

# Computer Marked Assignment

Course and assignment number:

**S281 42**

Make sure you know how to use the CMA form: detailed instructions are given in your student handbook (or supplement).

You are strongly advised to attempt every question in this assignment.

If you do not wish to answer a question, pencil across the 'don't know' cell ('?').

If you think that a question is unsound in any way, pencil across the 'unsound' cell ('X').

*in addition to pencilling across either an answer cell or the 'don't know' cell, you must pencil across either the required number of answer cells or the 'don't know' cell.*

Note For each question, you must pencil across either the required number of answer cells or the 'don't know' cell.

Covering: Block 2

(Chapters 1-7)

Cut-off date:

Friday 7 July 1995

## PART A

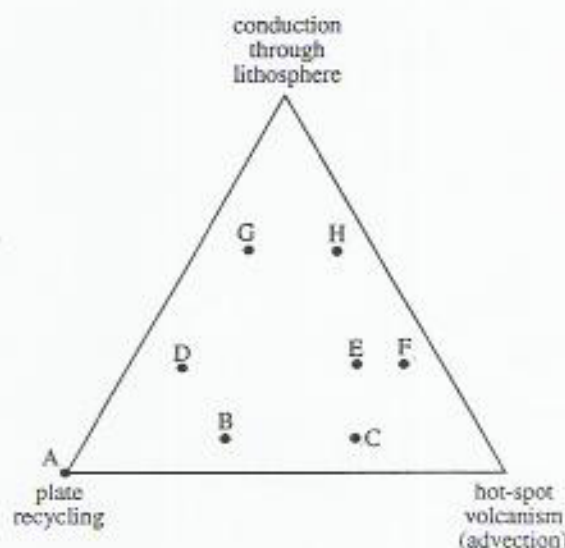
This part covers mainly Chapters 1-5 of Book 2, and carries 60% of the marks available for this assignment.

**Q1** The key for this question consists of several statements concerning the nature and origin of the Solar System. Which two are *incorrect*? Pencil across *two* cells in row 1.

KEY for Q1

- ☒ A Jupiter has more orbital plus axial angular momentum than all the other planets put together.
- ☒ B The solar nebula, when it first formed, was probably mostly molecular hydrogen.
- ☒ C Carbonaceous chondrites have *exactly* the same composition as the Sun.
- ☒ D Bipolar outflow from the protoSun can explain mass loss from the solar nebula, but it cannot explain the Sun's low angular momentum.
- ☒ E No water could be incorporated in material that condensed in the solar nebula at a temperature of greater than 180 K.
- ☒ F Planetary embryos are thought to have grown with the aid of gravitationally focused collisions of smaller planetesimals onto larger ones.
- ☒ G The Earth probably lost its primitive atmosphere when the Sun's T Tauri wind was active.
- ☒ H Saturn probably contains about 70 times more hydrogen and helium than Uranus does.

**Q2** Europa, an icy satellite of Jupiter, has an icy lithosphere probably about 10-30 km thick, overlying an icy asthenosphere which surrounds a large rocky core (Book 2 Figure 3.13, and *Images of the Cosmos* Plate 2.22). It shows signs of recent (and probably continuing) activity. How Europa's internal heat is transferred to the surface is not well understood in detail. However, one estimate of the relative importance of the three main processes of lithospheric heat transfer in Europa is as follows: conduction 10%, advection 30%, plate recycling 60%. Assuming this estimate to be correct, which point on Figure 1 represents Europa? Pencil across *one* cell in row 2.



**Figure 1 and KEY for Q2.** A plot to show options for the relative importance of conduction, advection and plate recycling in Europa's lithosphere.

**Q3** Which of the following processes or combinations of processes would you expect to be significant sources of heat in Europa today? Pencil across *one* cell in row 3.

KEY for Q3

- ☒ A Accretional heating only.
- ☒ B Core formation only.
- ☒ C Tidal heating only.
- ☒ D Decay of  $^{26}\text{Al}$ ,  $^{235}\text{U}$ ,  $^{238}\text{U}$ ,  $^{232}\text{Th}$  and  $^{40}\text{K}$ .
- ☒ E Tidal heating and decay of  $^{26}\text{Al}$ .
- ☒ F Tidal heating and decay of  $^{235}\text{U}$ ,  $^{238}\text{U}$ ,  $^{232}\text{Th}$  and  $^{40}\text{K}$ .
- ☒ G Tidal heating and decay of  $^{26}\text{Al}$ ,  $^{235}\text{U}$ ,  $^{238}\text{U}$ ,  $^{232}\text{Th}$  and  $^{40}\text{K}$ .
- ☒ H Accretional heating and decay of  $^{235}\text{U}$ ,  $^{238}\text{U}$ ,  $^{232}\text{Th}$  and  $^{40}\text{K}$ .