1)

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.

2)

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.

3)

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.

4)

X and Y are identical stars. When viewed from Earth the flux from star X is 4 times the flux from star Y. Which of the following explanations is possible?

☒ **A** X is twice as far away as Y.

☒ **B** X is four times as far away as Y.

☒ **C** Y is twice as far away as X.

☒ **D** Y is four times as far away as X.

5)

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.

6)

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.

7)

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.

8)

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.

9)

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.

10)

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.

11)

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

12)

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.

13)

Dark energy appears to be increasing the rate at which the universe expands.

As a result it is more likely that the universe is

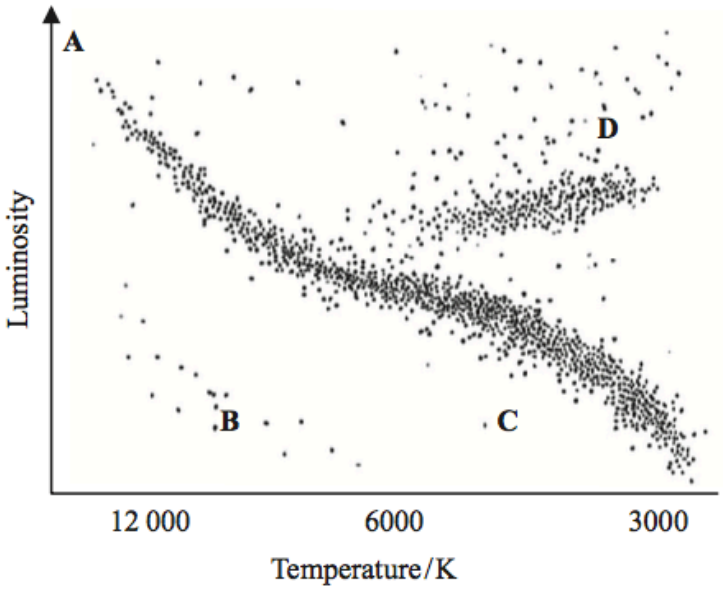
☒ **A** closed.

☒ **B** open.

☒ **C** infinite in size.

☒ **D** younger than we thought.

14)



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

☒ **A**

☒ **B**

☒ **C**

☒ **D**

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15)

Which letter, **A**, **B**, **C** or **D**, indicates the region where a main sequence star would be shown?

☒ **A**

☒ **B**

☒ **C**

☒ **D**

16)

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.

17)

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** $\frac{D}{4}$

18)

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

19)

Exoplanets are planets orbiting stars other than our own Sun. Most exoplanets discovered so far are giant planets similar to the planet Jupiter. The exoplanet Kepler-7b has a mass about 0.43 times the mass of Jupiter, and a radius about 1.6 times the radius of Jupiter.

Take the gravitational field strength at the surface of Kepler-7b to be g_K, and the gravitational field strength at the surface of Jupiter to be g_J.

The ratio $\frac{g_K}{g_J}$ is

☒ **A** 0.17

☒ **B** 0.27

☒ **C** 0.69

☒ **D** 1.1

20)

A number of conditions must be met if the fusion of hydrogen nuclei is to occur. Which condition, in a sample of hydrogen, is **not** necessary for nuclear fusion to occur?

☒ **A** very high density

☒ **B** very high mass

☒ **C** very high pressure

☒ **D** very high temperature

21)

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

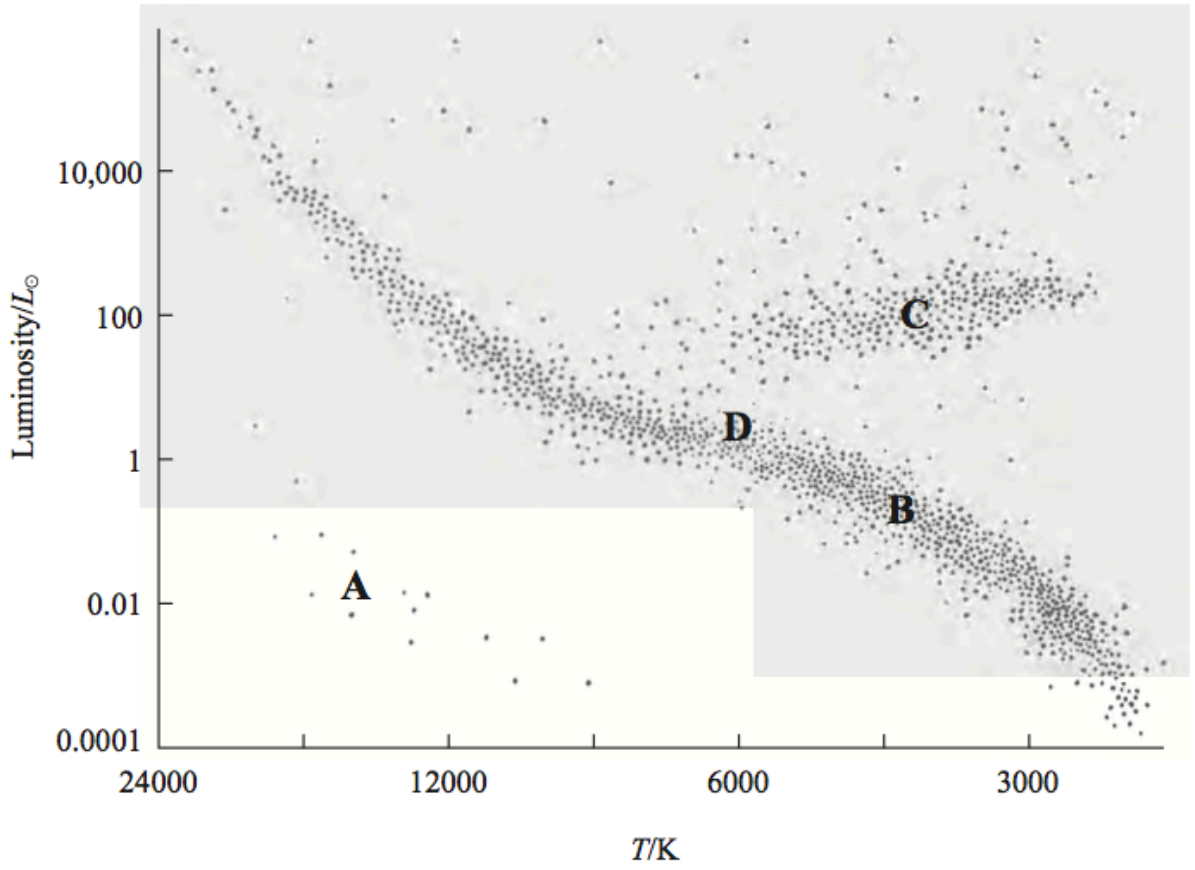
☒ **A**

☒ **B**

☒ **C**

☒ **D**

22)



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**

23)

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

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

24)

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.

25)

About 25% of the mass of our Universe is thought to consist of dark matter. A key property of dark matter is that it

☒ **A** absorbs all electromagnetic-radiation.

☒ **B** cannot be detected.

☒ **C** emits no detectable electromagnetic-radiation.

☒ **D** exerts no gravitational force.

26)

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.

27)

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