

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.