

### PART III

Attempt **TWO** questions in this Part, which carries 24% of the marks for the examination. All of these questions carry equal marks. You are advised to spend about **40 minutes** on this Part. Write your answers to this Part in the **SEPARATE ANSWER BOOK** provided.

Remember to write your name, personal identifier and examination number on your answer book.

#### Question 4

part a, 5%  
part b, 7%

In 1996, scientists analysing the trajectory of the spaceprobe *Galileo* as it passed close by Jupiter's satellite Io were able to determine Io's internal mass distribution (which had never been done before). From this they concluded that Io has a dense, presumably iron-rich core occupying about 30% of Io's volume.

- (a) Sketch (roughly to scale) a cross-section through Io (from its centre to its surface), marking and naming the three main *compositional* layers that it may be expected to have, bearing in mind the evidence presented in the introduction. For each named layer, give a suggested composition, emphasizing the differences between the layers.
- (b) Describe *three* heat sources that could have led to Io's differentiation (i.e. that preceded differentiation). For each of the three, discuss whether it can contribute significantly to Io's present-day volcanic activity.

#### Question 5

part a, 6%  
part b, 4%  
part c, 2%

- (a) Explain, using a diagram, how solar heating of planetary atmospheres gives rise to Hadley cells.
- (b) What general effect does the rotation of a planet have on its Hadley cells (or convection cells), and what are the different outcomes in the atmospheres of the Earth, Venus, and Jupiter?
- (c) What effect do Hadley cells have on the difference in surface temperature between the equatorial regions and regions at higher latitudes?

#### Question 6

part a, 8%  
part b, 4%

Suppose that a basaltic meteorite has been found on the Earth, which the experts state confidently to have come from Mars.

- (a) Describe the evidence that has probably been used to identify Mars as the parent body. You should consider
- age
  - isotopic evidence
  - mineral composition
  - physical characteristics
- (b) State why other parent bodies would have been ruled out as likely sources of this meteorite.