

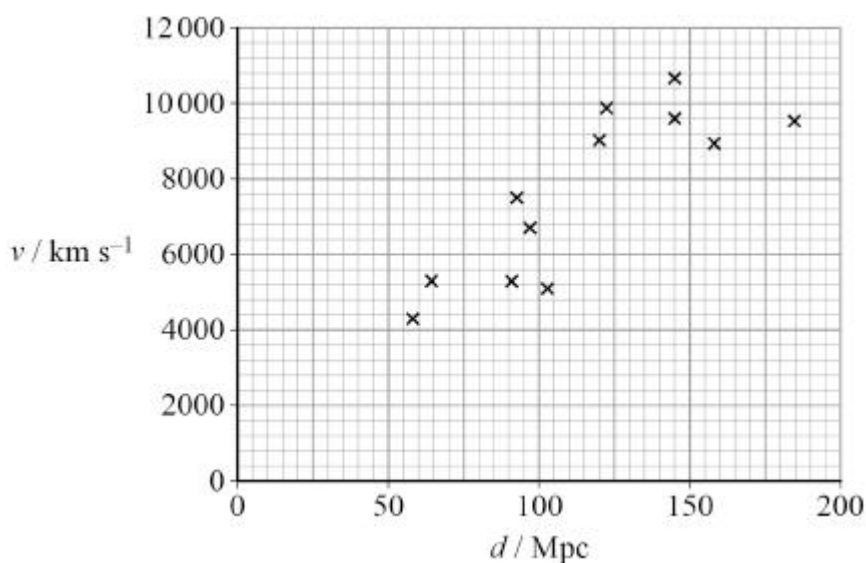
Name of the Student: _____

Max. Marks : 20 Marks

Time : 20 Minutes

Q1.

The graph below shows, for some galaxies, how their recession speed v varies with distance d from the Earth.



- (a) Estimate, using the graph above, the age in seconds of the Universe.

age of Universe = _____ s

(3)

- (b) The estimate in part (a) assumes that the Universe has expanded at a constant rate. Measurements involving type 1a supernovae that are at large distances from Earth caused astronomers to make a modification to this assumption.

State:

- the modification
- the explanation that was proposed to account for this modification.

(2)
(Total 5 marks)

Q2.

M40 A and M40 B are two stars that appear very close to each other when viewed from Earth. There are two possible reasons for this:

- they are an orbiting binary system
- they are distant from each other and only appear in the same line of sight.

In an orbiting binary system, the difference between the apparent magnitude and the absolute magnitude for each star is similar.

The table below shows data about these two stars.

	Temperature / K	Radius of star / m	Apparent magnitude
M40 A	6000	6.3×10^9	9.7
M40 B	4700	1.1×10^{10}	10.1

Discuss the appearance of the two stars to an astronomer on the Earth. In your answer you should:

- compare the colour of the stars
- compare the brightness of the stars
- deduce, with a calculation, whether the stars form an orbiting binary system.

(Total 6 marks)

(a) Draw a ray diagram to show how a converging lens can cause spherical aberration.

(1)

(3)

- (c) The James Lick telescope is an astronomical refracting telescope.
When in normal adjustment, the distance between the lenses of the telescope is 17.4 m and the angular magnification is 750

Calculate the focal length of the eyepiece lens.

focal length = _____ m

(2)

- (d) The James Lick telescope can be used to identify binary stars.

Two techniques are available using this telescope:

- using a processed image from a CCD, and
- direct observation using the naked eye.

Compare the use of a CCD with the use of the naked eye to observe binary stars with this telescope.

(3)

(Total 9 marks)