1 Standard candles are stars for which we know the

☒ **A** brightness.

☒ **B** colour when observed from Earth.

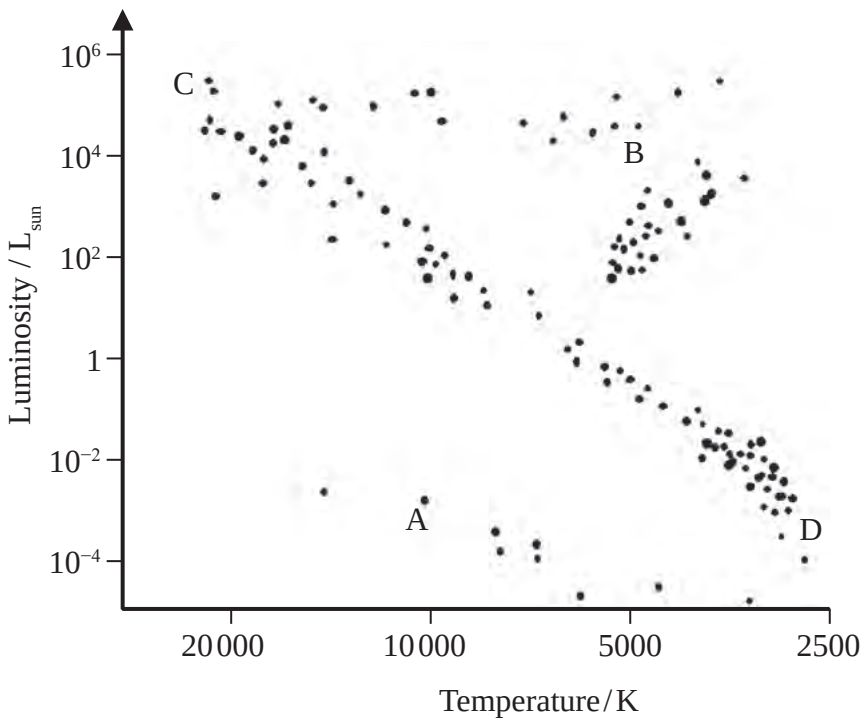
☒ **C** distance from the observer.

☒ **D** luminosity.

(Total for Question = 1 mark)

2 T Tauri stars are very young low mass stars, still in the process of gravitational contraction.

The Hertzsprung-Russell diagram below shows data for a range of stars.



Identify in which area, A, B, C or D, on the Hertzsprung-Russell diagram T Tauri stars are likely to be found.

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for Question = 1 mark)

3 Two stars have the same surface temperature but different sizes. Star X has twice the diameter of star Y.

Which of the following statements is correct?

☒ **A** Star X has twice the luminosity of star Y.

☒ **B** Star X has four times the luminosity of star Y.

☒ **C** Star X has eight times the luminosity of star Y.

☒ **D** Star X has sixteen times the luminosity of star Y.

(Total for Question = 1 mark)

4 The wavelength of a line in the spectrum produced by a distant star is found to be shorter than the wavelength of the corresponding line in the spectrum produced by the Sun.

This is because the distant star is

☒ **A** cooler than the Sun.

☒ **B** hotter than the Sun.

☒ **C** moving away from the Earth.

☒ **D** moving towards the Earth.

(Total for Question = 1 mark)

5 Recent determinations of the Hubble constant give a much smaller value than that originally obtained.

Compared to original ideas about the universe, the smaller value of the Hubble constant leads to the conclusion that the universe is

☒ **A** more dense.

☒ **B** less dense.

☒ **C** older.

☒ **D** younger.

(Total for Question = 1 mark)

6 A standard candle, within a nearby star cluster, is a distance D from the Earth. It produces a radiation flux F at the surface of the Earth.

The flux at the surface of the Earth, for a standard candle of the same luminosity in a second star cluster, is $4F$.

The distance of the second star cluster from the Earth is

☒ **A** $4D$

☒ **B** $2D$

☒ **C** $\frac{D}{2}$

☒ **D** $\frac{D}{4}$

(Total for Question = 1 mark)

7 Star A has twice the radius of star B but only half the surface temperature.

The ratio of the luminosity of star A to luminosity of star B is

☒ **A** 1:4

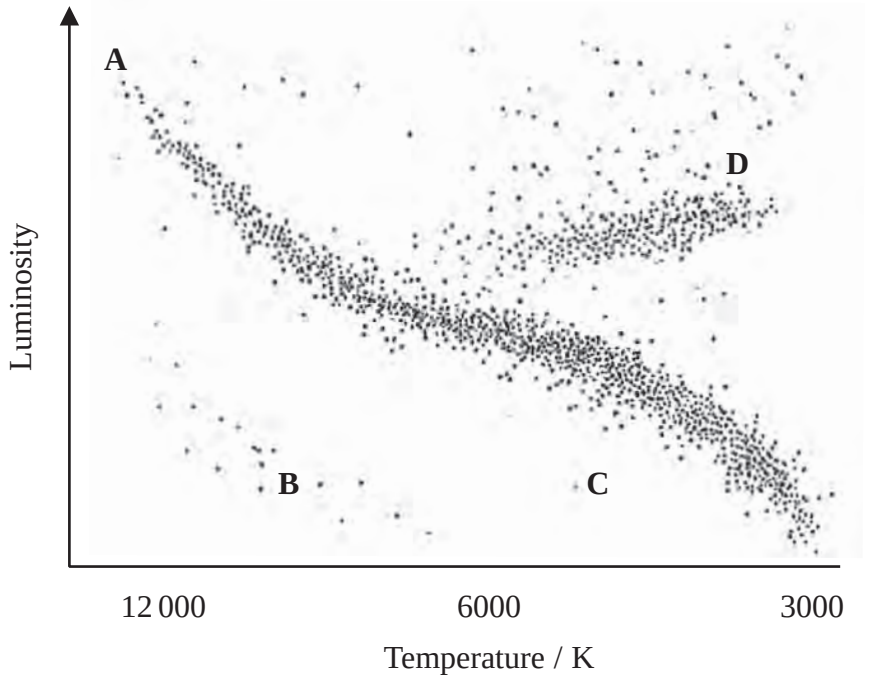
☒ **B** 1:2

☒ **C** 2:1

☒ **D** 4:1

(Total for Question = 1 mark)

Questions 8 and 9 refer to the Hertzsprung-Russell diagram below.



8 Which letter, **A**, **B**, **C** or **D**, indicates the region where a white dwarf star would be shown?

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question = 1 mark)

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9 Which letter, **A**, **B**, **C** or **D**, indicates the region where a blue giant star would be shown?

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question = 1 mark)

10 α-Centauri is one of the nearest stars to our Sun. The surface temperatures of these two stars are about the same. α-Centauri has a 20% greater diameter than the Sun.

The ratio of the luminosity of α-Centauri to the luminosity of the Sun is about

☒ **A** 1.2

☒ **B** 1.4

☒ **C** 1.7

☒ **D** 2.1

(Total for Question = 1 mark)

11 Scientists cannot be sure what their current models predict for the ultimate fate of the universe because

☒ **A** of the matter-antimatter asymmetry.

☒ **B** the average density of the universe is uncertain.

☒ **C** the Big Bang is just a theory.

☒ **D** the nature of dark matter is unknown.

(Total for Question = 1 mark)

12 Two distant stars are observed through a telescope. Star A is observed to be half as bright as star B. Star A is calculated to be twice as far away as star B.

Which of the following is correct?

☒ **A** Star A has half the luminosity of star B.

☒ **B** Star A has the same luminosity as star B.

☒ **C** Star A has twice the luminosity of star B.

☒ **D** Star A has 8 times the luminosity of star B.

(Total for Question 1 mark)

13 The interior of a star has conditions that are ideal for sustainable fusion reactions. The general conditions for fusion require a very large

☒ **A** amount of hydrogen and temperature.

☒ **B** amount of hydrogen and pressure.

☒ **C** density and pressure.

☒ **D** density and temperature.

(Total for Question 1 mark)

14 Current theories give a number of alternatives for the future evolution of our universe. According to current theory, an open universe

☒ **A** eventually reaches a maximum size.

☒ **B** expands forever.

☒ **C** has an unpredictable future.

☒ **D** is a steady state universe.

(Total for Question 10 1 mark)

15 On a Hertzsprung-Russell diagram, the main sequence shows

☒ **A** only the most luminous stars.

☒ **B** only the most massive stars.

☒ **C** stars near the end of their lives.

☒ **D** stars principally fusing hydrogen.

(Total for Question = 1 mark)

16 The ultimate fate of the Universe is uncertain because

☒ **A** atmospheric absorption limits our observations.

☒ **B** our galaxy is not typical of other galaxies in the Universe.

☒ **C** the total average density of the Universe is uncertain.

☒ **D** we cannot observe very distant galaxies.

(Total for Question = 1 mark)

17 Scientists believe that our universe began with a big bang, and is presently expanding. The ultimate fate of the universe depends upon the total amount of matter in the universe. One possibility is a big crunch where the universe eventually contracts back into a point of infinite density. A universe with such a future would be described as being

☒ **A** closed.

☒ **B** critical.

☒ **C** flat.

☒ **D** open.

(Total for Question = 1 mark)

18 On a Hertzsprung-Russell diagram our Sun is located on the main sequence. Which of the following statements is correct?

☒ **A** All giant stars are larger and cooler than our Sun.

☒ **B** All giant stars are larger and hotter than our Sun.

☒ **C** All white dwarf stars are smaller and hotter than our Sun.

☒ **D** All white dwarf stars are hotter and brighter than our Sun.

(Total for Question = 1 mark)

19 In which of the following situations would a blue shift be observed?

☒ **A** Source and observer moving with the same velocity.

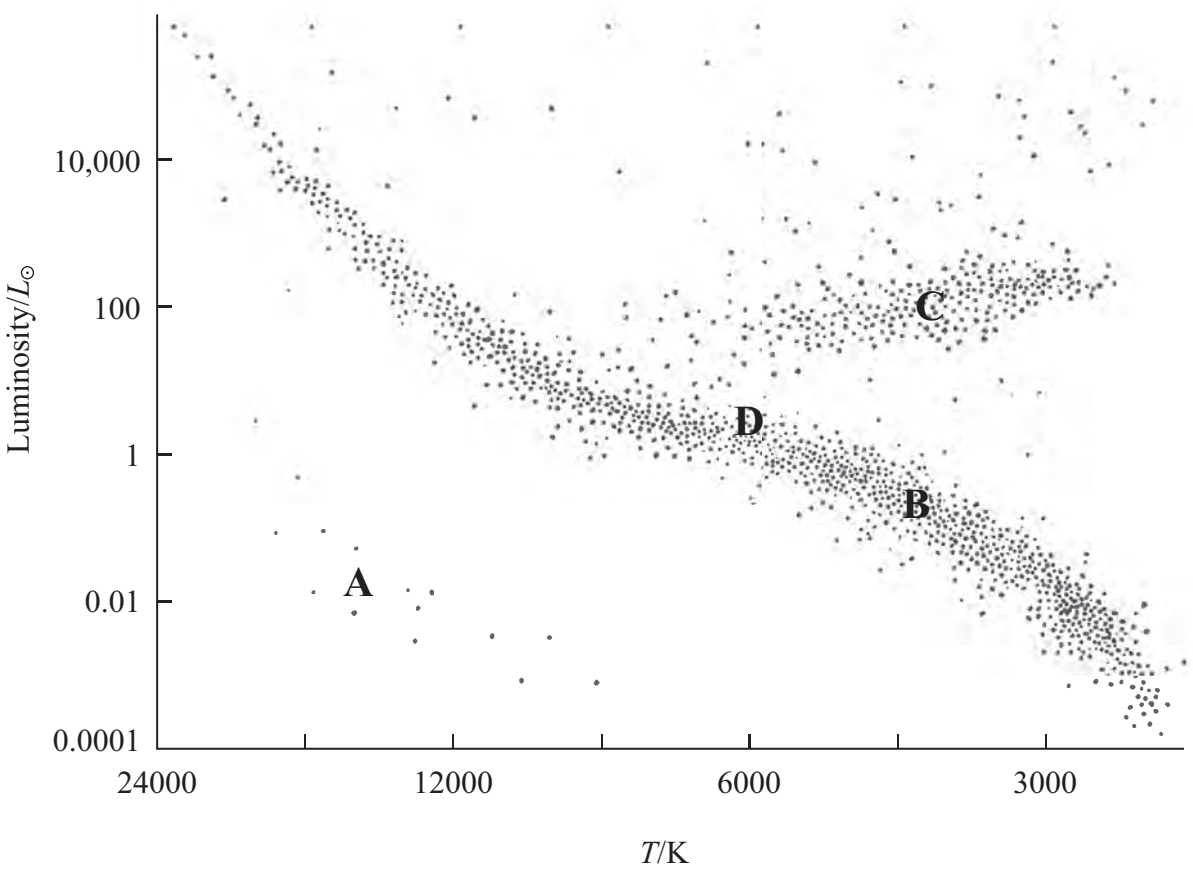
☒ **B** Source moving along a circular path around an observer.

☒ **C** Source moving away from a stationary observer.

☒ **D** Source moving towards a stationary observer.

(Total for Question = 1 mark)

Questions 20 and 21 refer to the Hertzsprung-Russell diagram below.



20 Which letter A, B, C or D represents the region on the diagram where a white dwarf star would be shown?

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 1 mark)

21 Which letter A, B, C or D represents the region on the diagram where our Sun would be shown?

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 1 mark)

22 When light from a distant star reaches us on Earth, its wavelength appears shifted towards the red end of the spectrum. This is because

☒ **A** the distance travelled by each successive wave has increased.

☒ **B** the frequency of the light emitted has decreased.

☒ **C** the speed of the star has increased.

☒ **D** the star is emitting longer wavelengths.

(Total for Question 1 mark)

23 A Hertzsprung-Russell diagram is plotted for an old star cluster. Compared with a young cluster containing a similar number of stars there will be fewer

☒ **A** light main sequence stars.

☒ **B** massive main sequence stars.

☒ **C** red giant stars.

☒ **D** white dwarf stars.

(Total for Question 1 mark)

24 Cosmologists describe the universe as being open, closed or flat.
A closed universe is one which

☒ **A** has always been the same size.

☒ **B** has a maximum size.

☒ **C** has an uncertain future.

☒ **D** will expand forever.

(Total for Question 1 mark)

25 Two stars with the same luminosity might produce different radiation fluxes at Earth. This is primarily due to the stars having different

☒ **A** diameters

☒ **B** distances from the Earth

☒ **C** motions through the Universe

☒ **D** surface temperatures

(Total for Question 1 mark)

26 Which of the following statements about the possible fate of the Universe is **not** correct?

☒ **A** If the Universe is open then it will continue to expand forever.

☒ **B** If the Universe is open then it will eventually reach a maximum size.

☒ **C** If the Universe is closed then it will eventually reach a maximum size.

☒ **D** If the Universe is closed then it will reach a maximum size and then contract.

(Total for Question 1 mark)

27 When light from the galaxy in Andromeda is analysed, it is found that the wavelengths are shorter than expected.
This tells us that the galaxy is

☒ **A** moving towards us.

☒ **B** moving away from us.

☒ **C** a very distant galaxy.

☒ **D** rotating on an axis.

(Total for Question = 1 mark)

28 A star is estimated to have approximately the same surface temperature as the Sun, but less than 1% of the Sun's luminosity.

The star is best classified as a

☒ **A** main sequence star.

☒ **B** red dwarf star.

☒ **C** red giant star.

☒ **D** white dwarf star.

(Total for Question = 1 mark)