

# GCSE Astronomy Coursework

## A8 & B8 Sunspots

Use a pinhole (A8) or a small telescope (B8) to project an image of the Sun onto a suitable background and observe and record sunspots over a sufficiently long period of time to determine the Sun's rotation period.

For A8 project an image of the Sun on a piece of card by using a pinhole in another piece of card. For project B8 use a telescope to project an image of the Sun on a piece of card held 15 cm behind the eyepiece. Telescopes with apertures less than 100 mm should be used to minimise heat passing through. The finder should be covered up as a precaution and only low-power eyepieces (long focal length) should be used (no plastic barrels as these might melt). Use the shadow cast by the telescope to determine where the Sun is - NEVER LOOK AT THE SUN DIRECTLY.

Alternatively for B8 use a solar telescope with an appropriate filter such as a hydrogen alpha ( $H\alpha$ ) which only transmits light through a narrow band of wavelengths centred on 656.3 nm (red light). Photograph the Sun through the eyepiece.

The Sun exhibits differential rotation, this means the rotational period varies from 25 days at the equator to 36 days at the poles (as measured from the Earth – this is called the synodic period and takes into account Earth's orbit around the Sun). Aim to record sunspots near the equator of the Sun. Solar rotation can be determined by measuring the distance covered by sunspots on your drawing or by measuring their angular distance by using a latitude-longitude grid (see links below for more information).

Check the weather forecast and plan ahead: [www.metoffice.gov.uk](http://www.metoffice.gov.uk)

Find out the current state of the Sun including visible sunspots here:  
<http://spaceweather.com/>  
<http://sdo.gsfc.nasa.gov/> (The Solar Dynamics Observatory)

You can find observational and experimental advice for measuring sunspots and solar rotation here:

<http://solar-center.stanford.edu/spin-sun/estimate.html>  
<http://solar-center.stanford.edu/images/sungrid-0.gif>  
<http://astro.wku.edu/astr106/sunspotlab09f.pdf>

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
- > **B8 only:** All set-up details of binoculars/telescope/camera listed (filter used, aperture size, magnification (eyepiece), field of view, tripod)
- > Astronomical terms explained
- > Planned frequency of measurements
- > Choice of location, latitude & longitude
- > Limits of location noted
- > Alternative locations suggested
- > Mention of the weather forecast
- > Range of dates and times to observe & why (solar altitude and hour angle)

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)

- > Projected images of Sun obtained at various intervals, sunspots marked
- > Location stated (latitude & longitude)
- > Date and time stated
- > 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 Sun with reference (hour angle/altitude)
- > All figures labelled and referenced in text
- > Reference to NASA SOHO/SDO images

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)

- > Grid drawn and sunspot tracks measured
- > Distance travelled by sunspots in mm OR angular distance (longitude) measured with latitude-longitude grid
- > Converted into km taking into account circumference of Sun
- > Converted into degrees of motion
- > Rotational period calculated

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
- > Error in measurements, final error stated
- > 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.