Astrology and space GCSE AQA Higher Physics Past Papers Questions

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

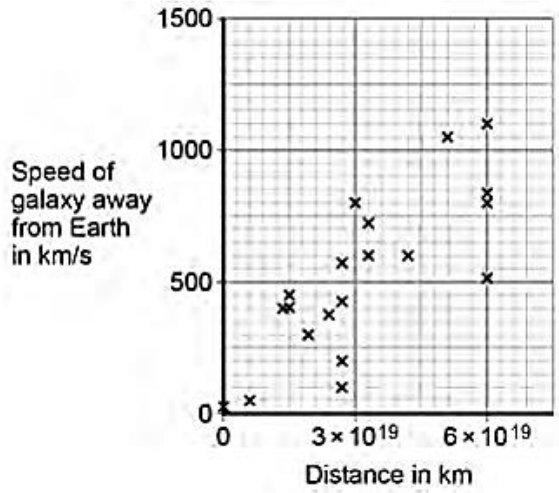
1 What name is given to this effect?

[1 mark]

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

Figure 5 shows the results of Hubble's calculations.

Figure 5



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

[1 mark]

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 6 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 6

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

[2 marks]

strength

weakness

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

[1 mark]

5 Most scientists now believe that Theory 2 is correct.

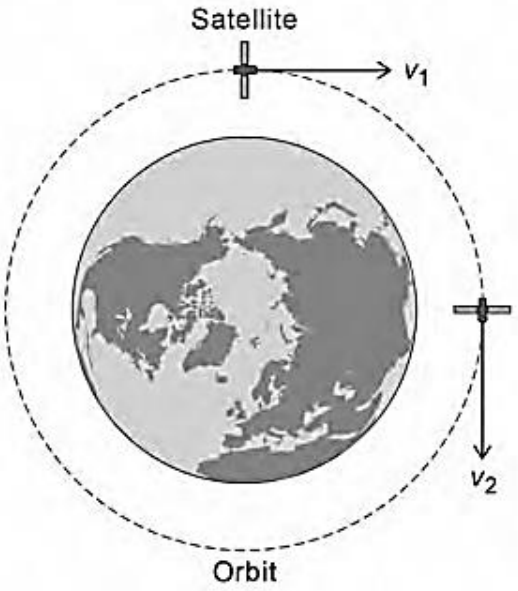
Suggest what is likely to have caused scientists to start thinking Theory 1 is wrong.

[1 mark]

02. A satellite is in a circular orbit around the Earth.

Figure 14 shows the velocity of the satellite at two different positions in the orbit.

Figure 14

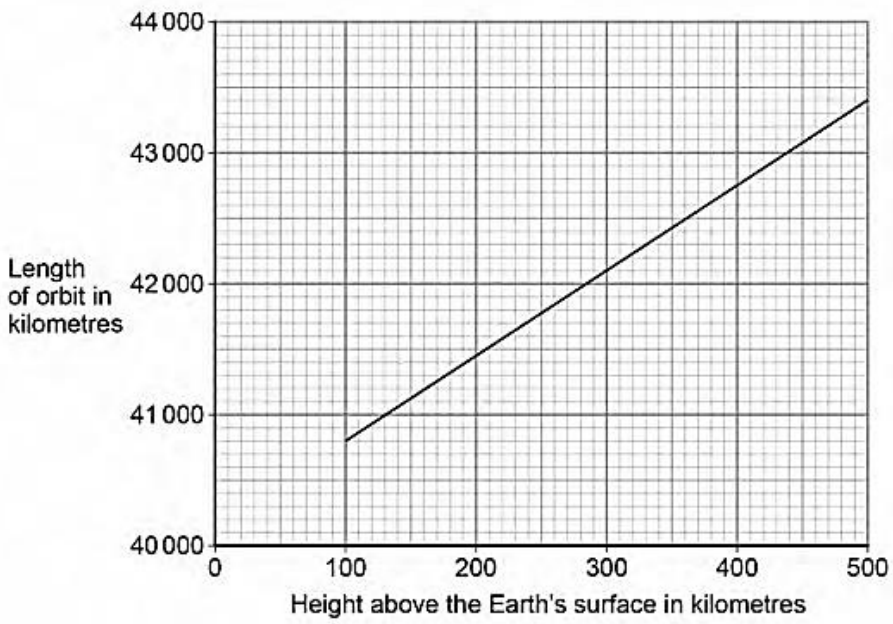


1 Explain why the velocity of the satellite changes as it orbits the Earth.

[3 marks]

2 **Figure 15** shows how the length of a satellite orbit depends on the height of the satellite above the Earth's surface.

Figure 15



A satellite orbits 300 km above the Earth's surface at a speed of 7.73 km/s.

Calculate how many complete orbits of the Earth the satellite will make in 24 hours.

[5 marks]

Number of complete orbits = _____

In 1772, an astronomer called J Bode developed an equation to predict the orbital radii of the planets around the Sun.

Table 3 shows Bode's predicted orbital radii and the actual orbital radii for the planets that were known in 1772.

Table 3

Planet	Predicted orbital radius in millions of kilometres	Actual orbital radius in millions of kilometres
Mercury	60	58
Venus	105	108
Earth	150	150
Mars	240	228
Jupiter	780	778
Saturn	1500	1430

3 The predicted data can be considered to be accurate.

Give the reason why.

[1 mark]

4 J Bode used his equation to predict the existence of a planet with an orbital radius of 2940 million kilometres.

The planet Uranus was discovered in 1781.

Uranus has an orbital radius of 2875 million kilometres.

Explain why the discovery of Uranus was important.

[2 marks]

11

03.

1 The light from distant galaxies shows red-shift.

Complete the sentence.

[1 mark]

The term red-shift describes the observed increase

in the _____ of the light from a distant galaxy.

2 The Big Bang theory is one model used to explain the origin of the universe.

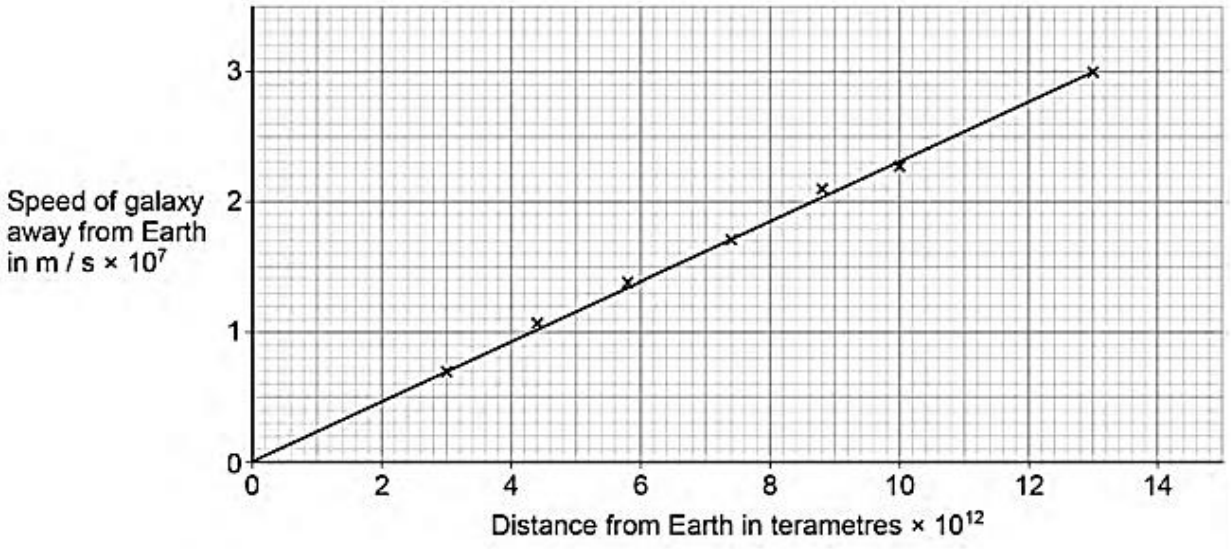
How does the Big Bang theory describe the universe when it began?

[1 mark]

_____

Figure 9 shows data scientists have calculated from measurements of red-shift.

Figure 9



3 Describe the relationship between the speed of a galaxy and the distance the galaxy is from the Earth.

[1 mark]

4 Which of the following is the same as 6×10^{12} terametres?

[1 mark]

Tick (✓) **one** box.

- 6×10^{15} m ☐
- 6×10^{18} m ☐
- 6×10^{21} m ☐
- 6×10^{24} m ☐

5 Explain how the data in **Figure 9** supports the suggestion that the universe began from a very small region.

[2 marks]

. 6 The Big Bang theory suggested that gravity would slow the rate at which galaxies move away from the Earth.

New observations suggest that distant galaxies are moving away from the Earth at an increasingly fast rate.

What do the new observations suggest is happening to the universe?

[1 mark]

. 7 New observations and data that do not fit existing theories should undergo peer review.

Give **one** reason why peer review is an important process.

[1 mark]

8 The Andromeda galaxy is moving towards the Earth.

Describe how the wavelength and frequency of the light from Andromeda seem to have changed when viewed from the Earth.

[2 marks]

10

04.

1 Complete the sentences.

[2 marks]

The Sun is a stable star. This is because the forces pulling inwards caused by _____ are in equilibrium with the forces pushing outwards caused by the energy released by nuclear _____.

2 Write down the equation that links distance travelled (s), speed (v) and time (t).

[1 mark]

_____

3 The mean distance between the Sun and the Earth is 1.5×10^{11} m.

Light travels at a speed of 3.0×10^{8} m/s.

Calculate the time taken for light from the Sun to reach the Earth.

[3 marks]

_____

_____

_____

_____

_____

Time = _____ s

4 Some stars are much more massive than the Sun.

Describe the life cycle of stars much more massive than the Sun, including the formation of new elements.

[6 marks]

5 Stars emit radiation with a range of wavelengths.

Which property of a star does the range of wavelengths depend on?

[1 mark]

Tick (✓) **one** box.

Density ☐

Mass ☐

Temperature ☐

Volume ☐

13

05. A main sequence star in a distant galaxy is the same size and mass as the Sun.

1 Explain why the star is stable while it is in the main sequence stage of its life cycle.

[2 marks]

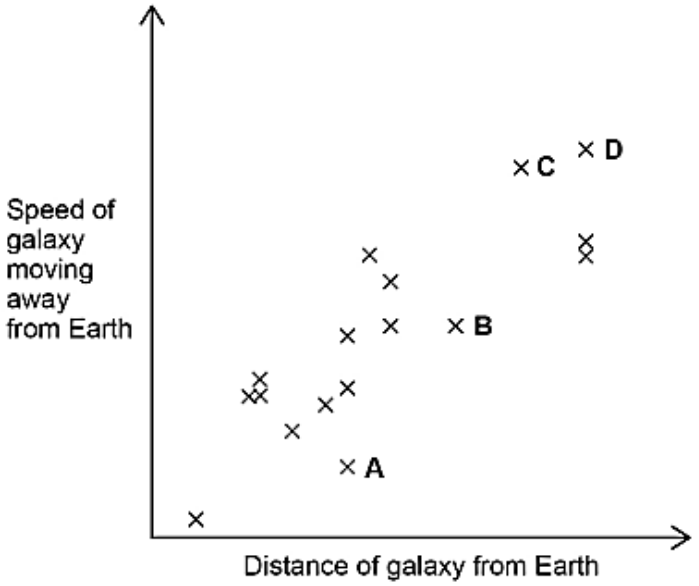
2 Describe what will happen to the star between the main sequence stage and the end of the star's life cycle.

You should include the names of the stages in the life cycle of the star.

[3 marks]

3 **Figure 5** shows how the speed of galaxies moving away from Earth varies with the distance of the galaxies from Earth.

Figure 5



Which galaxy would show the smallest observed change in the wavelength of visible light?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

A ☐ B ☐ C ☐ D ☐

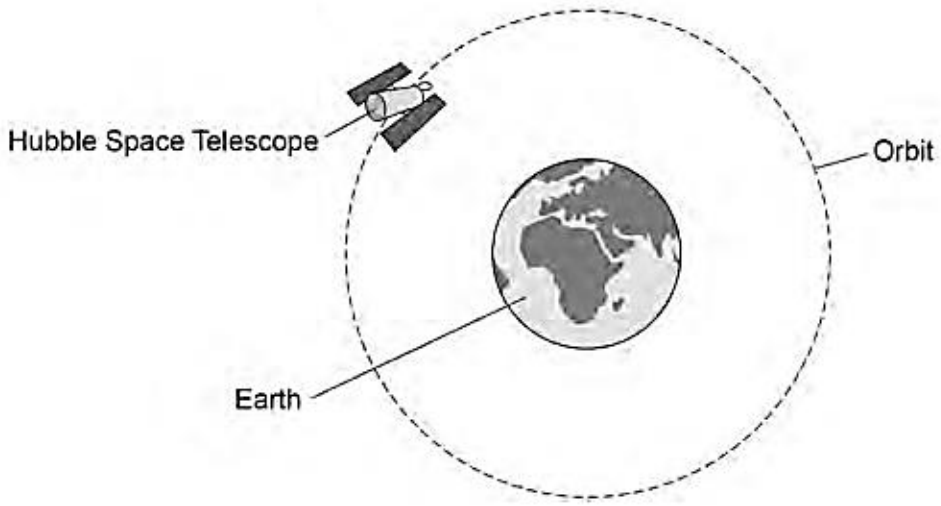
Reason _____

_____

7

06. **Figure 15** shows the Hubble Space Telescope orbiting the Earth.

Figure 15



1 What name is given to objects that orbit a planet?

[1 mark]

2 A space telescope uses microwaves to communicate with the Earth.

A microwave has a wavelength of 12.5 cm.

The speed of microwaves through space is 3.0×10^8 m/s.

Calculate the frequency of the microwave.

Use the Physics Equations Sheet.

Give your answer in standard form.

[5 marks]

Frequency (in standard form) = _____ Hz

3 Explain the effect of the Earth's gravitational force on the motion of the Hubble Space Telescope.

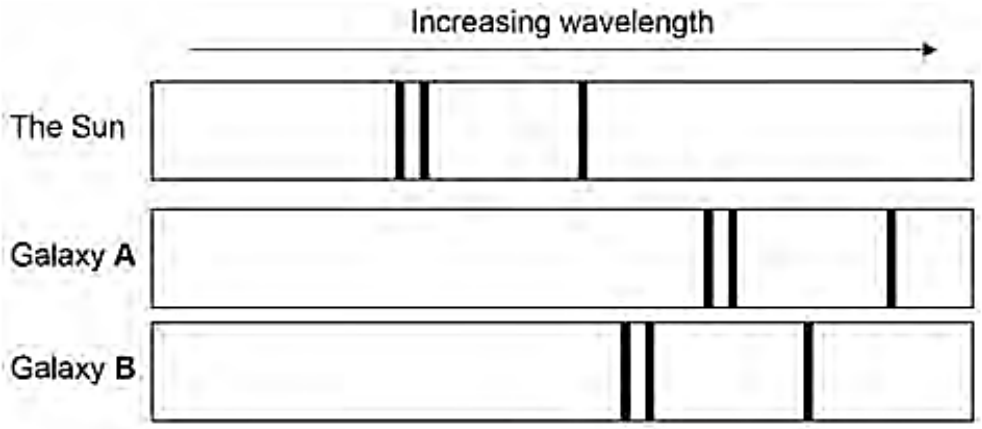
[3 marks]

4 The Hubble Space Telescope can detect visible light from distant galaxies.

The visible light spectra from stars and galaxies include dark lines at specific wavelengths.

Figure 16 shows the visible light spectra from the Sun and two galaxies.

Figure 16



Explain what conclusions can be made about galaxies **A** and **B**.

[3 marks]

12