ROYAL OBSERVATORY GREENWICH

GCSE Astronomy Coursework

A10 & B10 Estimating/Measuring Stellar Density

By counting the numbers of visible stars within a certain area of sky, estimate and compare the density of stars in the sky (A10) or use binocular/telescopic observations or original photographs to measure and compare the density of stars (B10), parallel with and perpendicular to the plane of the Milky Way.

These observations must take place in a rural area away from light pollution on a clear dark night with no Moon (i.e. somewhere where you can see the Milky Way!). You may want to repeat your observations on different nights for comparison of atmospheric effects. Try using a piece of card with a square cut out and count the number of stars within that square in the Milky Way and outside of the Milky Way. Always aim for high altitudes where stars can be seen more easily. If taking photographs take care to use the same field of view (do not change the lens or focal length when taking photos parallel and perpendicular to the Milky Way). Also it may help to look at your photograph as a negative (dark sky = white, stars = black) when counting the stars.

To locate the Moon 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'.

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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
> **B10 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 (if above horizon)
> Appropriate location selected
> Limits of locations noted
> Alternative locations suggested
> Mention of the weather forecast
> Range of dates and times to observe & why (Moon, weather)

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)

> Density of stars recorded parallel and perpendicular to the Milky Way
> **B10 if camera used:** photographs of sky taken parallel and perpendicular to the Milky Way and all camera settings listed for each image
> Optional: repeat observations taken along Milky Way (from centre to outer regions of disc)
> Limiting visual magnitude stated (faintest star visible)
> Location(s) stated (latitude & longitude)
> Date and time stated
> Night vision acquired & maintained (red light used)
> Weather
> Seeing

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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 and phase of Moon (if above horizon)
> 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)

> Fraction of sky observed, number density of stars stated (number per unit area)
> Explanation of differences
> Optional: Comparison of stellar number density along Milky Way

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.**

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Evaluation (5 marks)

> Accuracy of measurements evaluated
> **B10 only:** Quality of photos evaluated
> Comparison of repeat observations
> 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.**