shown the correct alignment of the pointers, but unfortunately the asterism contains the incorrect number of stars and thus gained only one mark.

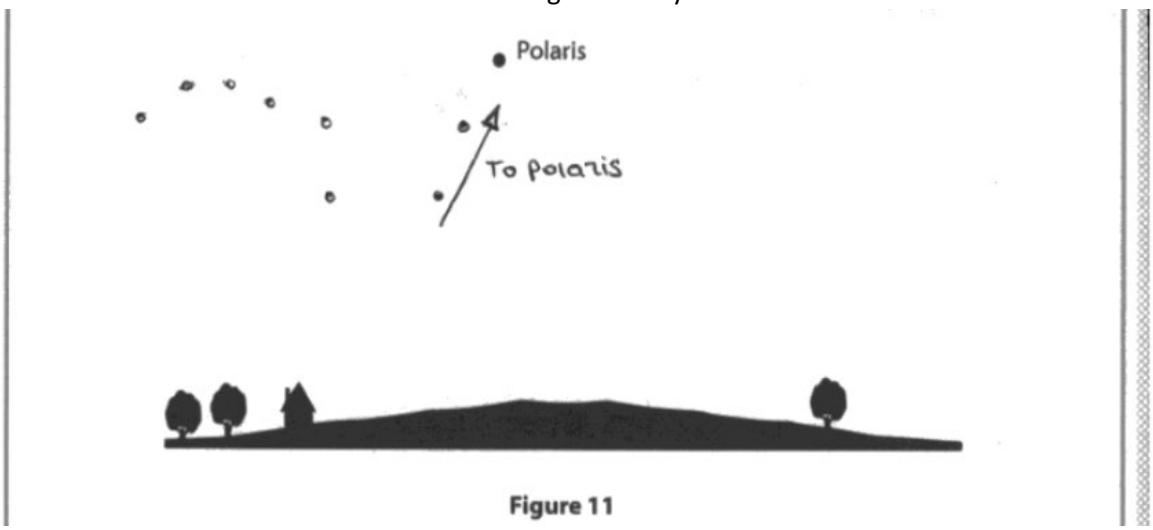


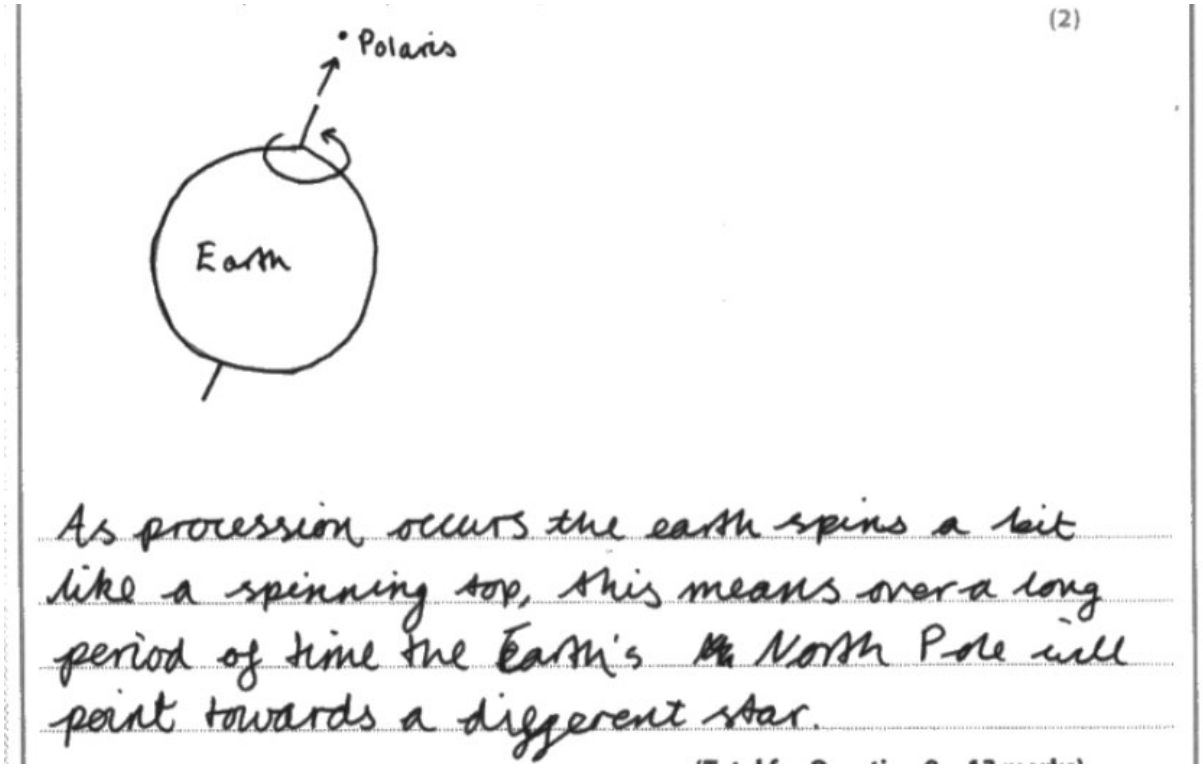
Figure 11

Q9(c)(ii)

This question was well answered in general. Some seemingly diverse routes did lead to the correct answer.

Q9(c)(iii)

Often students described in great detail how and what precession is and were awarded one mark for describing the movement of Polaris from the Celestial North Pole. Candidates are reminded to describe how this would affect the use of Polaris for finding positions on the Earth.



This was awarded 1 mark.

Q10(a)(i – ii)

Both parts of this question was answered correctly by the majority of students.

Q10(b)

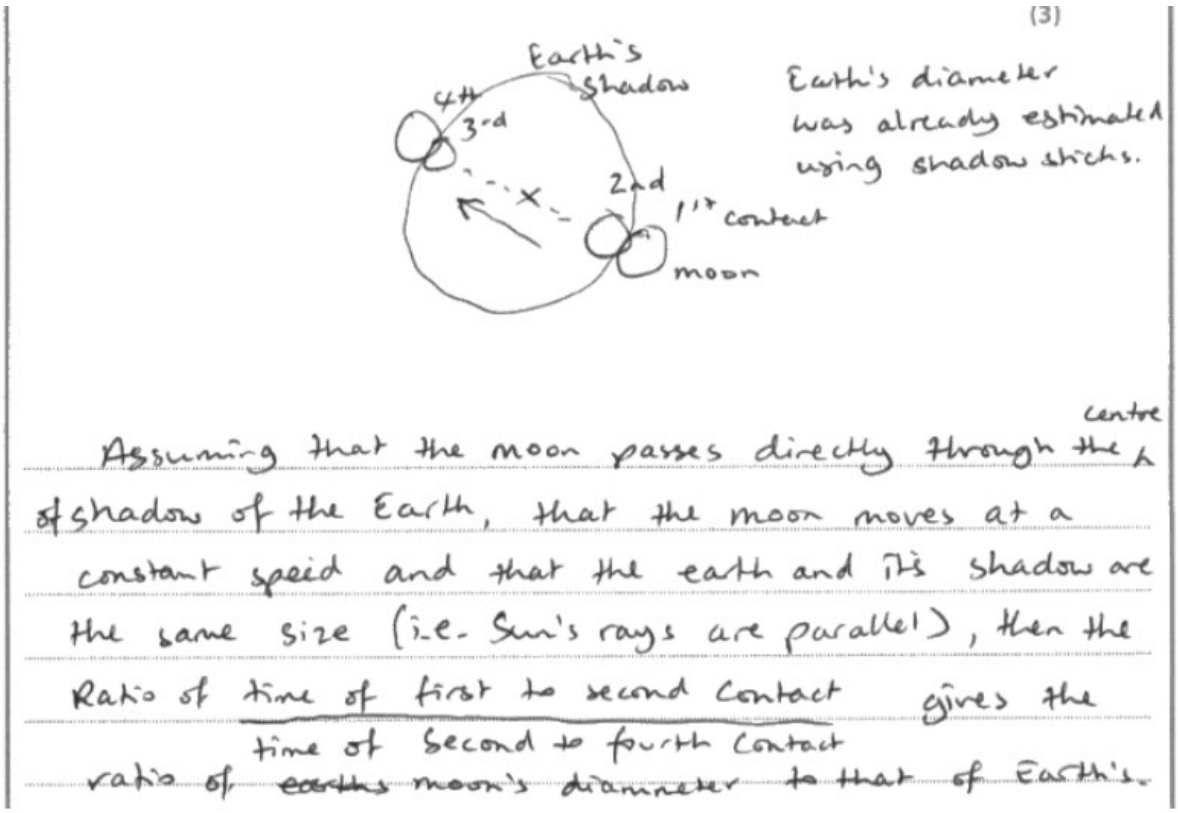
The terms spinning, orbiting and rotating were frequently interchanged, but the concepts were well understood.

Q10(d)

Many students showed good transposition of the equation, although some students referred to the data sheet, to gain marks students were required to show their workings for the calculation.

Q10(f)

Many students gained marks with this question and successfully included a clear and relevant diagram. The example below was awarded full marks as the method was explained using the diagram.



Q10(g)

A well answered question and most students ended the paper with the mark.