1. Tick the correct answer

a. What is the main constituent of nebula?
Hydrogen (iv)

b. What is the powerful explosion that occurs during death of a star called?
Supernova (ii)

c. Which of the following time periods is equal to 1 day of Brahma?
4.32 billion human years (ii)

d. Which of the following is equal to 1 Mahakalpa?
Life span of the universe (i)

e. Which of the following is the unit of distance?
Light year (iv) ✓

2. Answer these questions in brief

a. What is universe?
The universe is the vast space that contains everything—stars, planets, galaxies, matter, energy, and all forms of radiation.

Define a planet.
A planet is a heavenly body that revolves around a star (like the Sun), has its own gravity, is spherical in shape, and does not produce light of its own.

Name any two units that are used to measure distance between heavenly bodies.

Light year and Astronomical unit (AU) are two units used to measure between heavenly bodies.

Define nebula.
A nebula is a large cloud of gas and dust in space, often the birthplace of new stars.

What is meant by one light year?
One light year is the distance that light travels in one year, which is about **9.46 trillion kilometers**.

What is meant by black hole?
A black hole is a region in space with extremely strong gravity from which nothing, not even light, can escape.

3. Answer these questions

a. Elaborate some scientific facts about the universe.
The universe is believed to have originated about 13.8 billion years ago with the Big Bang. It is still expanding continuously, as discovered by Edwin Hubble. The universe is immensely vast and contains billions of galaxies, each with billions of stars, planets, and other celestial bodies. Stars shine because of nuclear fusion reactions occurring in their cores, where hydrogen is converted into helium releasing enormous energy. The universe is composed not only of normal matter but also of dark matter and dark energy, which together account for most of its mass and energy. Galaxies are not scattered randomly but are arranged in clusters and superclusters, showing the large-scale structure of the universe.

b. Explain the life cycle of a star with clean diagrams.
A star is born inside a nebula, which is a huge cloud of gas and dust. Due to gravitational force, the cloud contracts and forms a hot dense body called a protostar. When the core temperature becomes high enough, nuclear fusion begins, marking the beginning of the main sequence stage where the star shines steadily for most of its life. When hydrogen in the core is exhausted, the star expands and cools into a red giant (for medium stars) or a red supergiant (for massive stars). Medium stars shed their outer layers forming a planetary nebula, and the remaining core becomes a white dwarf, which eventually cools into a black dwarf. Massive stars, on the other hand, explode as a supernova, and the remaining core may form a neutron star or collapse further to form a black hole.

c. What would happen if all the fuel available on the Sun gets exhausted eventually?
When the hydrogen fuel of the Sun is exhausted, the nuclear fusion reactions in its core will stop. As a result, the core will contract due to gravity while the outer layers will expand, and the Sun will transform into a red giant. It may engulf nearby planets including Mercury and Venus, and possibly Earth. After this stage, the Sun will shed its outer layers as a planetary nebula and the remaining core will shrink into a white dwarf. Over billions of years, this white dwarf will gradually cool and fade into a black dwarf.

d. How do the matter and energy return to the universe? Elaborate on the basis of the principle of conservation of energy.
According to the principle of conservation of energy, energy can neither be created nor destroyed; it can only change from one form to another. When stars explode as supernovae or shed their outer layers, the matter is released into space and forms nebulae. These nebulae again become the birthplaces of new stars and planetary systems. Similarly, the energy released in the form of light, heat, and radiation is spread throughout the universe but is never lost.

Thus, both matter and energy are recycled within the universe, ensuring the continuity of cosmic processes.

4. Write down differences between

Nova	Supernova
A nova is a sudden temporary increase in brightness of a star caused by nuclear reactions on its surface.	A supernova is a powerful explosion of a massive star at the end of its life cycle.
The star survives after the nova event.	The star is either destroyed or left as a neutron star or black hole.

Protostar	Star
A protostar is an early stage of star formation formed from contracting clouds of gas and dust.	A star is a fully developed celestial body where nuclear fusion takes place in the core.
No nuclear fusion reactions occur in a protostar.	Nuclear fusion produces light and heat in a star.

Red Giant	Red Supergiant
A red giant is formed from a medium-sized star like the Sun after hydrogen in its core is exhausted.	A red supergiant is formed from a very massive star in the later stage of its life.
It is smaller and less luminous compared to a red supergiant.	It is much larger, more luminous, and ends its life in a supernova explosion.

5. Give reasons

a. We cannot see or observe the black hole.
A black hole has extremely strong gravitational force from which nothing can escape, not even light. Since it does not emit or reflect light, it cannot be observed directly. Its presence is known only through its effect on nearby matter and radiation.

b. All stars are not of the same colour.
Stars have different surface temperatures, which determine their colour. Very hot stars appear blue or white, moderately hot stars like the Sun appear yellow, and cooler stars appear red. Therefore, the difference in temperature makes stars appear in different colours.

c. Nebula is also known as stellar nursery.

A nebula is a vast cloud of gas and dust in space where new stars are born. Under the influence of gravity, parts of the nebula contract to form protostars, which later develop into stars. Since nebulae are the birthplaces of stars, they are called stellar nurseries.