Scientists and telescopes

1 Herschel and Hubble were astronomers who have had telescopes named after them.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

The telescope named after Herschel detects infrared radiation.
Herschel is a suitable name for this infrared telescope because

(1)

☒ **A** Herschel discovered Uranus using a telescope

☒ **B** Herschel constructed over 400 telescopes

☒ **C** Herschel discovered infrared radiation

☒ **D** Herschel constructed this telescope

(b) Both the Hubble telescope and the Moon orbit the Earth.
The table gives data about these

	average radius of orbit / km	**time of orbit**
Moon	385 000	27 days
Hubble	560	96 minutes

(i) What is the closest distance between the Moon and the Hubble telescope?

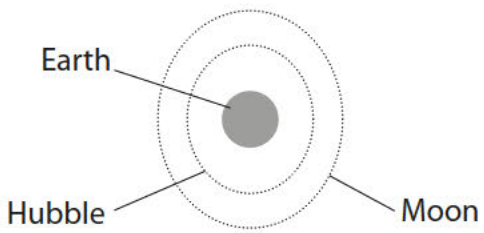
(1)

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(ii) Explain why the distance between the Moon and the Hubble telescope changes.

You may add to this diagram to help your answer.

(2)



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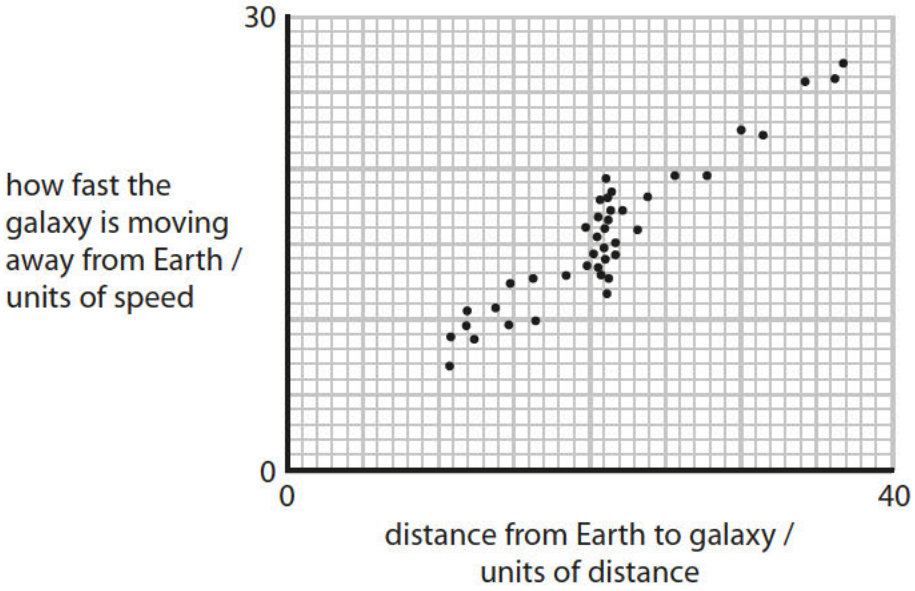
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(c) Hubble measured the distance of many galaxies from Earth.
He also measured the speed at which each galaxy moved away from Earth.

Hubble plotted his data on a graph like this.



(i) Plot the point: distance = 5 units, speed = 4 units

(1)

(ii) Draw the straight line of best fit.

(1)

(d) Hubble's work led to the theory of the Big Bang.

Describe what is meant by the Big Bang theory.

(2)

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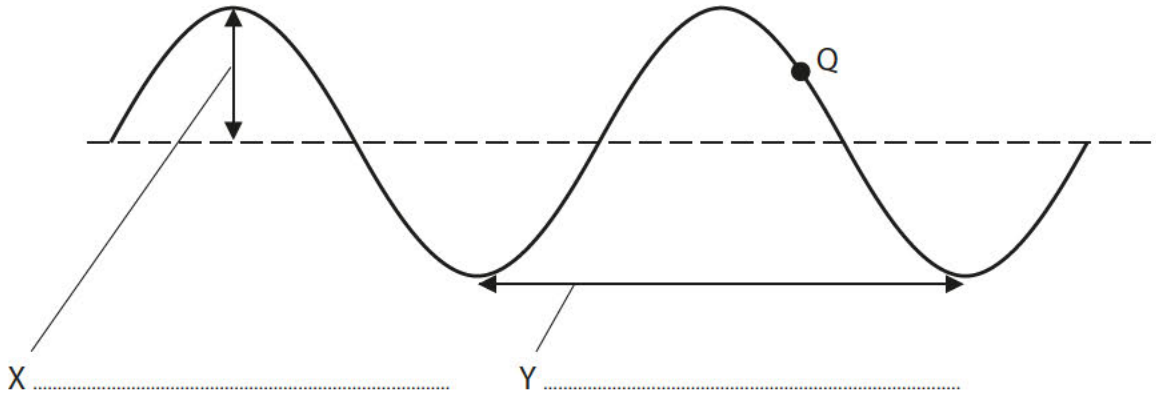
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(Total for Question 2 = 8 marks)

Waves in action

2 (a) The diagram shows a transverse wave.



(i) Use words from the box to label the distances X and Y.

amplitude	frequency	magnification	speed	wavelength

(2)

(ii) Q is a particle in the wave.

Which of these shows the way in which particle Q moves?

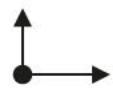
Put a cross (☒) in the box next to your answer.

(1)

☐ **A**



☐ **B**



☐ **C**



☐ **D**



(b) The photographs show a refracting telescope and a reflecting telescope.



refracting telescope reflecting telescope

Both telescopes are used to form an image of a distant object.

(i) The two types of telescope form their images of a distant object in different ways.
A refracting telescope uses a converging lens to form an image of a distant object.

Describe how a reflecting telescope forms an image of a distant object.

(2)

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(ii) Both telescopes use a converging lens as an eyepiece.

State what the eyepiece of a telescope is intended to do to the image.

(1)

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*(c) A long time ago, astronomers thought that the Earth was the centre of the Universe.

This was called the geocentric model.
The evidence for this model came from observations of the sky using the naked eye.

After the telescope was invented, astronomers quickly gathered evidence which showed that the geocentric model is not correct.

Describe the evidence both for the geocentric model and against the geocentric model.

(6)

(Total for Question 5 = 12 marks)

3 (a) Our Sun is a main sequence star.

It will stay as a main sequence star for millions of years, continuing to radiate energy.

(i) Our Sun was formed from a nebula.

Describe the formation of our Sun from nebula to main sequence.

(2)

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(ii) Our Sun will go through many stages.

Which of these stages will our Sun go through?

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

(1)

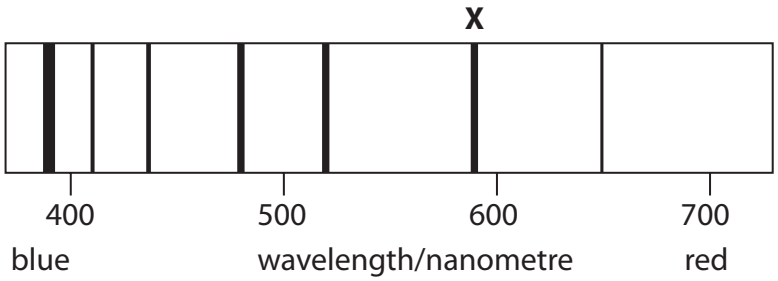
☐ **A** a black hole

☐ **B** a neutron star

☐ **C** a supernova

☐ **D** a white dwarf

(b) The diagram shows some lines in the spectrum of light from a nearby galaxy.
One of the lines is marked **X**.



(i) Line **X** will be in a different position in the spectrum of light from a much more distant galaxy.

Draw a line on the diagram to show a possible new position for line **X** in the spectrum of light from a much more distant galaxy.

Label this new line **Y**.

(1)

(ii) Explain why you have drawn line **Y** in this position on the diagram.

(2)

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(c) Two theories about the Universe are the Steady State Theory and The Big Bang Theory.

(i) The table shows some ideas about the Universe.

Which row of the table applies to the Steady State Theory?
Put a cross (☒) in the box next to your answer.

(1)

	the Universe.....	**the Universe.....**
☒ **A**	... is not expanding	... had a beginning
☒ **B**	... is expanding	... had a beginning
☒ **C**	... is not expanding	... did not have a beginning
☒ **D**	... is expanding	... did not have a beginning

(ii) State the name of the discovery that persuaded most scientists to prefer the Big Bang Theory to the Steady State Theory.

(1)

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(Total for Question 2 = 8 marks)

Stars and planets

4 (a) Our Sun is a star.

(i) The life cycle of a star has several stages.
The Sun is in its main sequence stage.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The next stage in the life cycle of the Sun will be

(1)

☐ **A** a nebula

☐ **B** a red giant

☐ **C** a white dwarf

☐ **D** a black hole

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The galaxy which contains our Sun is called

(1)

☐ **A** Andromeda

☐ **B** Orion

☐ **C** the Milky Way

☐ **D** the Solar System

(iii) Which of these is furthest from the Sun?

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

(1)

☐ **A** Earth

☐ **B** The Moon

☐ **C** The planet Jupiter

☐ **D** The star Proxima Centauri

(b) Scientists search for signs of life on the planet Mars.
Describe **one** method they use to search for signs of life on the planet Mars.

(2)

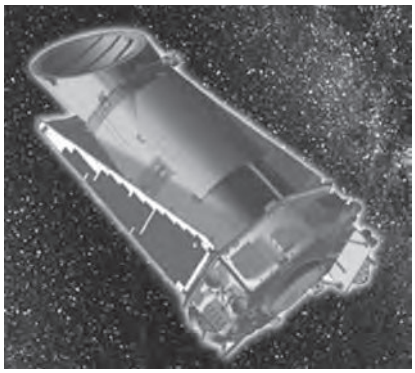
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(c) Scientists search for new planets orbiting distant stars.
The photograph shows the Kepler space telescope.



The Kepler space telescope records the brightness of light from distant stars.
When a planet passes in front of a distant star, there is a tiny dip in the brightness of the light from the star.

(i) Many telescopes are used on the Earth but the Kepler space telescope orbits above the Earth's atmosphere.
Explain why telescopes that search for planets are not on the Earth's surface.

(2)

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(ii) The Kepler space telescope was pointed towards one star.
It detected the same dip in the brightness of the star every 150 days.

Suggest what information this gives about the planet that orbits this star.

(1)

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(Total for Question 2 = 8 marks)

Changing Universe

5 A long time ago scientists thought that the Universe never changed.

Now there is evidence to show that stars progress through various stages and that the Universe is expanding.

(a) Our Sun is in its main sequence stage.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

A star of much greater mass than the Sun will eventually become

(1)

☐ **A** a black hole

☐ **B** a protostar

☐ **C** a red dwarf

☐ **D** a white dwarf

(ii) Describe how the Sun reached its main sequence stage.

(3)

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(iii) Scientists can estimate the age of a star. They want to find the age of the oldest star.

Suggest why knowing the age of the oldest star is not enough to tell scientists the age of the Universe.

(2)

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*(b) Edwin Hubble discovered that the Universe was expanding.
He did this by using observations of red-shift.
Explain what red-shift is and how it provides evidence that the Universe is expanding.

(6)

(Total for Question 6 = 12 marks)