The Open University

Science Supplementary Material
S281 Astronomy and planetary science

**S281 CMA 42,
TMA 03**

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 ('U') *in addition to* pencilling across either an answer cell 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 to 7**

Cut-off date:
Friday 4 July 1997

PART A

This part covers mainly Chapters 1–5 of Book 2, and carries 65% of the marks for this assignment.

Q1 The Earth's Moon is too small for it to have retained any significant atmosphere. What would the Moon's *minimum* mass have had to have been in order for it to have retained for thousands of millions of years an atmosphere that included nitrogen and oxygen? Use equation 1.3 on p. 22 and Figure 1.10 on p. 23 to help you, and assume that the Moon's radius and temperature remain unchanged. Choose from the key for Q1 the value nearest to yours.

KEY for Q1

A 0.7×10^{23} kg
B 1.2×10^{23} kg
C 3.3×10^{23} kg
D 7.9×10^{23} kg
E 4.9×10^{24} kg
F 5.9×10^{24} kg
G 7.3×10^{24} kg

Pencil across *one* cell in row 1.

Q2 Which *two* of the statements in the key are FALSE?

KEY for Q2

A All of the planetary bodies in the Solar System formed entirely by homogeneous accretion.
B Good evidence that the Moon was probably formed by a giant impact on the Earth lies in the fact that the Moon's bulk composition is poor in iron relative to the Earth's.
C Transmission of P-waves through the Earth's core indicates that it is liquid.
D Unlike the other terrestrial planets, the Earth loses a significant fraction of its radiogenically generated internal heat by plate recycling.
E *When the Earth formed*, the radioactive isotope ^{40}K contributed about 10 times as much heat per kilogram of the Earth as ^{235}U.
F Transfer of heat by both conduction and convection takes place in the Earth's asthenosphere.
G Heat presently escapes through the surface of the Earth at about one and a half times the present rate of radioactive heat production. *NB You can take it as true that the surface area of the Earth is about 5.1×10^{14} m^2 and that heat escapes through the surface at an average rate of 0.08 W m^{-2} (p. 115).*

Pencil across *two* cells in row 2.

Q3 The size–frequency distribution of impact craters has been determined for an area of the surface of a planet covering 2.6×10^7 km^2. Examine the crater density data tabulated below, and plot it on a suitable figure in Chapter 4. Which one of the planetary surfaces listed in the key for Q3 is the data most likely to pertain to?

Crater size range	Number of craters in size range
1–2 km	1
2–4 km	2
4–8 km	3
8–16 km	2
16–32 km	3

KEY for Q3

A The lunar highlands
B The lunar maria
C Ancient parts of the Earth's crust
D Youthful parts of the Earth's crust
E The heavily cratered plains of Mars
F The volcanic plains of Mars

Pencil across *one* cell in row 3.