Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Q1.

In 1929, the astronomer Edwin Hubble observed that the light from galaxies moving away from the Earth had longer wavelengths than expected.

(a) What name is given to this effect?

_____

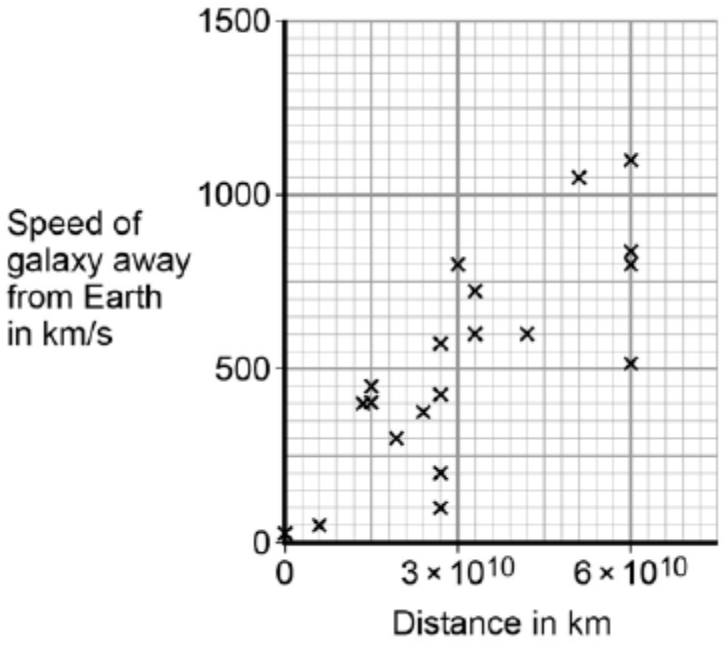
_____

(1)

(b) From his observations, Hubble was able to calculate the speed of a galaxy and the distance of the galaxy from the Earth.

Figure 1 shows the results of Hubble's calculations.

Figure 1



What relationship between the speed of a galaxy and the distance is suggested by Hubble's results?

_____

_____

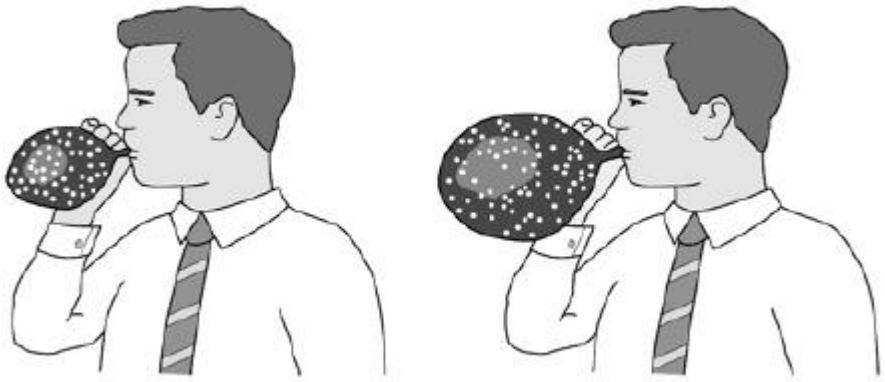
(1)

The observations made by Hubble support the idea that the Universe is expanding. This means that galaxies are continually moving away from each other and from the Earth.

Figure 2 shows a student using a balloon to model the idea of an expanding Universe.

Some dots, which represent galaxies, were marked on the balloon.
The balloon was then inflated.

Figure 2



(c) Give **one** strength and **one** weakness of this model in representing the idea of an expanding Universe.

Strength _____

_____

Weakness _____

_____

(2)

In the 1950s there were two main theories to explain how the Universe began.

Theory 1	The Universe has always existed, it is continually expanding. New galaxies are formed as older galaxies die out.
Theory 2	The Universe began from a very small region that was extremely hot and dense. The Universe has been expanding ever since.

(d) In what way do the observations made by Hubble support both Theory 1 and Theory 2?

_____

_____

_____

(1)

(e) Most scientists now believe that Theory 2 is correct.
Suggest what is likely to have caused scientists to start thinking Theory 1 is wrong.

_____

_____

_____

(1)

(Total 6 marks)

Q2.

The early Universe contained only the lightest element.

(a) Use the correct answer from the box to complete the sentence.

hydrogen	**iron**	**uranium**

The early Universe contained only _____ .

(1)

(b) Use the correct answer from the box to complete the sentence.

main sequence star	**protostar**	**supernova**

The heaviest elements are formed only in a _____ .

(1)

(c) Use the correct answer from the box to complete the sentence.

red giant	**red super giant**	**white dwarf**

Only a star much bigger than the Sun can become a _____ .

(1)

(d) The Universe now contains a large variety of different elements.

Describe how this happened.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

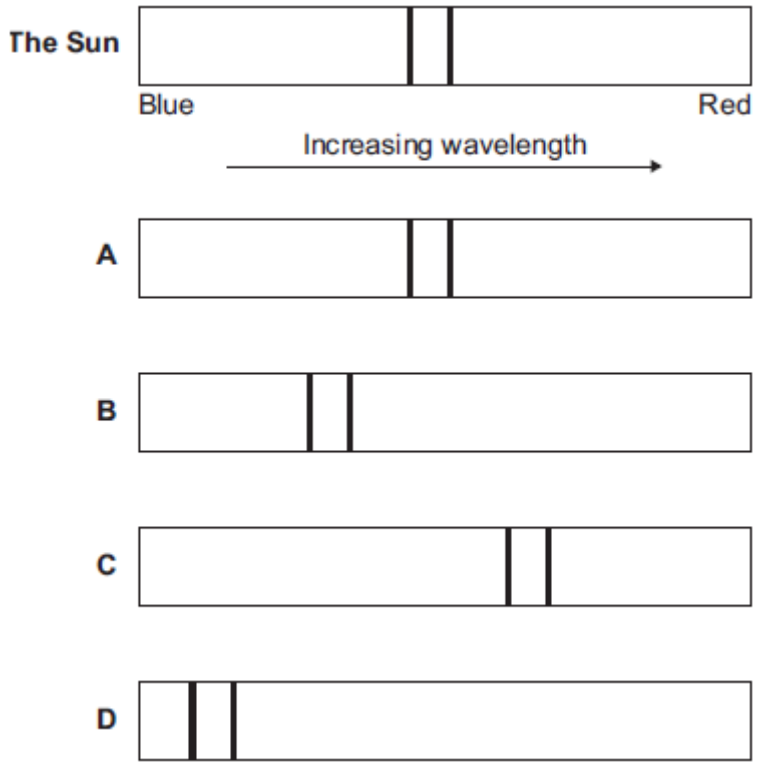
(Total 7 marks)

Q3.

Scientists can use the visible light spectrum from distant stars to determine whether the stars are moving.

The visible light spectrum from stars includes dark lines at specific wavelengths.

(a) The diagram shows the visible light spectrum from the Sun and from four other stars, **A**, **B**, **C** and **D**.



(i) Which star, **A**, **B**, **C** or **D**, is moving away from the Earth?

(1)

(ii) How does the speed of star **B** compare with the speed of star **D**?

Tick (✓) **one** box.

	Tick (✓)
The speed of star **B** is greater than the speed of star **D**.	
The speed of star **B** is less than the speed of star **D**.	
The speed of star **B** is the same as the speed of star **D**.	

(1)

(b) A radio wave is emitted by a star.
The radio wave has a wavelength of 1500 m and a frequency of 200 000 Hz.

Calculate the speed of this radio wave.

Choose the correct unit from the list below.

m **m/s** **m/s^2**

_____

_____

_____

Speed = _____ unit _____

(3)

(Total 5 marks)