

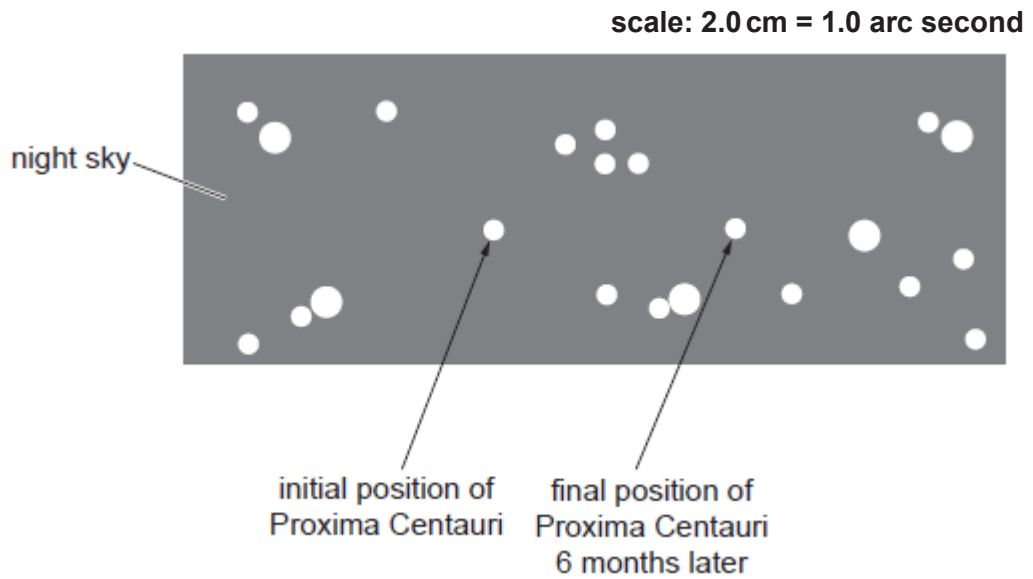
**A Level Physics A**  
**H556/01** Modelling physics

**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.



**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

$d = \dots\dots\dots$  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  $1.4 \times 10^{23}$  m and each galaxy occupies a cube of space of volume  $2.7 \times 10^{69}$  m<sup>3</sup> as shown in Fig. 24.2.

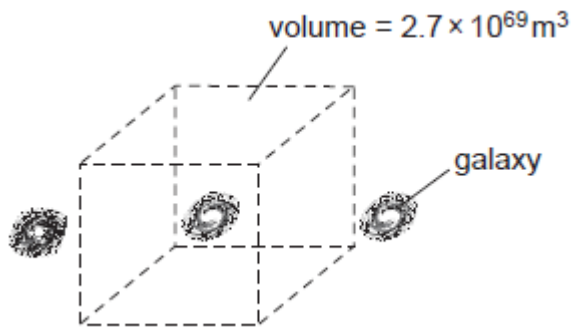


Fig. 24.2

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

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

force = ..... N [2]

- (ii) Show that the mean density of the Universe is about  $7 \times 10^{-29}$  kg m<sup>-3</sup>. [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**

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