

### 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, 4%  
part b, 8%

Describe, stage by stage, the processes that occur in the model of Solar System formation presented in Book 2 of S281. Begin your description with the contraction of the solar nebula, and end it when the terrestrial planets have attained their final mass. Do *not* discuss the origin or evolution of atmospheres. Do *not* discuss events occurring beyond the orbit of Mars. You should divide your answer into two clearly marked parts, covering

- (a) from the formation of the solar nebula to the condensation of dust grains;
- (b) from dust grains to fully formed *terrestrial* planets.

#### Question 5

part a, 2%  
part b, 3%  
part c, 2%  
part d, 2%  
part e, 3%

(a) What is the main chemical constituent of the seasonal polar ice-caps of Mars? Why is this different from that of the polar ice-caps on Earth?

(b) Describe how the Martian polar caps give rise to a pole-to-pole circulation of the atmosphere.

(c) What are the conditions necessary for clouds to form in a planetary atmosphere?

(d) How can clouds be used to estimate wind speeds on planets that are studied remotely?

(e) How (if at all) does the rotation speed of the planet affect the atmospheric circulation of (i) Venus near the surface and (ii) Jupiter?

#### Question 6

part a, 4%  
part b, 2%  
part c, 6%

(a) Certain meteorites contain refractory grains that have survived intact the processes of Solar System formation and are demonstrably pre-solar in origin. What are these grains made of, and where did they form? Give two lines of evidence for their site of origin? (*Note: these grains are not calcium aluminium inclusions (CAIs).*)

(b) Describe the evidence used to determine the length of time that these refractory grains spent in the interstellar medium before being incorporated into meteorite parent bodies.

(c) Pre-solar grains are found in only one important class of meteorites.

(i) What class of meteorite is this?

(ii) Describe the constituents (in addition to pre-solar grains) that make up this class of meteorites.

(iii) Describe how such meteorites probably formed.