

GCSE Astronomy Coursework

A7 & B7 Measuring Light Pollution

Use repeated observations of the faintest stars observable (A7) or use the magnitudes of the faintest stars visible in long exposure photographs (B7) to quantify the effect of light pollution at two different sites.

Look for the **faintest stars** in the night sky in recognisable constellations. This is best done when the Moon is not up as you are trying to measure the effects of artificial light pollution not the effects of natural moonlight. You will need to take observations in London and outside of London (in a rural area). For A7 be prepared to stay out a little longer in darker regions as you will see more stars in your chosen constellations and you will need time to record them all. Be careful to try and find the same stars in these different regions when they reach the **same** altitude as in the previous region. This helps to eliminate atmospheric effects, something you are not measuring. For B7 make sure you record your camera settings for both sites so that you can compare them in the analysis section.

Example: Observed Deneb on 5th October from Lewisham at 21:20 (altitude: $81^{\circ}41''$, hour angle: 0h 44m) and on 19th October from Paddock Wood at 20:24 (altitude: $81^{\circ}41''$, hour angle: 0h 44m).

You can find observational advice and the option to post your observations in the fight to reduce light pollution here:
www.windows2universe.org/citizen_science/starcount/

To locate the Moon and suitable stars use www.stellarium.org or alternatively download an app for your mobile:
http://downloads.bbc.co.uk/tv/guides/BBC_Stargazing_Live_2012_Mobile_App_guides.pdf

To find sunrise, sunset, moonrise and moonset times and the phase of the Moon use www.timeanddate.com

Check the weather forecast - www.metoffice.gov.uk

See our useful guides for help on how to carry out observations and take photographs of various objects: www.rmg.co.uk/discover/astronomy-photographer-competition/how-to-guides

For examples of reports with moderator comments visit the Edexcel GCSE Astronomy website: <http://www.edexcel.com/quals/gcse/gcse09/astronomy/Pages/default.aspx>

Here you will find two documents that will help you write a report: Under 'Controlled assessment' download 'Controlled Assessment Teacher Support Book' and under 'Teacher Support Materials' download 'GCSE Astronomy Teachers Guide'.

Below is a checklist of points that you should include in your report. Remember to reference all sources of information and to label all images, diagrams and tables and refer to them in the text e.g. Table 1, Figure 1 etc.

Design (5 marks)

- > All equipment listed
- > **B7 only:** All set-up details of binoculars/telescope/camera listed (aperture size, magnification, field of view, ISO, f-stop, exposure time, focal length/zoom, tripod)
- > Astronomical terms explained
- > Rise and set times of the Moon and phase taken into account
- > One urban and one rural location chosen
- > Limits of location noted
- > Alternative locations suggested
- > Target stars chosen
- > Explanation of why they were chosen
- > Positions of stars (altitude, hour angle)
- > Weather forecast
- > Range of dates and times to observe & why (Moon, hour angle of stars)

Edexcel marking guidelines:

0	No procedure designed.
1	Outline a simple procedure for the observations, using basic astronomical terminology.
2-3	Astronomical knowledge and understanding used to decide on the most appropriate site,time, equipment for observations.Spelling, punctuation and grammar used with reasonable accuracy. Limited use of astronomical terminology.
4-5	Detailed astronomical knowledge and understanding used to design the most appropriate observing programme with a range of sites, times and instruments evaluated. Spelling, punctuation and grammar used with considerable accuracy. Good range of astronomical terminology used correctly.

Observation (5 marks)

- > Faintest stars recorded appropriate to location
- > **B7 only:** all camera settings listed for both sites
- > Repeat observations from both sites carried out
- > Stars identified, magnitudes labelled
- > Limiting magnitude stated
- > Location stated (latitude & longitude)
- > Date and time stated
- > Night vision acquired & maintained (red light used)
- > Weather
- > Seeing

Antoniadi scale

A five-point scale to indicate the quality of seeing:

I – perfect seeing, without a quiver

II – slight undulations, with moments of calm lasting several seconds

III – moderate seeing, with larger tremors

IV – poor seeing, with constant troublesome undulations

V – very bad seeing, scarcely allowing the making of a rough sketch.

- > Position of Moon and phase if above horizon
- > Positions of stars with reference
- > Proximity to meridian (hour angle/altitude)
- > All figures labelled and referenced in text

Edexcel marking guidelines:

0	No observations completed.
1	Simple observations completed, providing some data. A few observational details included.
2-3	Sound observations completed and recorded, providing adequate data for the task. Clear and accurate observational details included.
4-5	Excellent programme of observations completed and recorded, providing conclusive data for the task. Full observational details included clearly and accurately.

Analysis (5 marks)

- > Magnitudes for all stars observed
- > Limiting magnitude stated for both sites determined from observations of faintest stars
- > Altitude differences between stars of same magnitude
- > Extent of light pollution in both sites stated

Edexcel marking guidelines:

0	No analysis on the observations.
1	Simple comments on what is shown by the observations, using basic astronomical terminology.
2-3	Conclusions or calculations derived from observational data used to address the task set. Spelling, punctuation and grammar used with reasonable accuracy. Limited use of astronomical terminology.
4-5	Full analysis of the observational data, resulting in clear conclusions related to the task set. Spelling, punctuation and grammar used with considerable accuracy. Good range of astronomical terminology used correctly.

Evaluation (5 marks)

- > Accuracy of measurements evaluated
- > **B7 only:** Quality of photos evaluated
- > Limitations of project explored
- > Suggested improvements to project
- > Suggested extension to project

Edexcel marking guidelines:

0	No evaluation of the observation.
1	Simple comment on the accuracy of the observations, using basic astronomical terminology.
2-3	Supported statement of the accuracy of the observational data obtained. Feasible suggestions for improvements or extensions to the observations. Spelling, punctuation and grammar used with reasonable accuracy. Limited use of astronomical terminology.
4-5	Clearly reasoned quantitative assessment of the accuracy of the observational data obtained. Detailed suggestions for improvements or extensions to the observations. Spelling, punctuation and grammar used with considerable accuracy. Good range of astronomical terminology used correctly.