

Question 4

This question relates to Book 4 Chapter 1, and carries 27% of the marks for this assignment.

This question will enable you to develop your understanding of cosmology, and at the same time concentrates on further developing your skill of writing about a technical topic: writing about a subject in this manner is an excellent way of developing your own understanding of it. In TMA 01 there was a similar exercise, so now we are building on it. This time, instead of imagining that you are writing an article for a local newspaper, imagine that you are writing it for the magazine of an amateur astronomy society. You might never have to/want to do such a thing for real, but there are many other circumstances where similar writing skills are needed.

Much of audio band 1 is still relevant, and your article must again not exceed 500 words. Moreover, in spite of the presumed enthusiasm for astronomy among your readers, you must assume that they have only the most basic background in astronomy and no knowledge of the subject of your article. In contrast to the newspaper article in TMA 01, simple line drawings **MUST** be included: the word limit decreases by 50 per drawing, e.g. 400 words maximum if there are two drawings.

The topic for the article is the evidence from Hubble's law that there was a Big Bang. You need NOT include any material from Chapter 2 of Book 4 – you are advised to concentrate on the material in Chapter 1.

Marks are available as follows

- 10 marks for the evidence in the article that you understand the topic
- 17 marks for its effectiveness as a piece of written communication.

Appendix Proof of the formula given in part c(ii) of Question 1

Consider a thin spherical shell of radius r and thickness Δr . If $M(r) = (8.3 \times 10^{20} \text{ kg}) \times (r/\text{m})$ then we can write the mass $M(r)$ within a radius r as $M(r) = kr$. The mass within a radius $(r + \Delta r)$ is $k(r + \Delta r)$. Therefore, the mass between r and $(r + \Delta r)$ is $[k(r + \Delta r) - kr]$ i.e. $k\Delta r$. The volume of a thin spherical shell of radius r and thickness Δr is given by $4\pi r^2 \Delta r$. Thus the density in this shell, mass/volume, is given by

$$\rho(r) = k \times \Delta r / (4\pi r^2 \Delta r) = k / (4\pi r^2)$$