

Question 3

This question relates to Block 1, Chapter 3, and carries 19% of the marks for this assignment.

(a) (6 marks) A spherical fragment of a dense interstellar cloud has the following characteristics:

- radius, 0.1 parsec
- temperature, 10 K
- number density, 10^{10} m^{-3} (to a sufficient approximation you can take this to be the number of hydrogen molecules per cubic metre).

By considering the Jeans mass corresponding to these conditions (Book 1, Figure 3.2), determine the probable immediate fate of this fragment. Show your working.

(b) (13 marks) For the fragment in part (a), write brief notes (no more than *about 250 words* in total) on its nature, its physical characteristics, and the main processes taking place within it, after each of the following times, measured from when the fragment breaks away from the parent cloud:

- 10^6 years
- 5×10^9 years
- 3×10^{10} years

Note: You can assume that in the early stages of stellar evolution about 50% of the initial mass of the fragment is lost to the interstellar medium (by various means).

Question 4

This question relates to Block 1, in particular the skill of writing a non-technical account of a scientific topic. It carries 25% of the marks for this assignment.

The skill of writing a non-technical account of a scientific topic has broad applications. To make it more specific you have to imagine here that you are writing an article for your local newspaper — **please listen to**

audio band 1, Writing a newspaper article, for general advice before you tackle this exercise. However, it is important for you to realize that the skills that this exercise will help you to develop are relevant to many other sorts of written communication of a scientific topic to a non-scientific audience.

For your article, marks are available as follows:

- 5 marks for the evidence it contains showing that you understand the topic,
- 20 marks for its effectiveness as a piece of written communication.

The article should address ONE of the following options. In either case, it *must not exceed 500 words*.

Option 1

On 11 August 1999 a total solar eclipse will be visible from Cornwall, lasting a little over 2 minutes. Imagine that you are writing an article to tempt people to make the journey to see it. You will need to explain what causes such an eclipse, and explain what will be seen — notably solar prominences and the corona. You must warn people not to look at the Sun until the eclipse is total. Mention the British weather!

Option 2

Imagine that it has just (March) been discovered that the Sun is part of a binary system in which the other star is a $0.1 M_{\odot}$ main sequence star in a highly elliptical orbit. It is getting closer and will soon be visible in the night sky roughly in the direction of Betelgeuse (in Orion)! In your article, explain:

- what sort of star it is,
- why it has been invisible in recorded history (its orbital period is 10^7 years),
- where to find the star in the sky.

Do reassure your readers that it will not collide with the Earth!