

#### Question 4

This question relates to Book 2, Chapters 6 and 7, and carries 23% of the marks for this assignment.

This question is about the atmosphere of Titan. You should use information and concepts that you have met in Chapters 6 and 7 to answer it.

Titan has an axial inclination of  $27^\circ$  with respect to the plane of Saturn's orbit. Its axial rotation period is 15.9 days. The composition of its atmosphere is given in Table 7.2, p. 181. The surface temperature is 95 K.

(a) (4 marks) Would you expect Titan to have seasons? Explain your reasoning. (A few sentences.)

(b) (6 marks) Radiation from the Sun reaching the surface of Titan would give rise to convection in the atmosphere. Explain in a few sentences how this would produce Hadley cells.

(c) (4 marks) How much disruption of the Hadley cells would you expect to result from the Coriolis effect on Titan? (A qualitative answer of a few sentences only is required.)

(d) (6 marks) Which of the gases present at an abundance of greater than  $10^{-6}$  would definitely *not* contribute to a greenhouse effect on Titan? Explain why not. From the surface temperature of Titan, estimate the wavelength at which emission of radiation for Titan is a maximum. In what region of the electromagnetic spectrum would molecules have to absorb to produce a greenhouse effect on Titan?

(e) (3 marks) Figure 1 shows a saturation vapour pressure diagram for methane. Would the clouds shown in Figure 7.12 consist of solid or liquid particles? Explain your reasoning, in a few sentences.

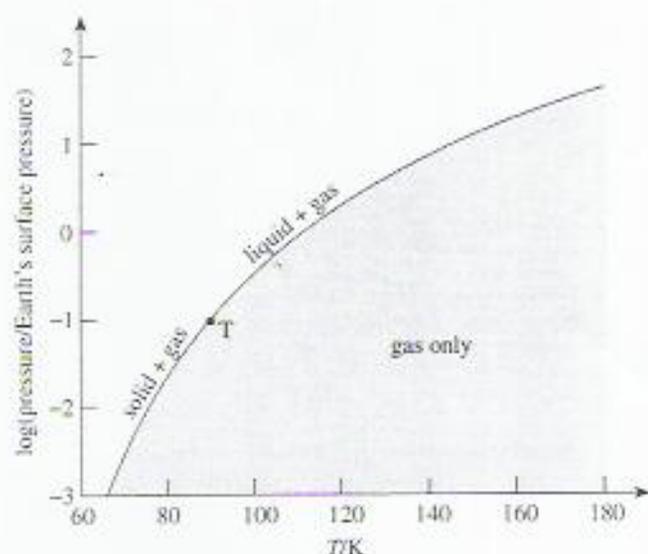


Figure 1 Saturation vapour pressure curve for methane.

#### Question 5

This question relates to Book 2, mainly Chapter 8, and carries 25% of the marks for this assignment.

Basalt is widespread throughout the Solar System. While back-packing across the vast basalt plains of the Deccan traps in India, a perceptive OU student stumbles across a curious-looking lump of basalt weighing about 5 kg, protruding through the thin soil. The student, suspecting it might be a meteorite, takes the specimen back home, to a complete range of laboratory facilities.

(a) (13 marks) Describe the *four* main factors the student could use to determine whether or not the lump was a meteorite, and not just a chunk of local basalt. (One or two sentences each.)

(b) (12 marks) If the sample proved to be a meteorite, list the possible sources from which it may have come, and discuss the best means of deciding the likeliest source.