

Chapter 12

INVESTIGATING THE SPACE

REVIEW EXERCISES

Q.1 Fill in the blanks with appropriate words given below

hydrogen, spiral, higher, matter, stars, elliptical, dust, light, origin, helium, gas

- i) The scientific theory that describes the origin of the universe is called the Big Bang.
- ii) Stars are huge balls of gas mainly consist of helium and hydrogen.
- iii) Blue stars have higher temperature than orange and red stars.
- iv) A galaxy is a vast collection of gas and dust.
- v) A lenticular galaxy is an intermediate form of spiral and elliptical galaxies.
- vi) Black hole is a region of space where matter has collapsed on itself.
- vii) A telescope is an instrument that gathers light from distant source.

Q.2 Circle T for True and F for False state. Provide a correct statement for the False statement.

- i) The universe is 10 billion years old. (F)
- ii) CMB stands for Cosmic Matter Blue radiations. (T)
- iii) NASA launched COEB satellite in 1992. (T)
- iv) The Sun has temperature of around 6000 degree Celsius. (T)
- v) The named "Arcturus" is a hot blue star. (F)
- vi) Earth galaxy is called "Milky Way". (T)
- vii) Einstein proposed a way to classify galaxies. (F)

viii) The Sun is about 15000 light years away from the center of our galaxy. (T)

ix) The final stage of a Sun-like star is a black hole. (T)

x) Constellations provide only a visual reference for the objects in the sky. (T)

Q.3 Write down the short answers to the following questions.

i) **What type of a star ends its life cycle as a black hole?**

Ans: Black holes are formed when a heavyweight star, about 10 times heavier than the Sun, ends its life in a supernova explosion. What is left of the star collapses into an area only a few kilometres across. A supernova is an exploding star that blasts parts of the star into space.

ii) **What is a light year?**

Ans: Light year is a unit of distance and not the time. If one travels in a direction with the speed of light for one year (365 days), then the distance covered will be equal to one light year.

iii) **Define the term "constellation".**

Ans: Constellations:

A constellation is a group of stars in the sky that, when viewed from earth, create an outline of some recognizable shape or pattern. Modern constellations are mostly named after mythological themes such as gods, legendary heroes, creatures or structures. Although most constellations resemble the figures after which they are named, others are not as recognizable.

The constellations encompass the entire sky and only provide a visual reference for objects in the sky. There are a total of 88 constellations in the sky which are internationally recognized. Table below lists some

well-known constellations.

iv) ***On what factors does the brightness of a star depend?***

Ans: Brightness of Stars:

Stars vary in their brightness levels as seen from Earth. A hot star gives off more energy than a cooler star. Does this then mean that a hot star is going to appear brighter than a cooler one in the sky? The answer to this depends on a few factors. These include:

The Size of Star:

If two stars having the same temperature but differ in size then the larger star gives off more light than the smaller star; and will appear brighter in the sky.

The Distance to the Star:

All the stars we see in the night sky are at vast distances but some are much closer as compared to others. For two stars of the same size and temperature, the closer one will appear brighter than the star which is at most distance. An analogy is a row of street lights; the closer ones appear much brighter than those at some distance.

v) ***What are Cosmic Microwave Background radiations?***

Ans: Cosmic Microwave Background (CMB):

CMB is said to be:

"the cooled leftover energy from the hot, early universe that travels freely throughout the universe and still fills space in every direction."

Scientists consider it as an echo of the Big Bang. Over the time, this light has cooled and weakened considerably; nowadays, we detect it as the microwaves.

Q.4 Write down the detailed answer of the following questions.

i) Explain the Big Bang Theory about the origin of the universe.

Ans: The Big Bang Theory:

The scientific theory that describes the origin of the universe is called Big Bang Theory. According to this theory:

"The universe began to exist as a single point, unimaginably hotter and denser than anything, and it has been expanding ever since."

Time, space and matter all began with the Big Bang. In a fraction of a second, the universe grew from smaller than a single atom of bigger than a galaxy. It is still expanding today. Due to the expansion of the universe, the conditions in the universe have changed from small to big, from hot to cold and from young to old resulting in the universe we observe today.

ii) Explain the stages of life-cycle of a low mass star.

Ans: How long a star will live and how it will die, depends upon its mass at the time of its birth. Low mass stars have different endings than the violent and explosive ending of high mass stars. Sun is an average type of low mass star among billions of other stars in our galaxy.

iii) Describe the types of galaxies.

Ans: Types of galaxies:

In the 1920s the pioneering astronomer Edwin Hubble, who devoted his life to studying galaxies, proposed a way to classify galaxies based on their shapes. The sequence is known as the Hubb' sequence.

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"According to this sequence galaxies are generally grouped by their appearance into spiral, elliptical, lenticular and irregular."

Galaxies are also often categorized by the characteristics they possess other than their appearance. For example, there are starburst galaxies, merging galaxies, active galaxies, radio galaxies and many more.

Spiral Galaxy:

A spiral galaxy appears to have spiral-shaped structures or arms that contain bright young bluish stars. Spiral galaxies also have oval-shaped bulges at their centers which are filled with stars. There is also a thin disk of spinning gas surrounding the bulge; and a thinly populated halo that encloses both the disk and the bulge.

Elliptical Galaxy:

An elliptical galaxy appears to be an oval shaped from our point of view as seen from the telescope. Astronomers have found that elliptical galaxies can have length, width and height that are all different from one another. Elliptical galaxies can be shaped like gigantic basketballs, ostrich eggs or anything like that. Due to their yellowish appearance, elliptical galaxies mostly contain old stars.

Irregular Galaxy:

An irregular galaxy does not fit well into the standard categories of elliptical or spiral galaxies. Two examples of irregular galaxies are the Large Magellanic Cloud and Small Magellanic Cloud, which are visible from Earth's southern hemisphere.

Lenticular Galaxy:

A lenticular galaxy is a lens-shaped galaxy that

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has components of both elliptical and spirals galaxies. It can be viewed as either an elliptical galaxy with a disk surrounding its outer edge, or as a spiral galaxy with a very large bulge and almost no spiral arm structure.

iv) *How do we measure distances to nearby stars?*

Ans: The determination of distances to stars is important in understanding their physical nature. Astronomers have developed a variety of clever techniques for measuring the vast distance to stars, one is called Parallax.

This effect can be used to measure the distance to nearby stars. As Earth orbits the Sun, a nearby star will appear to move against the more distant background stars,

Since this universe is so big, distances are no longer measured in meters or kilometers. Such distances to nearby stars measured in 'light year' unit. The brightest star visible in the sky without a telescope is Sirius which has a distance of little more than 8 light years. It is interesting to note that light reaches us from the Sun is about 8 minutes and from Sirius in about 8 years.

v) *Explain the birth and death of our Sun.*

Ans: The Birth and Death of our Sun:

Our Sun is an average type low mass star among billions of other stars in our galaxy.

Scientists believe the Sun is about half way through its lifetime. The Sun and all the planets of our Solar System began from a huge cloud of gas and dust about 4.5 billion years ago. These clouds are known as nebula.

Nebula are made up of 97% hydrogen and 3% helium. Then something caused the cloud to contract under its own gravitational forces and a ball of gas and

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dust is formed around which the material of gas and dust circled. At this time it is known as protostar. "Proto" means "early" or "before". So a protostar is the first step in becoming a full-fledged burning star.

The Sun spent about 100,000 years as a proto-star before the nuclear fire began at the core. Then it settled down into its current form. The most stable part of its life known as "the main sequence". Generally, a star remains in this phase for most part of its lifetime burning hydrogen.

A star leaves its main sequence phase when it runs out of hydrogen and starts fusing helium and other elements. In 3.5 billion years from now, the Sun will be 40% more brighter than it is right now.

About 4.5 billion years from now the Sun will exit the main sequence. With its hydrogen exhausted in the core, the helium ash will become unstable and collapse under its own weight and start heating the core. The Sun will then grow in size and will become the Red Giant and it will be dead.

v) *Define the terms star, galaxy and milky way.*

Ans: Stars:

"Stars are huge balls of gas in outer space made from hydrogen, helium and other elements producing light, heat and other forms of energy."

Galaxy:

"Galaxy is a vast collection of stars, gas, dust and other forms of matter which are bound together gravitationally as a unit."

The Milky Way:

"The Milky Way is the galaxy we live

in. It contains the Sun and at least one hundred billion other stars. There are billions of tons of free floating clouds of gases with dust and several hundred star clusters in milky way."

- vi) **Describe the safety methods when observing the sun.**

Ans: Safety Methods when Observing the Sun:

The Sun is so bright that prolonged, direct exposure can cause permanent damage to the retina, leading to loss of vision or blindness. To observe the Sun safely, more than 99% of the Sun's light must be filtered before it reaches eyes. One should never view the Sun with the naked eye or with any unfiltered optical device, such as binoculars, telescope, regular sun glasses etc.

Special filters should be used to cover up the objective lens of the telescope.

Galileo, the scientist who invented the telescope, looked at the Sun through a telescope, suffered permanent eye damage.

One safe way to observe the Sun is to project an image of the Sun through a telescope or binoculars onto a white screen or any other plain surface. This is an indirect way of observing the Sun.

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