Answer Sheet

1. What is a red giant?

A. Gas and dust that did not reach a high enough temperature to initiate fusion

B. The end result of the explosion of a white dwarf

C. A small body mainly composed of ice and dust that orbits around a star

D. A normal star that has evolved into a very large, reddish star

Answer: A normal star that has evolved into a very large, reddish star

Explanation: A red giant is a normal star that has evolved past the main-sequence phase and has become a large, reddish star due to nuclear reactions that cause it to expand.

2. What is a planetary nebula?

A. Clouds of dust in the space between stars

B. The ejected envelope of a red giant star

C. A group of stars that are physically near each other in space

D. Galaxies close to one another and affecting one another gravitationally, behaving as one unit

Answer: B

Explanation: A planetary nebula is the ejected envelope of a red giant star.

3. What is the main consequence of nuclear fusion?

A. Radiation pressure increasing.

B. Gravitational contraction increasing.

C. Star getting cooler and dimmer.

D. Energy is being used up indefinitely.

Answer: Radiation pressure increasing.

Explanation: Nuclear fusion provides the energy that is needed to keep the star hot, so that the radiation pressure is high enough to oppose further gravitational contraction, and at the same time to provide the energy that the star is radiating into space.

4. What is a cepheid variable?

A. A type of black hole

B. A star of variable luminosity

C. A type of planetary nebula

D. A cluster of galaxies

Answer: A star of variable luminosity

Explanation: A cepheid variable is a star that pulsates in a regular pattern, causing its luminosity to vary. The period of this pulsation is related to the star’s absolute luminosity, allowing it to be used as a standard candle to measure distances in space.

5. What is a Cepheid variable?

A. A main-sequence star undergoing nuclear fusion

B. A star made entirely of neutrons

C. A star of variable luminosity

D. A very small star with low temperature

Answer: A star of variable luminosity

Explanation: A Cepheid variable is a star of variable luminosity. The luminosity increases sharply and falls off gently with a well-defined period. The period is related to the absolute luminosity of the star and so can be used to estimate the distance to the star.

6. What is a neutron star?

A. The end result of the explosion of a red supergiant

B. A star made entirely of neutrons

C. The ejected envelope of a red giant star

D. A normal star undergoing nuclear fusion

Answer: A star made entirely of neutrons

Explanation: A neutron star is the end result of the explosion of a red supergiant. It is a small, dense star consisting almost entirely of neutrons.

7. What is a white dwarf?

A. A small, dense star made up entirely of neutrons

B. The remnant of a white dwarf after it has cooled down

C. The ejected envelope of a red giant star

D. A normal star undergoing nuclear fusion

Answer: The remnant of a white dwarf after it has cooled down

Explanation: A white dwarf is the end result of the explosion of a red giant. It is a small, dense star (about the size of the Earth) in which no nuclear reactions take place. It is very hot but its small size gives it a very low luminosity.

8. What is a supernova (Type II)?

A. The explosion of a white dwarf due to accretion

B. The fusion of hydrogen into helium in a main-sequence star

C. The explosion of a red supergiant star

D. The collision of two stars

Answer: The explosion of a red supergiant star

Explanation: A supernova (Type II) is the explosion of a red supergiant star. The amount of energy emitted in a supernova explosion can be staggering, comparable to the total energy radiated by our Sun in its entire lifetime.

9. What is a main-sequence star?

A. The ejected envelope of a red giant star

B. A type of star that is undergoing nuclear fusion of hydrogen into helium

C. A very small star (a few tens of kilometers in diameter) and very dense, consisting almost entirely of neutrons

D. A small body mainly composed of ice and dust that orbits around a star

Answer: A type of star that is undergoing nuclear fusion of hydrogen into helium

Explanation: A main-sequence star is a normal star that is undergoing nuclear fusion of hydrogen into helium in its core. This is the phase in which our Sun is currently in.

10. What is a brown dwarf?

A. A star that has run out of fuel

B. A star that is undergoing nuclear fusion of hydrogen into helium

C. Gas and dust that did not reach a high enough temperature to initiate fusion

D. A very small star with low temperature

Answer: C

Explanation: A brown dwarf is gas and dust that did not reach a high enough temperature to initiate fusion. These objects continue to compact and cool down.

11. What is the unit of apparent brightness?

A. Watts per metre squared.

B. Joules per metre squared.

C. Kelvin per metre squared.

D. Candela per metre squared.

Answer: Watts per metre squared.

Explanation: The unit of apparent brightness is W m^{-2}.

12. What is a main-sequence star?

A. A star that has run out of fuel

B. A star that is undergoing nuclear fusion of hydrogen into helium

C. A star that is about to explode

D. A star that is very small and has low temperature

Answer: B

Explanation: A main-sequence star is a normal star that is undergoing nuclear fusion of hydrogen into helium.

13. What is a brown dwarf?

A. A small, dense star made up entirely of neutrons

B. A cloud of dust and gas between stars

C. A star that has exhausted all of its nuclear fuel

D. Gas and dust that did not reach a high enough temperature to initiate fusion

Answer: Gas and dust that did not reach a high enough temperature to initiate fusion

Explanation: A brown dwarf is gas and dust that did not reach a high enough temperature to initiate fusion. These objects continue to compact and cool down.

14. What is a galaxy?

A. A collection of planets

B. A collection of stars

C. A collection of asteroids

D. A collection of comets

Answer: B

Explanation: A galaxy is a collection of a very large number of stars mutually attracting one another through the gravitational force and staying together.

15. Which of the following is not a type of nebula?

A. Planetary Nebula

B. Stellar Nebula

C. Reflection Nebula

D. Irregular Nebula

Answer: Stellar Nebula

Explanation: Stellar nebula is not a type of nebula. The three main types of nebula are emission nebula, reflection nebula, and planetary nebula.

16. What is a supernova (Type Ia)?

A. The explosion of a white dwarf that has accreted mass from a companion star exceeding its stability limit.

B. The explosion of a red supergiant star.

C. The end result of the explosion of a red giant.

D. A small, dense star in which no nuclear reactions take place.

Answer: The explosion of a white dwarf that has accreted mass from a companion star exceeding its stability limit.

Explanation: A Type Ia supernova is the explosion of a white dwarf that has accreted mass from a companion star exceeding its stability limit.

17. Which of the following is the correct description of a star?

A. A celestial object that emits light through nuclear fusion reactions in its core

B. A planet-like object that orbits around a star

C. A type of planet that emits its own light

D. A cloud of interstellar gas and dust

Answer: A celestial object that emits light through nuclear fusion reactions in its core

Explanation: A star is a massive, luminous ball of gas, primarily hydrogen and helium, that emits energy through nuclear fusion reactions in its core.

18. What is a neutron star?

A. The ejected envelope of a red giant star

B. The end result of the explosion of a white dwarf

C. A star consisting almost entirely of neutrons. The neutrons form a superfluid around a core of immense pressure and density.

D. A very large, reddish star

Answer: C

Explanation: A neutron star is a star consisting almost entirely of neutrons. The neutrons form a superfluid around a core of immense pressure and density.

19. What is a cluster of galaxies?

A. A collection of a very large number of stars that mutually attract one another through the gravitational force and stay together

B. Galaxies close to one another and affecting one another gravitationally, behaving as one unit

C. A group of stars that are physically near each other in space, created by the collapse of a single gas cloud

D. Clouds of ‘dust’, i.e. compounds of carbon, oxygen, silicon and metals, as well as molecular hydrogen, in the space in between stars

Answer: B

Explanation: A cluster of galaxies are galaxies close to one another and affecting one another gravitationally, behaving as one unit.

20. What is a main-sequence star?

A. A small star with low temperature, reddish in colour.

B. A star that is undergoing nuclear fusion.

C. Gas and dust that did not reach a high enough temperature to initiate fusion.

D. A normal star that is undergoing nuclear fusion of hydrogen into helium.

Answer: A normal star that is undergoing nuclear fusion of hydrogen into helium.

Explanation: A main-sequence star is a normal star that is undergoing nuclear fusion of hydrogen into helium.

21. What is a cepheid variable?

A. A type of nebula

B. A type of comet

C. A star with variable luminosity that varies in brightness in a well-defined pattern

D. A type of cluster of galaxies

Answer: A star with variable luminosity that varies in brightness in a well-defined pattern

Explanation: Cepheid variables are stars that pulsate in a regular pattern, with a well-defined period. This period is related to the absolute luminosity of the star, which can be used to estimate the distance to the star via parallax.

22. Which statement best justifies the existence of dark matter?

A. It is a singularity in space time.

B. It is composed of gases (mainly hydrogen and helium) and dust grains (silicates, carbon and iron) filling the space between stars.

C. Its existence is inferred from techniques other than direct visual observation.

D. It is a collection of a very large number of stars mutually attracting one another through the gravitational force.

Answer: Its existence is inferred from techniques other than direct visual observation.

Explanation: Dark matter is the name given to matter in galaxies and clusters of galaxies that is too cold to radiate. Its existence is inferred from techniques other than direct visual observation.

23. Which of the following objects is made up mainly of ice and dust?

A. Galaxy

B. Black hole

C. Nebula

D. Comet

Answer: Comet

Explanation: A comet is a small body (mainly ice and dust) orbiting the sun in an elliptical orbit.

24. What is a planetary nebula?

A. The end result of the explosion of a red giant.

B. The ejected envelope of a red giant star.

C. A star of variable luminosity.

D. The explosion of a white dwarf that has accreted mass from a companion star exceeding its stability limit.

Answer: The ejected envelope of a red giant star.

Explanation: A planetary nebula is the ejected envelope of a red giant star.

25. What is a comet?

A. A small planet-like object that orbits around a star

B. A cloud of interstellar gas and dust

C. A massive ball of gas and dust held together by its own gravity

D. A small body mainly composed of ice and dust that orbits around a star

Answer: A small body mainly composed of ice and dust that orbits around a star

Explanation: Comets are small bodies mainly composed of ice and dust that orbit around the Sun in an elliptical orbit.

26. What is a black hole?

A. A type of galaxy in which most of the stars are very old and have mostly red colours.

B. A singularity in space-time that is the end result of the evolution of a very massive star.

C. A star that has exhausted its fuel and is in the process of burning helium.

D. A star that has exploded as a supernova.

Answer: A singularity in space-time that is the end result of the evolution of a very massive star.

Explanation: A black hole is a region of space-time where gravity is so strong that nothing, not even light, can escape its pull. They are formed from the collapse of very massive stars.

27. Which statement best defines a binary star?

A. A star consisting almost entirely of neutrons.

B. Two stars orbiting a common centre.

C. A remnant of a white dwarf after it has cooled down.

D. A singularity in spacetime.

Answer: Two stars orbiting a common centre.

Explanation: Binary stars are two stars orbiting a common centre.

28. What is a cluster of galaxies?

A. Galaxies close to one another and affecting one another gravitationally, behaving as one unit.

B. Clouds of ‘dust’, i.e. compounds of carbon, oxygen, silicon and metals, as well as molecular hydrogen, in the space in between stars.

C. A normal star that is undergoing nuclear fusion of hydrogen into helium.

D. The ejected envelope of a red giant star.

Answer: Galaxies close to one another and affecting one another gravitationally, behaving as one unit.

Explanation: A cluster of galaxies is a group of galaxies that are physically near each other in space, created by the collapse of a single gas cloud.

29. What is dark matter?

A. Matter in galaxies and clusters of galaxies that is too cold to radiate

B. Gases and dust filling the space between stars

C. A star that is undergoing nuclear fusion of hydrogen into helium

D. A singularity in space time

Answer: A

Explanation: Dark matter is generic name for matter in galaxies and clusters of galaxies that is too cold to radiate. Its existence is inferred from techniques other than direct visual observation.

30. What is the purpose of nuclear fusion in a star?

A. To keep the star hot and radiation pressure high enough to oppose further gravitational contraction while providing energy that the star radiates into space

B. To cause the star to explode as a supernova

C. To create a planetary nebula

D. To create a neutron star

Answer: A

Explanation: Nuclear fusion provides the energy that is needed to keep the star hot, so that the radiation pressure is high enough to oppose further gravitational contraction, and at the same time to provide the energy that the star is radiating into space.