

Name of the Student: _____

Max. Marks : 20 Marks

Time : 20 Minutes

Q1.

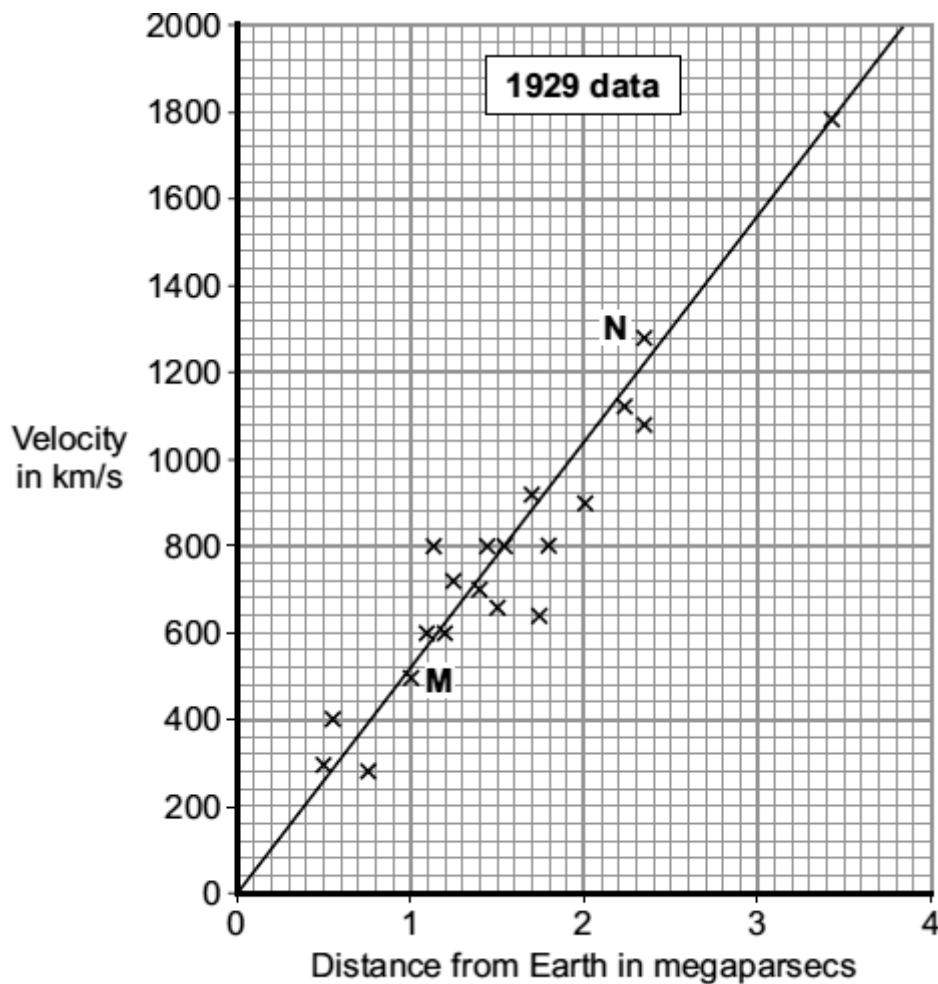
- (a) In 1929, the astronomer Edwin Hubble observed that the light from galaxies that are moving away from the Earth showed a *red-shift*.

What is *red-shift* ?

(1)

- (b) By measuring the *red-shift*, Hubble was able to calculate the speed at which the galaxies are moving away from the Earth. He was also able to calculate the distance of these galaxies from the Earth.

The graph shows some of the data calculated by Hubble.



- (i) The data from two galaxies, **M** and **N**, has been included in the graph. The light from galaxy **M** has a smaller *red-shift* than the light from galaxy **N**.

What does the difference in *red-shift* tell scientists about the two galaxies, **M** and **N**?

(2)

- (ii) The gradient of the line drawn on the graph gives a number known as the Hubble constant. The Hubble constant can be used to estimate when the universe began.

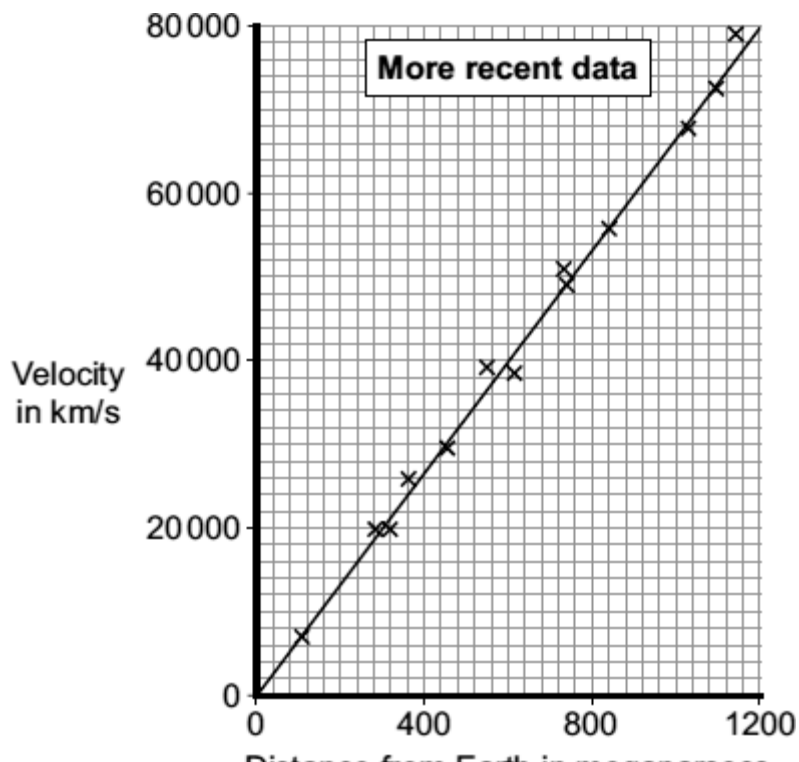
Use the graph to calculate the value of the Hubble constant.

Show clearly how you obtained your answer.

Hubble constant = _____ km/s per megaparsec

(2)

- (iii) More recently, data has been obtained from more distant galaxies.



The results from the more recent data give a totally different value for the Hubble constant to the one calculated from the 1929 data.

Which set of data, the 1929 or the more recent, is most likely to give the value closest to the true value for the Hubble constant?

Draw a ring around your answer.

1929

more recent

Give a reason for your answer.

(1)

- (c) The Andromeda galaxy is not moving away from the Earth. It is actually moving towards the Earth. This means that the light from Andromeda shows a blue-shift.

How do the wavelength and frequency of the light from Andromeda seem to have changed when viewed from the Earth?

(2)

(Total 8 marks)

Q2.

Every star goes through a 'life cycle'.

- (a) Describe how a star forms.

(2)

- (b) During a long period of its life, a star remains in a stable state.

Explain why a star remains stable.

(2)

- (c) Some stars are much more massive than the Sun.

Describe what will happen to a star, originally much more massive than the Sun, after it reaches its red giant stage.

(2)

(Total 6 marks)

Q3.

Read this statement from a website.

Immediately after the 'big bang', at the start of the Universe, there were only atoms of the element hydrogen (H).

Now the Universe contains atoms of over one hundred elements.

- (a) Explain how atoms of the element helium (He) are formed in a star.

(2)

- (b) Explain how atoms of very heavy elements, such as gold (Au), were formed.

(2)

- (c) Explain how, and when, atoms of different elements may be distributed throughout the Universe.

(2)

(Total 6 marks)