# Red Shift and Big Bang 1

**Q:1** Light is given out by the Sun and a distant galaxy.

**(a)**Compared to the light from the Sun, the light from the distant galaxy has moved towards the red end of the spectrum.

**(i)** What name is given to this effect?

_____

(1 mark)

**(ii)** Complete the following sentence by drawing a ring around the line in the box that is correct.

The fact that light from a distant galaxy seems to move towards the red end of the spectrum gives scientists evidence that

| |
|---|
| galaxies are shrinking |
| galaxies are changing colour |
| the universe is expanding |

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(1 mark)

**(b)** Scientists have a theory that the universe began from a very small point and then exploded outwards.

**(i)** What name is given to this theory?

_____

(1 mark)

**(ii)** Which statement gives a reason why scientists think that the universe began with an explosion?

Put a tick (☒) in the box next to your choice.

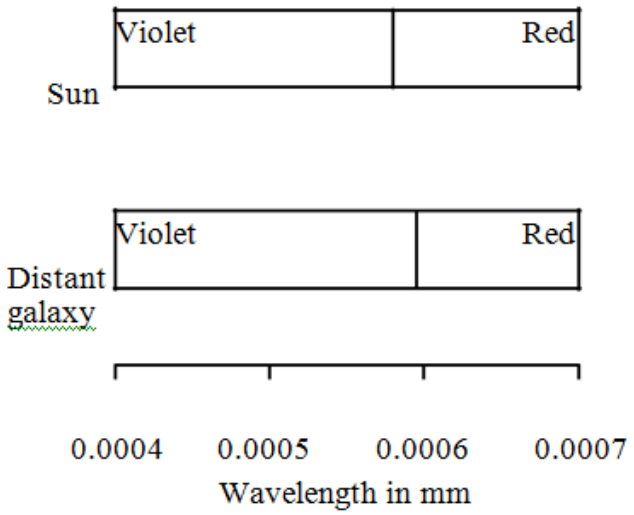
At the moment it is the best way of explaining our scientific knowledge.

It can be proved using equations.

People felt the explosion.

(1 mark)

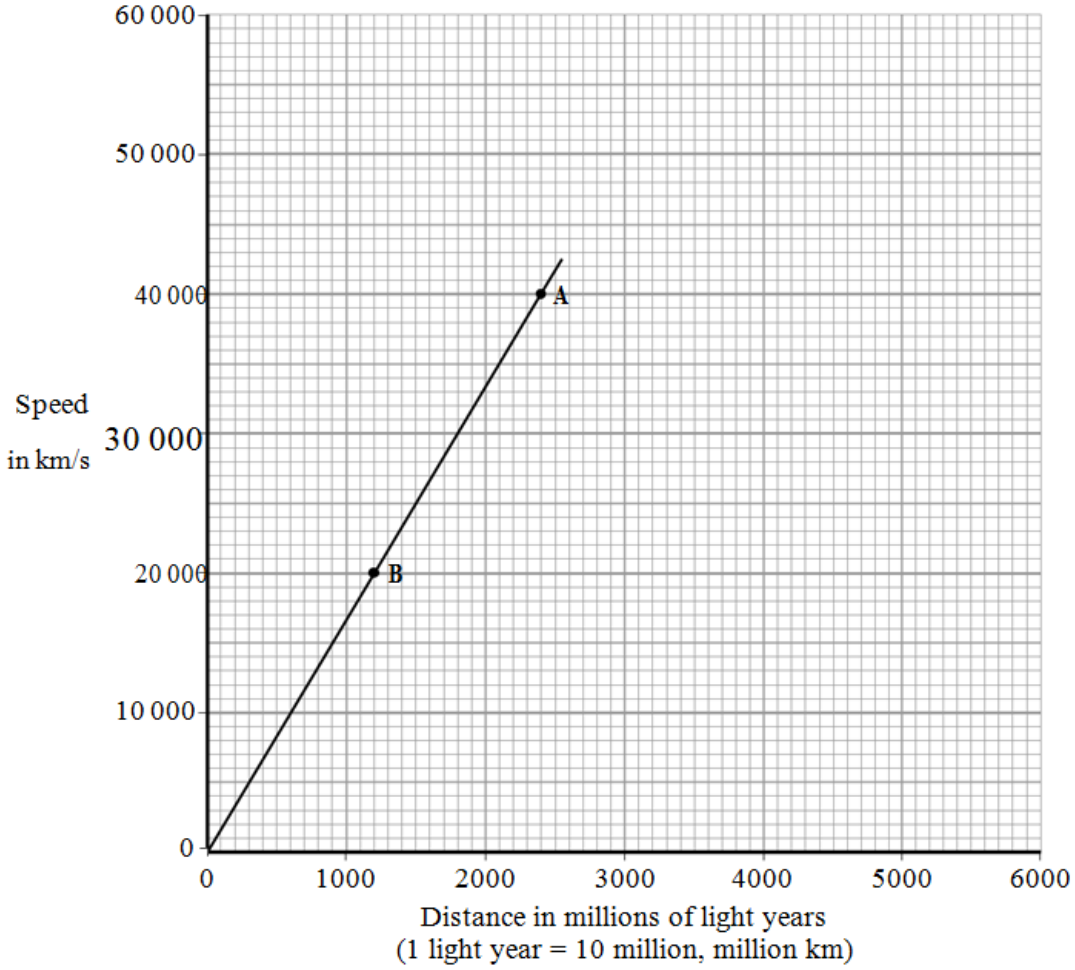
**Q:2** The visible part of the electromagnetic spectrum from a star includes a dark line. This line is at a specific wavelength. The diagram shows the position of the dark line in the spectrum from the Sun and in the spectrum from a distant galaxy.




**(a)** Explain how the spectrum 'shift' of the dark line supports the theory that the Universe began from a very small point.

(3 marks)

**b)**From data collected, a graph can be drawn that links the speed of a galaxy with the distance of the galaxy from the Earth




**(i)**How does the visible light spectrum from galaxy A look different from the visible light spectrum from galaxy B?

_____

_____

(1 mark)

(ii) A third galaxy, C, seems to be travelling away from the Earth at about 60 000 km/s.

Estimate how far galaxy C might be from the Earth, showing how you use the graph to do this.

_____

_____

Distance between galaxy C and the Earth = _____. million light years

(2 marks)

**Q:3** The 'Big Bang' theory is one theory of the origin of the Universe.

**(a)(i)** Explain what is meant by the 'Big Bang' theory.

_____

_____

_____

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(2 marks)

**(a)(ii)** The light arriving from distant galaxies provides scientists with evidence to support the 'Big Bang' theory.

Explain how.

_____

_____

_____

_____ (2 marks)

**(b)** At a meeting held in 2005, a group of scientists claimed that new data had been collected that showed the 'Big Bang' theory to be wrong. Other scientists said that there was no reason to doubt the 'Big Bang' theory.

What should scientists do when a theory does not appear to be supported by new data?

_____

_____

_____

_____

(2 marks)

**(c)** Scientists can answer many questions about the Universe, but not the question:

| |
|---|
| Why was the Universe created? |

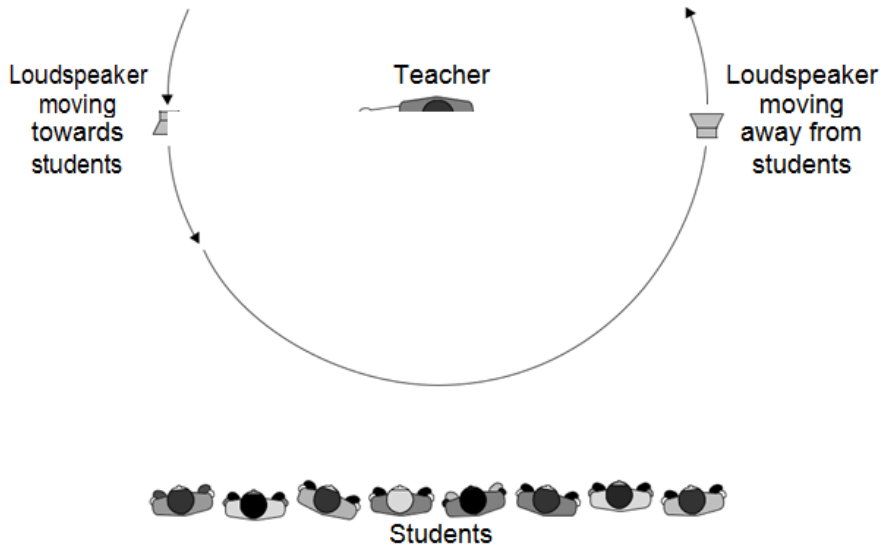
Suggest a reason why this question cannot be answered by scientists.

_____

_____

(1 mark)

**Q:4** The diagram shows a teacher using a loudspeaker to demonstrate an important effect. The loudspeaker, which produces a note of constant frequency, is swung around in a circle.



**(a)**The teacher is using the demonstration to model the red-shift in light that is observed from most distant galaxies.

**(a) (i)** Which one of the following statements gives the main reason why models are used in science?

Put a tick (☒) in the box next to your answer.

Models can help to explain an effect or theory.

Models can prove that a theory is correct.

Models can help to generate new ideas.

(1 mark)

**(b) (i)** Explain how this demonstration can be used as a model for red-shift.

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_____

_____

_____

(2 marks)

**(b)(ii)** Red-shift provides evidence to support the theory that the Universe began from a very small initial point.

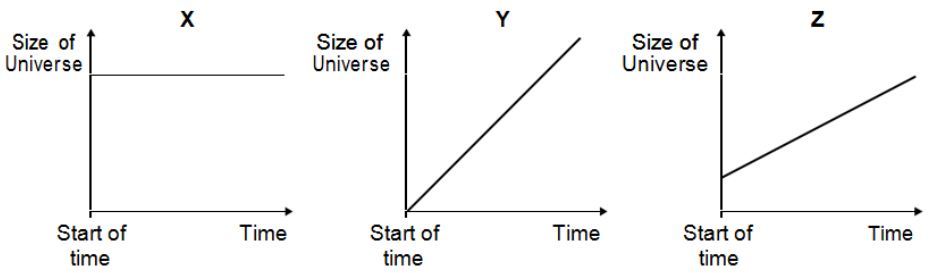
What name is given to this theory?

_____

(1 mark)

**Q:5** The 'big bang' theory is one theory explaining the origin of the Universe.

**(a)** The graphs X, Y and Z, show how the size of the Universe may have changed with time.



Which graph would the 'big bang' theory suggest is correct?

Write your answer, X, Y or Z, in the box. Explain the reason for your answer.

_____

_____

_____

_____

(3 marks)

**(b)** In 1948, an alternative to the 'big bang' theory, called the 'steady state' theory, was developed.

The 'steady state' theory suggested that the Universe, although expanding, has always existed without a beginning in time.

(**b) (i)** Complete the following sentence by drawing a ring around the correct line in the box. The measurement of red-shift in the light from distant galaxies provides evidence

only the 'big bang' theory. ☐

to support only the 'steady state' theory. ☐

both the 'big bang' and 'steady state' theories. ☐

(1 mark)

**(b) (ii)** In 1965, scientists rejected the 'steady state' theory in favour of the 'big bang' theory.

Suggest what might cause scientists to stop supporting one theory and to start supporting an alternative theory.

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_____

(1 mark)

**Q:6** Scientists use a radio telescope to measure the wavelength of the radio waves emitted from the galaxy as the waves reach the Earth. The scientists measure the wavelength as 25.2 metres. The effect causing this observed increase in wavelength is called red-shift.

**(a)** The waves emitted from most galaxies show red-shift.

What does red-shift tell scientists about the direction most galaxies are moving?

_____

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_____

(1 mark)

**(b)** The size of the red-shift is not the same for all galaxies.

What information can scientists find out about a galaxy when they measure the size of the red-shift the galaxy produces?

_____

_____

_____

(2 marks)

**(c)** What does the observation of red-shift suggest is happening to the Universe?

_____

_____

(1 mark)

**TOTAL MARKS=30**