Q1. 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)

(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

(1)

(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)

(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)

(Total 4 marks)

Q2. Scientists have observed that the wavelengths of the light given out from galaxies that are moving away from the Earth are longer than expected.

(a) (i) What name is given to this observation?

.....

(1)

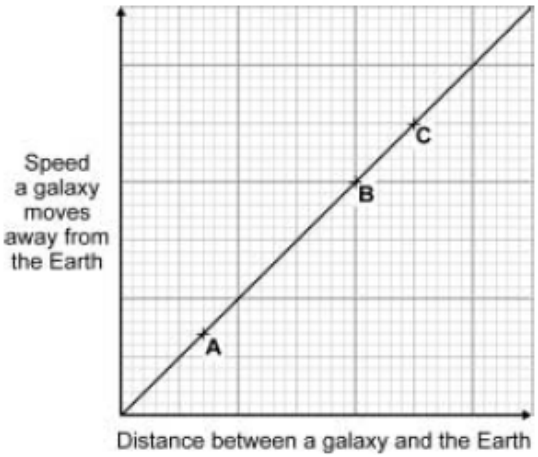
(ii) Draw a ring around the correct answer to complete the following sentence.

This observation gives evidence for the idea that the Universe is

shrinking.
not changing.
expanding.

(1)

(b) The graph shows that there is a link between the speed at which a galaxy moves away from the Earth and the distance of the galaxy from the Earth.



The positions of three galaxies, **A**, **B** and **C**, are marked on the graph.

From which galaxy, **A**, **B** or **C**, would the wavelength of the light reaching the Earth seem to have changed the most?

Galaxy .....

Give a reason for your answer.

.....

.....

.....

.....

(2)
(Total 4 marks)

Q3. (a) Scientists use telescopes to observe stars and galaxies.
Some telescopes are on Earth, but some are on satellites in space.

Why do telescopes in space give better images than telescopes on the Earth?

.....

.....

(1)

(b) Scientists have observed that the wavelengths of the light given out from galaxies that are moving away from the Earth are longer than expected.

(i) What name is given to this observation?

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

blue-shift	☐
green-shift	☐
red-shift	☐

(1)

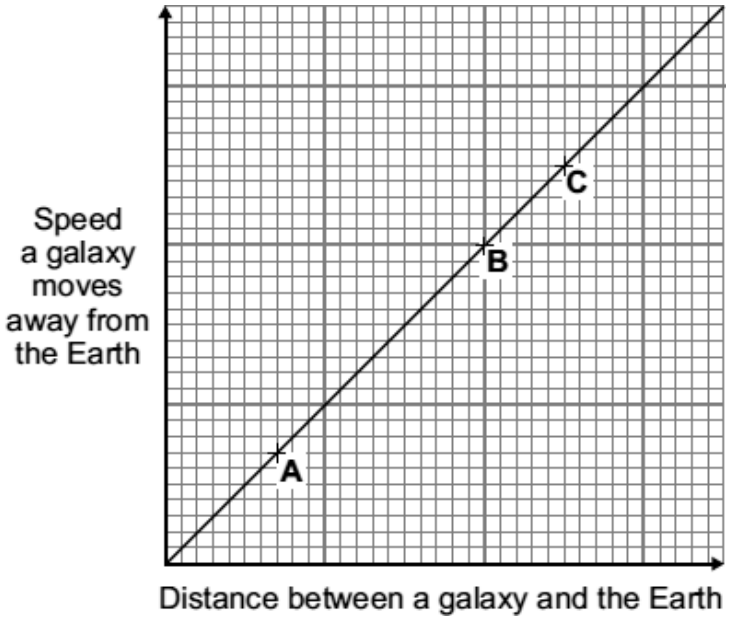
(ii) Complete the following sentence by drawing a ring around the correct line in the box.

This observation gives evidence for the idea that the universe is

shrinking.
not changing.
expanding.

(1)

(c) Use the graph to answer the following questions.



(i) What is the link between the speed that a galaxy moves away from the Earth and the distance between the galaxy and the Earth?

.....

.....

(1)

(ii) The positions of three galaxies, **A**, **B** and **C**, are marked on the graph.

From which galaxy, **A**, **B** or **C**, would the wavelength of the light reaching the Earth seem to have changed the most?

Galaxy .....

Give a reason for your answer.

.....

.....

.....

.....

(2)
(Total 6 marks)

Q4. A school is near a busy road. A car travels past the school at high speed.

Photograph supplied by Design Pics/Thinkstock

The students notice that the sound of the car engine seems to change as the car travels past the school. A teacher says that this is an example of the Doppler effect. The students decide to study the sound they hear from passing cars.

(a) (i) Give **one** risk the students should consider when doing their study.

.....

(1)

(ii) As a car travels towards the students, the frequency of the sound the students hear is different to the frequency of the sound they would hear if the car was stationary.

Draw a ring around the correct answer in the box to complete the sentence.

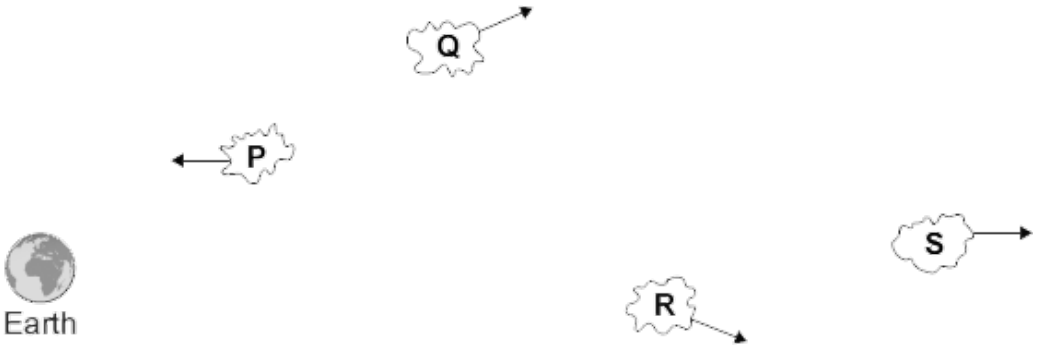
Compared to the sound from the stationary car, the frequency has

decreased.
increased.
become quieter.

(1)

(b) In the same way as the sound from the car engine changes, the light from most galaxies also seems to have a change in observed frequency. This is called red-shift.

(i) The diagram shows four galaxies, **P**, **Q**, **R** and **S**. The arrows show the direction the galaxies are moving relative to the Earth.



Which **one** of the galaxies is moving the fastest?

Write the correct answer in the box. ☐

Which **one** of the galaxies will produce the biggest red-shift?

Write the correct answer in the box. ☐

(2)

(ii) Most scientists support a theory that the Universe began from a very small initial point. Red-shift can be used as evidence for this theory.

What name is given to the theory that the Universe began from a very small initial point?

.....

(1)

(iii) Cosmic microwave background radiation (CMBR) provides more evidence for this theory. CMBR is detected coming from space.

Where does CMBR come from?

Tick (✓) **one** box.

CMBR only comes from near the Sun. ☐

CMBR comes from all parts of the Universe. ☐

CMBR only comes from the Moon. ☐

(1)

(iv) Which statement gives the reason why most scientists support the theory that the Universe began from a very small initial point?

Tick (✓) **one** box.

The evidence proves it happened. ☐

There is no other way of explaining how the Universe began. ☐

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

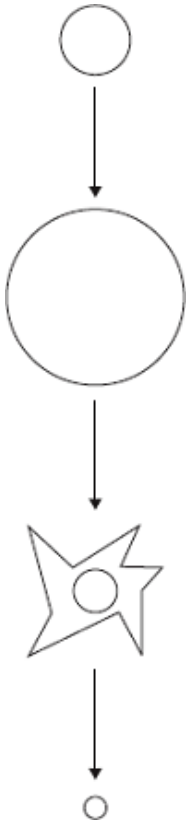
(1)
(Total 7 marks)

Q5. The diagram shows part of the lifecycle of a very large star.

Use words or phrases from the box to complete the sentences contained in the diagram.

black hole	**red supergiant**	**supernova**	**white dwarf**

(3)



The star is stable.

The star expands forming

a ..... .

The star collapses, the outer layers explode

as a ..... .

The centre collapses further and further until

it finally forms a ..... .

(Total 3 marks)

Q6. (a) Scientists have observed that the wavelengths of the light from galaxies moving away from the Earth are longer than expected.

(i) What name is given to this observation?

.....

(1)

(ii) Draw a ring around the correct answer to complete each sentence.

This observation gives scientists evidence that

light can be stretched.
galaxies are changing colour.
the Universe is expanding.

(1)

(iii) There is a pattern linking the size of the observed increase in the wavelengths of light from a galaxy and the distance the galaxy is from the Earth.

Which **one** of the graphs, **L**, **M** or **N**, shows the correct pattern?

Write the correct answer in the box. ☐

(1)

(b) Observations help scientists answer questions about the Universe.

Scientists **cannot** answer every question.

Which **one** of the following questions **cannot** be answered by scientists?

Tick (✓) **one** box.

How old is the Universe? ☐

Why was the Universe created? ☐

How fast does light travel through the Universe? ☐

(1)
(Total 4 marks)

Q7. (a) A lorry has an air horn. The air horn produces sound waves in the air.

(i) Use **one** word to complete the following sentence.

Sound waves cause air particles to ..... .

(1)

(ii) The air horn produces sound waves at a constant frequency of 420 Hz.

The wavelength of the sound waves is 0.80 m.

Calculate the speed of the sound waves.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Speed = ... m/s

(2)

(b) A person standing at the side of the road, as the lorry goes past, hears the sound from the air horn change pitch.

(i) What determines the pitch of a sound?

Draw a ring around the correct answer.

amplitude **frequency** **loudness**

(1)

(ii) As the lorry moves away from the person, the air horn continues to produce sound waves with a wavelength of 0.80 m.

What is the wavelength of the sound waves the person heard?

Draw a ring around the correct answer.

shorter than 0.8 m **equal to 0.8 m** **longer than 0.8 m**

(1)

(iii) The sound waves the person heard from the moving air horn are different to the sound waves the air horn produced.

What name is given to this effect?

Draw a ring around the correct answer.

diffraction **Doppler** **refraction**

(1)

(Total 6 marks)