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Subject : General Science Ability.

Q. No. 1 (a) What is "Black Hole"? How black holes formed and discovered?

(1)

⇒ What is "Black" Hole?

A Black hole is a cosmic body in the centre of almost every galaxy in the universe, including the milky way galaxy.

In which our solar system exists. A black hole is a massive object in space that is so dense that within a certain radius, its gravitational field does not let anything escape from it, not even light.

The black hole cannot be observed directly, it can be observed by its gravitational influence on nearby matter.

The boundary of black hole is called "event horizon".

⇒ (2) Example of Black Hole:-

Sagittarius A* is a supermassive black hole that exists at the centre of the milky way galaxy.

3 → How black holes are formed and discovered?

=> i) Discovery of Black Hole:-

Although the existence of black holes was first predicted by Albert Einstein in 1916 in his general theory of relativity, the first official black hole was discovered ~~by~~ in 1964 through astronomers when a sounding rocket detected celestial sources of X-rays.

ii)

Detection of First Black Hole:-

The first black hole detected by NASA, was Cygnus X-1, located within the Milky Way in the constellation of Cygnus, the Swan.

iii).

Naming of Black Hole:-

The term "Black Hole" was not coined until 1967, when American Astronomer John Wheeler named it so. Moreover, in 1971, astronomers the X-rays were coming from a bright blue star orbiting a strange dark object in all consuming black hole.

(4) Formation of Black Hole:-

(i)

Massive Star Collapse:-

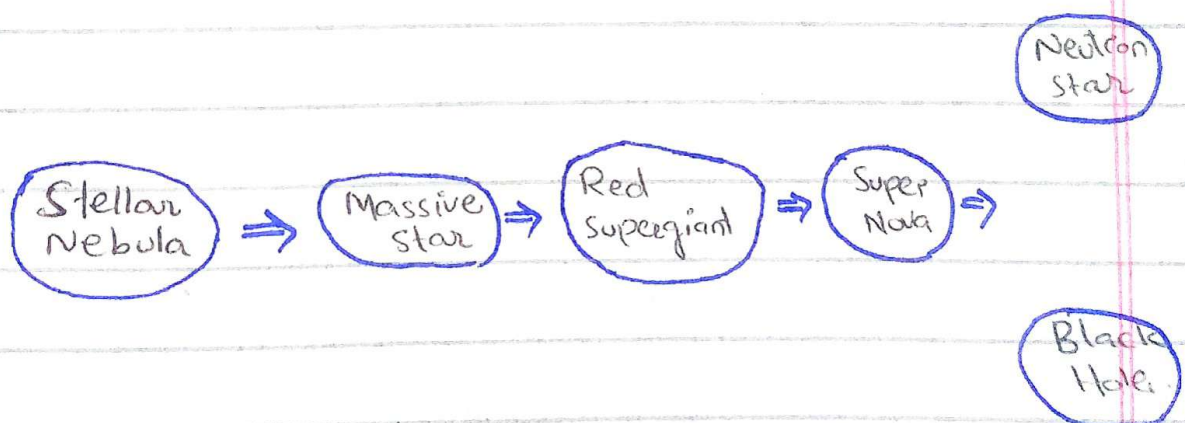
Massive stars collapse under gravity, leading to a supernova explosion and potentially forming a black hole.

(ii)

Core Collapse:- If the star is ~~big~~ enough, its core collapses into a singularity, creating a black hole.

(iii) Supermassive Black Hole Formation:-

Mergers of smaller black holes or direct collapse of gas clouds can form supermassive black holes at galaxy centers.



(Formation of Black Hole)

⇒ Q.1 (b): Differentiate b/w the occurrence of Lunar and Solar Eclipse?

Basis of differentiation	Solar eclipse	Lunar eclipse
(1) <u>Definition</u>	A solar eclipse happens when the moon passes in between the earth and the sun. During the solar eclipse, the moon partially or fully hides the sun's rays for a few minutes.	A lunar eclipse happens when earth passes in between the moon and the sun. During a lunar eclipse, the earth's shade partially or fully hides the moon for a brief period of time.
(2) <u>Eclipse and its types.</u>	Solar eclipse contain three types. Partial solar eclipse, Annular solar eclipse, Total solar eclipse.	The lunar eclipse has two types namely Partial lunar eclipse, Total lunar eclipse, Penumbral lunar eclipse.

Solar eclipse

(3) Frequency of occurrence:-

It occurs usually once in eighteen months during the day time.

(4) Duration:- The longest duration is around 7 and half minutes.



(5) Form of Appearance.

In solar eclipse, a bright disk of sunlight is seen around the new moon.

(6) Phases of moon:-

The solar eclipse happens in the new moon phase.

(7) Risk of health:-

It cannot be seen directly through naked eyes, because of

Lunar eclipse

(3) Frequency of occurrence:-

It happens twice a year during the night time.

(4) Duration:- The period of the lunar eclipse almost is an hour.

(5) Form of Appearance:-

In lunar eclipse, the moon appears slightly reddish in colour.

(6) Phases of moon:-

The lunar eclipse happens in the full moon phase.

(7) Risk of health:-

In comparison with solar eclipse watching a lunar

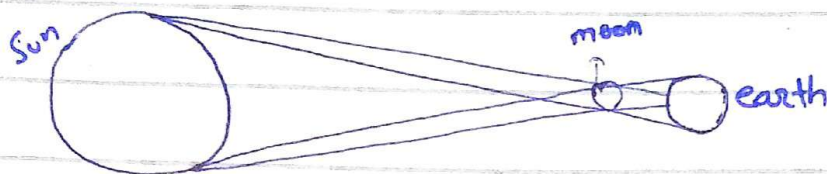
Solar eclipse

high chance of losing vision as it can damage the retina.

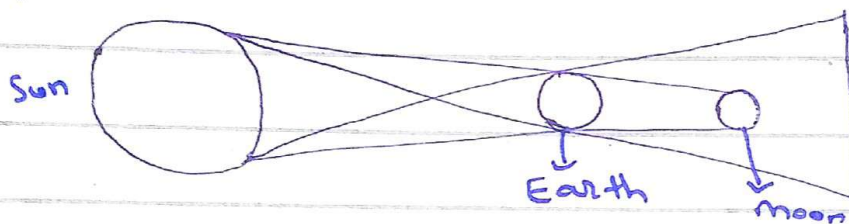
Lunar eclipse

eclipse with the naked eye is absolutely safe.

⇒ Solar eclipse:-



⇒ Lunar eclipse:-



⇒ Q. No 1 (c): Briefly explain what effects are produced due to rotation and Revolution of Earth?

(1) ⇒ Introduction:-

Rotation and revolution are the phenomena associated with the celestial objects. These phenomena also linked with earth.

(2) Rotation of Earth

A rotation is the earth's movement

around its axis, usually called the axis of rotation. The axis of rotation passes through the centre of mass of the earth.

(3) Effects Produced by due to the Rotation of earth:-

The spinning of earth around its axis is called rotation. The earth rotates from west to east, and its axis is tilted at 23.5 degrees.

(i) Day and Night:-

Earth's rotation causes day and night cycles as different parts of the planet face towards or away from the sun.

(ii) Time Zones:-

Rotation leads to creation of time zones, with different regions experiencing different times of day.

(iii)

Wind Patterns:-

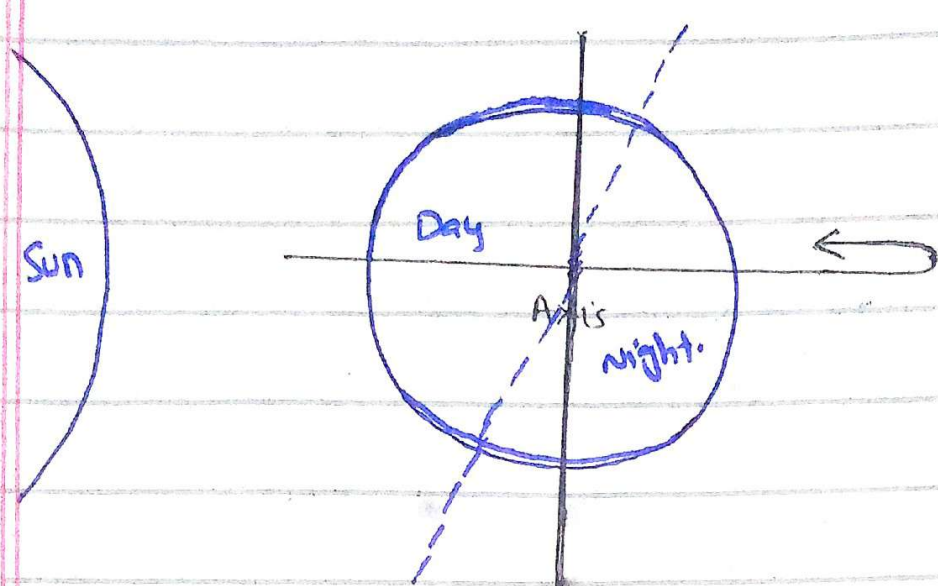
Rotation influences wind patterns, shaping global climate and weather.

(iv)

Ocean currents:-

Rotation affects ocean currents, which impacts global climate and ^{marine} ecosystems.

→ ~~Rotation of Earth~~



Rotation of earth.

→ (4) Revolution of Earth:-

Revolution of earth means the movement of the earth around the sun. It is referred to the orbital motion of an object.

(5) → Effects Produced due to Revolution of the earth:-

The movement of the earth around the sun in a fixed path is called revolution. It revolves in an elliptical orbit from west to east. i.e. in the anticlockwise direction.

(i) Seasons:-

Earth's tilt and revolution cause seasonal changes, with varying cause.

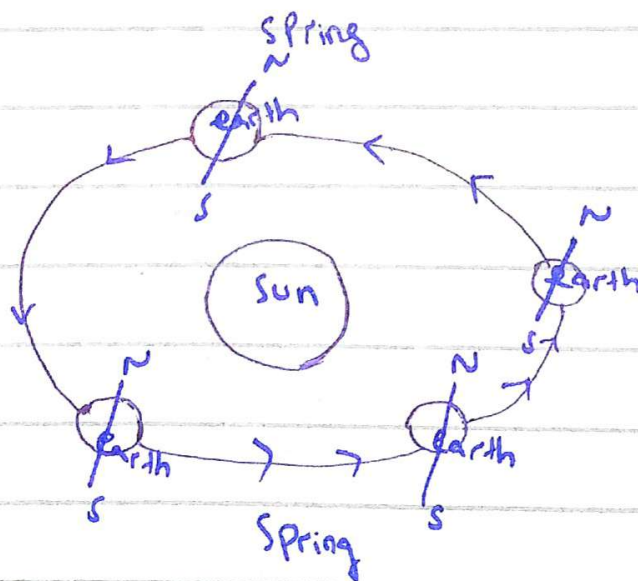
with varying temperatures and daylight hours.

(iii) Yearly Cycle:- Revolution results in a yearly cycle of 365.25 days, basis of our calendar year.

(iv) Variation in Sun's Apparent Position:- Revolution causes Sun's apparent position in sky to change, affecting solar energy received at different latitudes.

(v). Changes in Constellations:-

Revolution causes different constellations to be visible in night sky throughout year.



(Revolution of Earth)

Q. No. 1 (d). Describe different methods to estimate the age of the universe.

⇒ (1) Universe:-

The totality of everything that exists, including all matters and energy, the planets, stars, galaxies and the contents of intergalactic space.

⇒ (2) Methods to measure the age of the Universe:-

There are two methods scientifically rely on for calculating the age of the universe.

(i) Calculating the expansion rate of the universe.

(ii) By determining the age of the oldest universe.

⇒ (i) Calculating the expansion rate of the universe:-

According to scientists, the universe is approximately 14 billion years old. It is the age of the universe that is estimated through the Big Bang. According to this we can assume that the universe is expanding at a constant

rate by using Hubble's constant.

→ Hubble's Law:- Hubble noted that the distance of a galaxy is directly proportional to its speed, and means. The further the galaxy was it was moving away.

$$d = vt$$

$$t = \frac{d}{v}, \text{ where } v = H_0 d.$$

So,

$$t = \frac{d}{H_0 d}$$

$$, \quad \boxed{t = \frac{1}{H_0}}$$

Hence, Scientists were able to use the Hubble constant to estimate the age of the universe by working Big Bang.

⇒ (ii) By determining the age of the oldest universe:-

Scientists determine the age of the universe from the following.

(A). Spectrum:-

The star's spectrum helps determine the age of stars because blue stars tend to die faster than red stars.

(B). Luminosity:- A brighter star will exhaust its energy faster than a

less bright star. Therefore, the star with less luminous intensity exists for a longer time than with ~~less~~ a more luminous intensity.

(c) Mass:-

The amount of a star's mass also helps in finding the life of a star. If a star is dense, it tends to die quickly as compared to a less dense star. The density factor also helps calculate star's life.

(d) Motion / Speed

The brighter star tends to have more energy, in turn, its speed will be greater than the comparatively less luminous star. Eventually, the brighter star will consume its energy quickly and die before the other less bright star. Thus, it will have a short life and vice versa.
