Q4 Figure 5.15 on p. 115, which shows Apollinaris Patera, covers a total area of roughly 90 000 square kilometres. A number of *impact* craters are discernible, all of them greater than 4 km in diameter. By rapidly counting the number of craters visible in the entire photo (don't spend more than a couple of minutes on this), estimate the most likely age of the terrain illustrated in the photo. Choose from the key for Q4 the value nearest to yours. (1 billion = 10^9)

KEY for Q4

A 0.5 billion years
B 1.3 billion years
C 2.2 billion years
D 2.7 billion years
E 3.3 billion years
F 3.8 billion years
G 4.5 billion years

Pencil across *one* cell in row 4.

Q5 Assume for the sake of argument that one-sixth of the mass of Europa is made of water i.e. about 80×10^{20} kg. If this mass of water had melted from ice at 0 °C to water at 0 °C at a uniform rate over the last 4.6 billion years, what rate of heat generation per kilogram of Europa would have been required? Choose from the key for Q5 the value nearest to yours.

KEY for Q5

A 1×10^{-10} W kg^{-1}
B 4×10^{-10} W kg^{-1}
C 1×10^{-11} W kg^{-1}
D 4×10^{-11} W kg^{-1}
E 1×10^{-12} W kg^{-1}
F 4×10^{-12} W kg^{-1}
G 1×10^{-13} W kg^{-1}
H 4×10^{-13} W kg^{-1}

Pencil across *one* cell in row 5.

Q6 Which *two* of the statements in the key concerning planetary volcanism are CORRECT?

KEY for Q6

A Volcanism has continued until geologically recent times on Mars because of internal heating due to tidal interactions between Mars and its two satellites Phobos and Deimos.
B Venus and Earth are 'twin' planets which exhibit closely similar styles of volcanism.
C Although the Moon is generally depleted in volatiles, some lunar volcanoes were able to eject and disperse fragmented material.
D Active volcanism on Io is concentrated mostly in the equatorial regions, since this is where most tidal energy is dissipated.
E There is *no* evidence for widespread pyroclastic deposits around volcanoes on planetary bodies other than the Earth.
F A rock fragment of given size and density falling from a volcanic eruption column on Mars will attain a greater terminal speed than the same fragment falling on Earth.
G Although lunar samples returned to Earth were undoubtedly of volcanic origin, there are no visible manifestations of lava flows on the Moon, since these have been obliterated by impact crater formation.

Pencil across *two* cells in row 6.

PART B

This part covers mainly Chapters 6 and 7 of Book 2, and carries 35% of the marks for this assignment.

Q7 Calculate the east–west speed relative to the surface that a piece of atmosphere will gain by the Coriolis effect in travelling from the equator to 30° N on Triton. The equatorial radius of Triton is 1 350 km and its axial rotation period can be taken as equal to its orbital period, 5.88 days. Choose from the key for Q7 the value closest to yours.

KEY for Q7

A 16.7 m s^{-1}
B 19.3 m s^{-1}
C 0.0170 m s^{-1}
D 4 820 m s^{-1}
E 4.80 m s^{-1}
F 1 670 m s^{-1}
G 1 250 m s^{-1}
H 14.5 m s^{-1}

Pencil across *one* cell in row 7.

Q8 Select from the key the *one* statement that is FALSE.

KEY for Q8

A SO_2 can act as a greenhouse gas in the atmosphere of Venus.
B Homonuclear diatomic molecules, such as O_2, are not major greenhouse gases.
C Homonuclear diatomic molecules are not efficient at radiating energy from the thermosphere.
D Ozone, O_3, in the Earth's stratosphere protects life by absorbing UV radiation.
E There is no *natural* greenhouse effect in the Earth's atmosphere.
F Oxygen in the form O_2 in the atmosphere of the Earth absorbs UV radiation of shorter wavelengths than that absorbed by ozone.

Pencil across *one* cell in row 8.

Q9 Select from the key the likely major source of internal heat in Saturn that is absent (or weak) in Jupiter.

KEY for Q9

A Radiogenic heating
B Tidal heating
C Absorption of sunlight by clouds
D Accretional heat
E Heat of differentiation due to separation of hydrogen from helium
F Heat emitted when ammonia condenses to form clouds

Pencil across *one* cell in row 9.