

PART II

Remember that only two out of the three questions are to be attempted – this is also the case in Parts III and IV.

Question 1

[Section 1.2 of Book 1 and video sequence 1]

- (a) It is reasonable to regard the photosphere as the solar 'surface' because
- it is the region that is the source of nearly all of the solar radiation that we directly observe
 - it is very thin compared with the solar radius.

[Note the brevity of the answer – only 2% of the examination marks are available for part (a).]

- (b) The small features are solar granules.

These cover the photosphere, forming a seething pattern. Each granule is typically 1 000 km across and lives for 5 to 10 minutes. They are the tops of rising columns of hot material coming from deeper in the Sun where the temperatures are higher. The rising material travels upwards and then spreads out horizontally, radiating away its heat. The dark lanes between granules are regions where the cooled material descends back into the solar interior.

[Any three of the sentences in this paragraph would earn all the marks available for describing and accounting for solar granules.]

Granulations do not seem to vary during the solar activity cycle.

The large, dark features are sunspots.

Sunspots are large, relatively cool regions of the photosphere. The temperature at the centre of a sunspot is typically 4 200 K, compared with about 5 800 K for the rest of the photosphere. The inner, cooler part is called the umbra, and the outer, warmer part the penumbra. Individual sunspots are transient phenomena, with lives of the order of a few hours to a few weeks. They often occur in pairs, with opposite magnetic polarity. Magnetic fields play an important part in their formation and dissolution.

[Any four of the sentences in this paragraph would earn all the marks available for describing and accounting for sunspots.]

The fraction of the photosphere covered by sunspots varies during the solar activity cycle.

[Note the overall length of the answer – more than sufficient for full marks, given that only some of the points in the long paragraphs are needed.]