A-Level Physics

Cosmology

Question Paper

Time available: 67 minutes
Marks available: 38 marks

1. IC2497 is a galaxy that contained a quasar. It is believed that the quasar stopped emitting radiation several thousand years ago.

(a) Suggest why the quasar stopped emitting radiation.

_____

_____

_____

_____

_____

_____

(2)

(b) IC2497 has a red shift of 0.0516

Determine the distance from the Earth to IC2497.
Give an appropriate unit for your answer.

distance = _____ unit = _____

(4)

(Total 6 marks)

2. Type 1a supernovae can be used as standard candles.

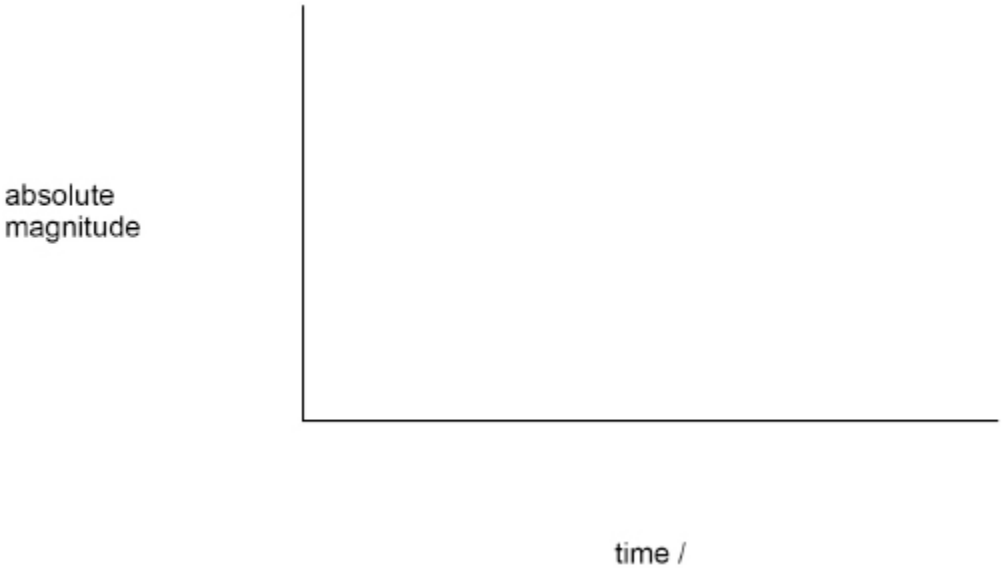
(a) State what is meant by a standard candle.

_____

_____

(1)

(b) Sketch on the axes below the light curve for a type 1a supernova.
Annotate your graph with suitable scales and a unit for time.



(3)

(c) Measurements of type 1a supernovae are used to find a value for the Hubble constant.

The distance from Earth is known for many type 1a supernovae.

Describe how these values of distance are used, with other data, to find the Hubble constant.

Your answer should include:

- the other data needed and how these data are used
- the graph plotted, including appropriate units for the axes
- how the Hubble constant is obtained and any limitations on the result.

(6)

(Total 10 marks)

3. (a) The table contains information about two galaxies.

Galaxy	Red shift, z	Distance from Earth / ly
NGC 936	4.8×10^{-3}	6.8×10^{7}
NGC 3379	3.0×10^{-3}	3.2×10^{7}

Discuss whether these data are consistent with Hubble's Law.

(3)

(b) Quasars are the most distant measurable objects.

Discuss **one** problem associated with the determination of the distance from the Earth to a quasar.

(2)

(Total 5 marks)

4. According to NASA nearly 2000 exoplanets had been discovered by 2016, and the search continues. One aim of this search is to find an Earth-like planet orbiting a Sun-like star.

Discuss the difficulties associated with the detection of an Earth-like planet orbiting a Sun-like star.

In your answer you should compare the methods that are used in the search and suggest which may be the most successful.

(Total 6 marks)

5. Two methods involved in the detection of exoplanets are the radial velocity method and the transit method.

(a) Explain what is meant by the transit method of detection.

(3)

(b) Explain why it is important that there is more than one method of detection.

(2)

(Total 5 marks)

6. In 1999 a planet was discovered orbiting a star in the constellation of Pegasus.

(a) State **one** reason why it is difficult to make a direct observation of this planet.

(1)

(b) The initial discovery of the planet was made using the radial velocity method which involved measuring a Doppler shift in the spectrum of the star.

Explain how an orbiting planet causes a Doppler shift in the spectrum of a star.

(2)

(c) The discovery was confirmed by measuring the variation in the apparent magnitude of the star over a period of time.

Explain how an orbiting planet causes a change in the apparent magnitude of a star. Sketch a graph of apparent magnitude against time (a light curve) as part of your answer.

(3)

(Total 6 marks)