Observing our Universe

1 (a) The photograph was taken by the Hubble Space Telescope.
Some of the objects in the photograph are galaxies.

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

A galaxy is a collection of

(1)

☒ **A** stars

☒ **B** moons

☒ **C** asteroids

☒ **D** planets

(ii) The photograph was taken using visible light.
Describe a benefit of using a telescope in space.

(2)

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(b) This photograph shows a line of radio telescopes.

(i) Name **one** type of electromagnetic radiation that they can detect.

(1)

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(ii) Radio telescopes are one type of modern telescope.

Describe how the use of modern telescopes like these has helped our understanding of the Universe.

(2)

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(c) The Hubble telescope has recently detected a nebula like the one in this picture.

(i) State what a nebula is.

(1)

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(ii) A nebula eventually becomes a star.

Describe how a nebula becomes a star.

(3)

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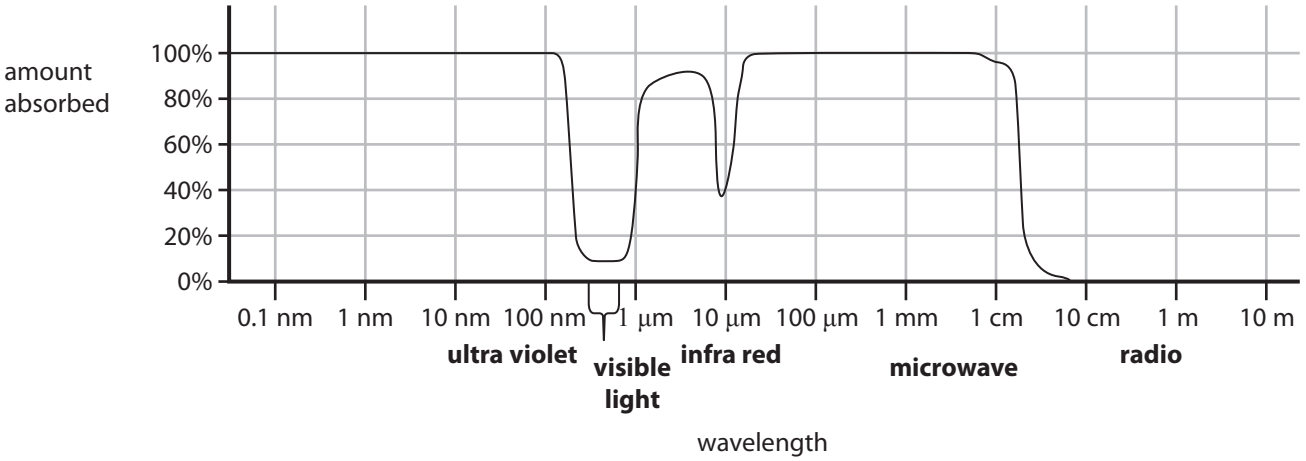
(Total for Question 4 = 10 marks)

2 (a) The Earth's atmosphere absorbs electromagnetic radiation.
The diagram shows how the amount absorbed changes with wavelength.



(i) How much of the visible light from space is **absorbed** as it passes through our atmosphere?

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

(1)

☒ **A** 0%

☒ **B** 10%

☒ **C** 90%

☒ **D** 100%

(ii) Large telescopes which collect visible light to explore the Universe are usually placed near the tops of mountains.
Suggest why radio telescopes do not have to be placed high up a mountain.

(1)

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(iii) One theory of the origin of the Universe predicted that there should be cosmic background radiation with a wavelength of about 1 mm.

Explain why scientists had to wait until the development of space flight before they could study this radiation in detail.

(2)

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(iv) The electromagnetic radiation from most galaxies has a red-shift.

Suggest why, when a galaxy has a very large red-shift, some of its visible light is not detected through the Earth's atmosphere.

(2)

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*(b) Scientists believe that the Universe is expanding.

Describe how careful observation of electromagnetic radiation from distant galaxies as well as from the whole of space gave evidence supporting the Big Bang Theory.

(6)

(Total for Question 6 = 12 marks)

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

Which of these is the biggest?

(1)

- ☒ **A** the Solar System
- ☒ **B** a galaxy
- ☒ **C** a nebula
- ☒ **D** the Universe

(b) These are four stages in the evolution of a star similar to the Sun.

They are **not** in the correct order.

1. main sequence star
2. white dwarf
3. red giant
4. nebula

Write down the stages in the correct order.

(2)

The first stage has been done for you.

nebula

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(c) (i) The chart shows the electromagnetic (EM) spectrum.
Some parts of the spectrum have been labelled.

radio	**P**	**Q**	visible light	**R**	**S**	gamma rays

State the name of part **Q**.

(1)

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(ii) Three telesc e been added to the chart.

radio	**P**	**Q**	visible light	**R**	**S**	gamma rays
Jodrell Bank			Hubble			ompton

Jodrell Bank is located near Manchester, whereas Hubble and Compton are in space.

Explain why some telescopes are located outside the Earth's atmosphere.

(2)

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*(d) Describe how modern telescopes have contributed to our understanding of the Universe.

(6)

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(Total for Question 5 = 12 marks)

The Universe

4 (a) Which row of the table shows these objects in the correct order of size?

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

(1)

	smallest →		biggest
☒ **A**	Milky Way	Solar System	Universe
☒ **B**	Milky Way	Universe	Solar System
☒ **C**	Solar System	Universe	Milky Way
☒ **D**	Solar System	Milky Way	Universe

(b) Some visible light telescopes are located in space.

Other visible light telescopes are located on the Earth's surface.

Explain why the images produced by telescopes on Earth are less clear than the images produced by telescopes in space.

(2)

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(c) This simplified diagram compares spectra of light from the Sun and two galaxies.

The light from galaxy 1 and galaxy 2 both show redshift.

Explain what these redshifts predict about the position and movement of the two galaxies.

(3)

(d) Scientists have studied stars to discover how stars evolve.

They know that stars form in a nebula when clouds of dust and gas are pulled together by gravity.

Describe how this process continues for stars much more massive than the Sun.

(4)

(Total for Question 3 = 10 marks)