OCR
Oxford Cambridge and RSA

A Level Physics A

H556/01 Modelling physics

Question Set 29

1 (a) Proxima Centauri is the closest star to Earth.
Fig. 24.1 shows the apparent positions of this star against the background of very distant stars as seen from the Earth over a period of exactly 6 months.

scale: 2.0 cm = 1.0 arc second

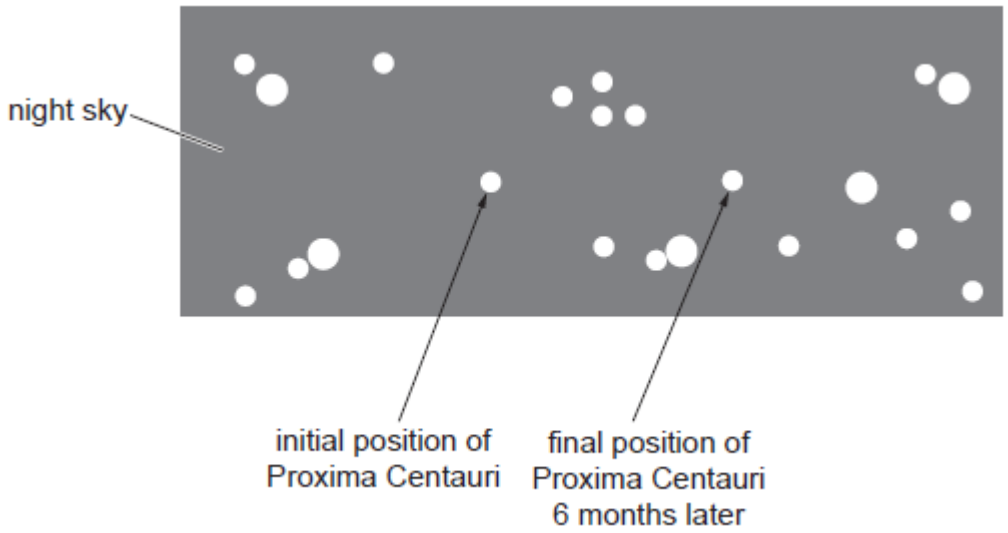

Fig. 24.1

The parallax angle for Proxima Centauri can be determined from Fig. 24.1 using the scale provided.

(i) Show that the parallax angle *p* for Proxima Centauri is about 0.8 arc second. **[2]**

(ii) Use your answer in **(i)** to calculate the distance *d* of Proxima Centauri from the Earth in light-years (ly).

1 pc = 3.26 ly

d = ... Ly **[2]**

(b) The galaxies in the Universe may be assumed to be distributed uniformly through space.

In this model, the separation between two neighbouring galaxies is 1.4×10^{23} m and each galaxy occupies a cube of space of volume 2.7×10^{69} m^3 as shown in Fig. 24.2.

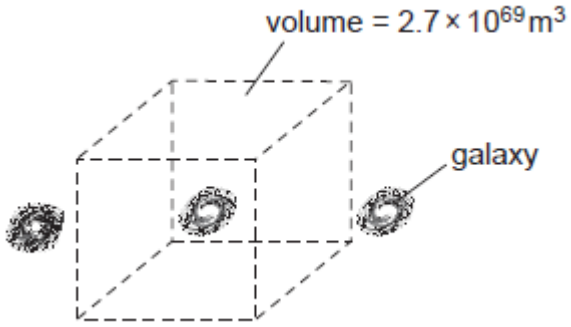

Fig. 24.2

There are on average 10^{11} stars in each galaxy and the mass of an average star is about 2.0×10^{30} kg.

(i) Estimate the gravitational force between two neighbouring galaxies.

force = …….. N **[2]**

(ii) Show that the mean density of the Universe is about 7×10^{-29} kg m^{-3}. **[1]**

(iii) Suggest why the actual mean density of the Universe is different from the value calculated in **(ii)**. **[1]**

Total Marks for Question Set 29: 8