8- Space Physics

Total mark – 17

Question: 1

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

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

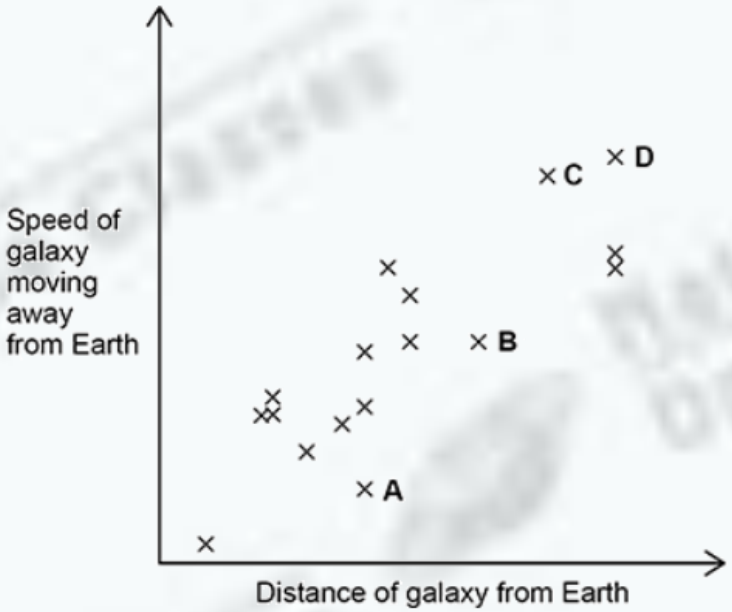
(2)

(b) 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)

(c) The figure below shows how the speed of galaxies moving away from Earth varies with the distance of the galaxies from Earth.



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

Give a reason for your answer.

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

Reason _____

_____

(2)

Mark Scheme

(a) gravitational force inwards and forces as a result of fusion reactions outwards

allow fusion energy for fusion reactions outwards

allow radiation pressure for fusion reactions outwards

1

are in equilibrium / balanced

dependant on scoring 1st mark point

*allow for **1** mark forces are in equilibrium*

1

(b) (the star will) expand to become a red giant

*the answers must be in the correct sequence to score all **3** marks*

1

(the star will) collapse to become a white dwarf

allowed outer layers ejected for collapsed

1

(the star will) cool to become a black dwarf

*if no other marks score, allow red giant, white dwarf, black dwarf in the correct order for **1** mark*

1

(c) **A**

1

it is (moving away from Earth) the slowest
or
it is the closest (to the Earth)

reason only scores if A is chosen

1

Question: 2

(a) The light from distant galaxies shows red-shift.

Complete the sentence.

The term red-shift describes the observed increase

in the _____ of the light from a distant galaxy.

(1)

(b) The Big Bang theory is one model used to explain the origin of the universe.

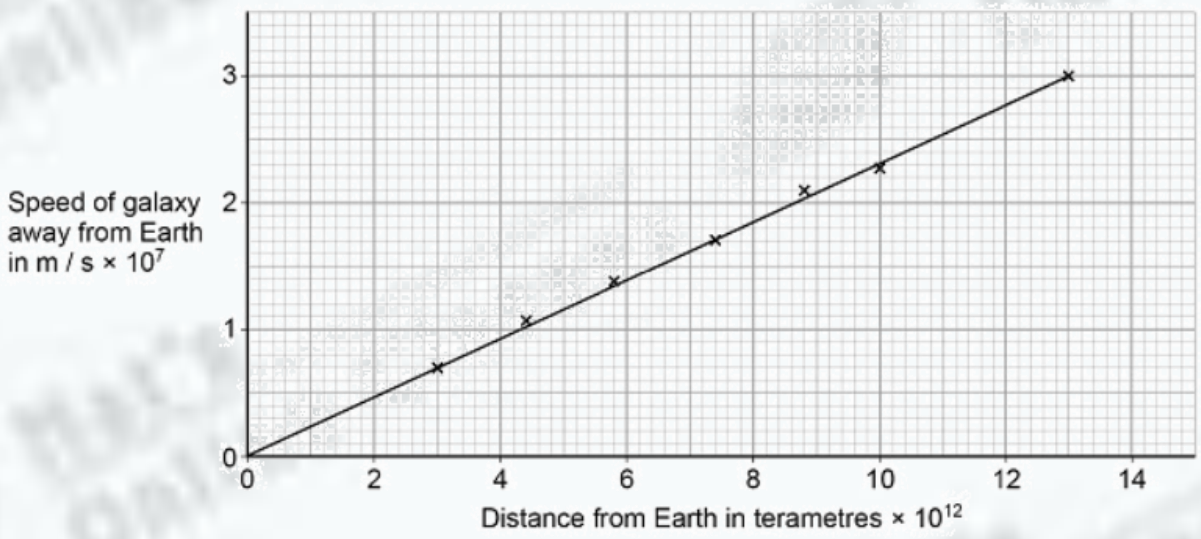
How does the Big Bang theory describe the universe when it began?

_____

_____

(1)

The figure below shows data scientists have calculated from measurements of red-shift.



(c) Describe the relationship between the speed of a galaxy and the distance the galaxy is from the Earth.

_____

_____

(1)

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

Tick (✓) **one** box.

6×10^{15} m ☐

6×10^{18} m ☐

6×10^{21} m ☐

6×10^{24} m ☐

(1)

(e) Explain how the data in the figure above supports the suggestion that the universe began from a very small region.

(2)

(f) 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)

(g) 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)

(h) 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)

Mark Scheme

(a) wavelength

this answer only

1

(b) (extremely) hot and dense

ignore very small

1

(c) (directly) proportional

allow a correct description of direct proportionality
ignore positive correlation

1

(d) 6×10^{24}

1

(e) the furthest galaxies are moving the fastest

1

(this suggests) the universe is expanding (from a very small region)

1

(f) expanding at (an ever) greater rate

allow expanding faster

1

(g) any **one** from:

- detects false claims

  allow provides credibility
- detects inaccurate data

  allow detects mistakes
- detects bias

  allow removes bias
- verifies new data

  allow checks validity
- provides a consensus (of opinion)

  ignore shows data is accurate

  ignore proves a theory

1

(h) wavelength (seems to have) decreased

1

frequency (seems to have) increased

1