SSC Board: Std 7: Ch 19: Life Cycle of Stars – Q Bank - Answers

Exercises

1. Search and you will find.

a. Our galaxy is called Milky Way or Mandakini .
b. For measuring large distances light year is used as a unit.
c. The speed of light is 3,00,000 km/s.
d. There are about 10^{11} stars in our galaxy.
e. The end stage of the Sun will be white dwarf
f. Stars are born out of interstellar clouds.
g. Milky way is a spiral galaxy.
h. Stars are spheres of hot gas.
i. The masses of other stars are measured relative to the mass of the Sun.
j. Light takes 8 minutes to reach us from the Sun while it takes 1 sec to reach us from the moon.
k. The larger the mass of a star the faster is its rate of evolution.
l. The number of fuels used in the life of a star depends on its mass.

2. Who is telling lies?

a. Light year is used to measure time. False
b. End stage of a star depends on its initial mass. True
c. A star ends its life as a neutron star when the pressure of its electrons balances its gravity. False
d. Only light can emit from the blank hole. False
e. The Sun will pass through the super giant stage during its evolution. True
f. The Sun will end its life as a white dwarf. True

3. Answer the following question.

a. How do stars form?
Due to some disturbance, the interstellar clouds start contracting. Because of the contraction, their density starts increasing and their temperature also starts to increase and a dense sphere of hot gas is formed from the cloud. Once the temperature and density at the centre of the sphere increase sufficiently, nuclear energy (energy generated through fusion of atomic nuclei) generation starts there. Because of this energy generation, the gas sphere becomes self luminous and a star is formed or we can say that a star is born.

b. Why do stars evolve?
As stars are continuously emitting energy, their energy is constantly decreasing. For their stability to remain intact energy must be generated inside the star. This generation of energy occurs because of burning of fuel at the centre of the star. The burning of and therefore, the decrease in the amount of fuel in their centre is the reason why stars evolve.

c. What are the three end stages of stars?
The three end stages of stars are White dwarf star, Neutron star and Black hole.

d. Why was the name black hole given?
All nearby objects get attracted towards these stars and nothing can come out of them, not even light. Also, any light falling on these stars does not get reflected and gets absorbed inside the star. Thus, we cannot see the star at all but can probably see a minute black hole at its place. This end stage of the star is therefore, called a black hole.

e. Which types of stars end their life as a neutron star?
Stars having mass between 8 and 25 time the mass of the Sun ($8\ M_{Sun} < M_{Star} < 25\ M_{Sun}$) end their life as a neutron star.

4. A. If you are the Sun, write about your properties in your own words.

Hi, I am the Sun.
All planets in my solar system revolve around me, including the planet Earth in which you live.

I am 4.5 x 109 years old.
My mass is 2 x 10^{30} kg of which Hydrogen makes up for 72%, helium is 26% and the rest 2% is made up of elements heavier than helium.
My radius is 695700 km.
My surface temperature is 5800 K while the temperature at the centre is 1.5 x 107 K.

B. Describe white dwarfs.
At the end of its evolution, the stars explode and their outer gas envelope is thrown out. The inner part contracts and its size becomes similar to the size of the earth. As the mass of the star is much higher, the density in the star becomes very high. The pressure becomes independent of temperature and is able to balance the gravitational force for ever. In this state, the star looks white and due to its small size it is called a white dwarf.

5. Answer the following:
1. What is a galaxy?
A galaxy is a collection of billions of stars, their planetary systems and interstellar clouds which are present in the empty spaces between stars.

2. What are the different constituents of our solar system?
Our solar system consists of the Sun, the planets Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and dwarf planet Pluto. It includes: the satellites of the planets; numerous comets, asteroids, and meteoroids; and other gases and dust particles.

3. What are the major differences between a star and a planet?

Stars	Planets
Stars have their own light.	Planets do not have their own light.
Stars do not revolve around any other heavenly body.	Planets revolve around a star
Their temperatures are very high.	Their temperatures are much lower.
Stars twinkle.	Planets do not twinkle.
Stars do not have satellites revolving around them.	Most planets have one or more satellites revolving around them.
They are very big.	They are small compared to the stars.

4. What is a satellite?
A satellite is a heaven body or a machine that orbits around another object. There are two kinds of satellites, natural and man-made. The moon is the natural satellite of the Earth. And International Space Station(ISS) is the man-made or artificial satellite orbiting the Earth.

5. Which is the star nearest to us?
The Sun is the star nearest to the Earth.
6. If we look at the sky at night we see only planets and stars, then how did we get information about the other components of the universe?
Several telescopes are placed on the surface of the earth, while some others are kept aboard manmade satellites which are orbiting the earth in fixed orbits. As these telescopes are situated above the earth's atmosphere they can observe astronomical objects more effectively. Astronomers study the observations made by all these telescopes to obtain detailed information about the universe.

7. What is meant by balanced and unbalanced forces?
When the gravitational force and gas pressure are balanced it is called a balance force and the star is stable. But when one of them is more than the other, it is called an unbalanced force and the star either contracts or expands.

8. Why doesn't the hot gas in the stars disperse in space?
This is because the gravitational force between the gas particles of the star keeps these particles together.

9. Why have the properties of the Sun remained unchanged over the last 4.5 billion years?

This is because the gravitational force between the gas particles of the star keeps these particles together.

10. How does the evolution finally stop? Or What is the end stage of a star?
When the energy generation in the star stops, the temperature decreases causing the gas pressure to decrease. The star contracts and its density increases. When the density becomes very high, some new types of pressures are generated which do not depend on the temperature of the gas. In such case, the gas pressure remains constant even after the energy generation stops completely and the temperature of the gas goes on decreasing. The stability of the star can remain intact for ever and this can be considered as the end stage of a star.

Extra Questions:

Fill in the blanks:

1. The universe is made up of innumerable galaxies.
2. Galaxies differ in structure and shape.
3. We can divide galaxies into three types, spiral, elliptical and irregular galaxies.
4. Our galaxy is a spiral galaxy and is called the Milky Way and Mandakini.
5. There are billions of stars which have higher or lower mass size and temperature than those of the Sun.
6. Astronomers study the observations made by all these telescopes to obtain detailed information about the universe.
7. Hydrogen makes up for 72% of the mass of the Sun while helium is 26% and the rest 2% is made up of elements heavier than helium.
8. Our galaxy has about 10^{11} stars.
9. The shape of our galaxy is like a disc with a bulge in the centre and its diameter is about 10^{18} km.
10. The solar system is situated at a distance of 2×10^{17} km from its centre.
11. The galaxy is rotating around an axis passing through its centre and perpendicular to the disc.
12. The period of rotation of our galaxy is about 2×10^{8} yrs.
13. The mass of the Sun is about 3.3 lakh times that of the earth and its radius is 100 times that of the earth.
14. The mass of the Sun is written as M_{Sun} is used as the unit of mass.
15. The properties of the Sun have remained unchanged over its lifetime i.e. the past 4.5 billion years.
16. According to the studies made by astronomers, the properties of the Sun will slowly change in further after 4.5 billion years.
17. Huge clouds of gas and dust present in the empty spaces between stars in a galaxy are called interstellar clouds.
18. Scientists use the unit of light year for measuring large distances.
19. A light year is the distance travelled by light in one year.
20. As the speed of light is 3,00,000 km/s, the light year is equal to 9.5×10^{12} km.
21. Because of the contraction, the density of the cloud starts increasing and their temperature also starts to increase
22. Once the temperature and density at the centre of the sphere increase sufficiently, nuclear energy generation starts there.
23. Because of the nuclear energy generation, the gas sphere becomes self luminous and a star is formed or we can say that a star is born.
24. In the Sun, this energy is generated by the fusion of hydrogen nuclei to form helium nuclei.
25. Light takes about 1 s to reach us from the moon while it takes 8 minutes to reach us from the Sun.
26. Alpha Centauri is the star closest to the Sun.
27. It takes 4.2 years to reach us from the star alpha Centauri which is the star closest to the Sun.
28. When a gas sphere contracts, its temperature increases.
29. More than one star can be produced by the contraction of a huge interstellar cloud.
30. The gravitatinal force is acting inwards, towards the centre of the star while the gas pressure is acting outwards, i.e. away from the centre of the star
31. Gas pressure depends on the density and temperature of the gas.
32. Higher the temperature and density, higher is the pressure.
33. Evolution of a star means change in its properties with time resulting in its passing through different stages.
34. As stars are continuously emitting energy, their energy is constantly decreasing.

35. For the stability of the stars to remain intact i.e. for maintaining a balance between the gas pressure and the gravitational force, it is necessary that the temperature remains constant.
36. For the temperature to remain constant, energy must be generated inside the star.
37. The generation of energy in the stars occurs because of burning of fuel at the centre of the star.
38. The reason for the evolution of stars is the burning of and therefore, the decrease in the amount of fuel in their centre.
39. When the fuel in the centre of the stars finishes, the energy generation stops.
40. When the energy generation in the stars stops, the temperature of the star starts decreasing.
41. Due to the decrease in temperature of the stars, the gas pressure decreases and the balance between gas pressure and gravitational force cannot be maintained.
42. When the gravitational force is higher than the gas pressure, the star starts contracting.
43. When hydrogen at the centre is finished, helium starts undergoing fusion and energy generation starts again.
44. How mach fuel will be used depends on the mass of the star.
45. Higher the mass of the star higher is the number of fuels used. 46. As a number of processes occur inside the star, it sometimes contracts and sometimes expands at other times.
47. When all possible fuels are exhausted, the energy generation finally stops and the temperature of the star starts decreasing.
48. The higher the mass of the star faster is its rate of evolution.
49. The different stages during the evolution of the star also depends on its mass.
50. Stars having initial mass less than 8 times the mass of the Sun undergo huge expansion and their radius increases by a factor of 100 to 200. In this stage they are called red giant stars.
51. White dwarf is the end stage of stars having initial mass less than 8 times the mass of the Sun.
52. Neutron star is the end stage of the stars having mass between 8 and 25 time the mass of the Sun.
53. The supernova explosion was first seen in 1054 A.D.
54. As the size of the white dwarfs is similar to that of the earth, their density is very large.
55. A star in our galaxy exploded about 7500 years back.
56. The end stage of the star having mass larger than 25 times the mass of the Sun is called a black hole.

Answer the following.

1. Why is Sun called an ordinary star?
The reason to call Sun an ordinary star is that even though it appears to be larger than all others stars in the sky because of its being nearest to us.

2. Describe our galaxy.
Our galaxy is a spiral galaxy and is called the Milky Way and Mandakini. It has about 10^{11} stars. Its shape is like a disc with a bulge in the centre and its diameter is about 10^{18} km. The solar system is situated at a distance of 2×10^{17} km from its centre. The galaxy is rotating around an axis passing through its centre and perpendicular to the disc. Its period of rotation is about 2×10^{8} yrs.

3. What has led scientists to conclude that the properties of the Sun have remained unchanged over its lifetime?
If the properties of the Sun had changed in its life time, it would have caused changes in the properties of the earth and in the life on the earth. Detailed studies of the properties of the earth have led scientists to conclude that the properties of the Sun have remained unchanged over its lifetime i.e. the past 4.5 billion years.

4. After how many years will the properties of the sun start changing?
According to the studies made by astronomers, these properties will slowly change in further after 4.5 billion years.

5. What are interstellar clouds?
Huge clouds of gas and dust are present in the empty spaces between stars in a galaxy. These are called interstellar clouds.

6. What is a light year?
A light year is the distance travelled by light in one year. And is equal to 9.5×10^{12} km.

7. How to scientist measure large distances.
Scientists use the unit of light year for measuring large distances.

8. What is the speed of light?
As the speed of light is 3,00,000 km/s, the light year is equal to 9.5×10^{12} km.

9. How is energy generated in the sun?
In the Sun, energy is generated by the fusion of hydrogen nuclei to form helium nuclei. This means that the hydrogen at the centre of the star acts as a fuel and energy is generated by the burning of this fuel.

10. Which is the star closest to the Sun?
Alpha Centauri is the star closest to the Sun.

11. When does the star remain stable?
When the gravitational force and the gas pressure are balanced, then the star remains stable.

12. What will happen if there was no gas pressure in the Sun?
If there was no gas pressure in the Sun, it will collapse to a point in 1-2 hours.

13. On what does gas pressure of a star depend on?
Gas pressure depends on the density and temperature of the gas. Higher the temperature and density, higher is the pressure.

14. What is meant by evolution of a star?
Evolution of a star means change in its properties with time resulting in its passing through different stages.

15. Why is the energy in the star constantly decreasing?
As stars are continuously emitting energy, their energy is constantly decreasing.

16. When does the energy generation in the star stops.
When the fuel in the centre finishes, the energy generation stops.

17. On what does the evolution of stars depend on?
The evolution of stars depends on its initial mass.

18. What are red giant stars?
Stars undergo huge expansion and their radius increases by a factor of 100 to 200. In this stage they are called red giant stars.

19. Why is the star called a red giant star?
This name is given because of the large size and because of the fact that the stars look reddish due to their lower temperature.

20. How are neutron stars formed?
The central portion which is left behind after the explosion, contracts and its size becomes as small as about 10 km. In this state, the stars are completely made up of neutrons and are called neutron stars.

21. Write down the three paths in the life cycle of stars and their end stages.

Initial mass of the star

< 8 M_{Sun}	between 8 to 25 M_{Sun}	> 8 M_{Sun}
Interstellar Cloud	Interstellar Cloud	Interstellar Cloud
⇩	⇩	⇩
Low mass star	High mass star	High mass star
⇩	⇩	⇩
Red Giant Star	Super Giant Star	Super Giant Star
⇩	⇩	⇩
Explosion	Supernova Explosion	Supernova Explosion
⇩	⇩	⇩
White Dwarf	Neutron	Black Hole