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Q.4

(a)

1. Fiber optics

Fiber optics is a communication system in which data is transmitted through light pulses with the help of internal reflection unlike the traditional copper wire. Fiber optics provide very fast transmission of data.

2. How do fiber optics work?

Fiber optics work through light pulses where the data is transmitted through internal reflection. In fiber optics, there are repeaters at different positions which refresh the data to a distance and with a very short period of time. Throughout the world, fiber optics are replacing the traditional copper wire system.

Hi there — you've prepared well!

Remember, knowing the content is one thing, but presenting it in the paper exactly as required is another. Here are a few key points to keep in mind:

For a 5-mark part, aim to write at least 2 and at most 3 sides of the answer sheet.

Often, a question has two or three parts, and the marks are divided accordingly — so address each part fairly.

2. Manage your time wisely — you have about 25 minutes per full question, which comes down to around 8 minutes for each 5-mark part. Stick to this to avoid rushing later.

3. Make your answers look scientific, not just theoretical. Use flowcharts and diagrams wherever they add clarity.

4. Neatness matters — keep your handwriting clear, avoid cutting or overwriting.

5. Mind your spelling and grammar — while GSA doesn't deduct marks for these, your expression leaves an impression.

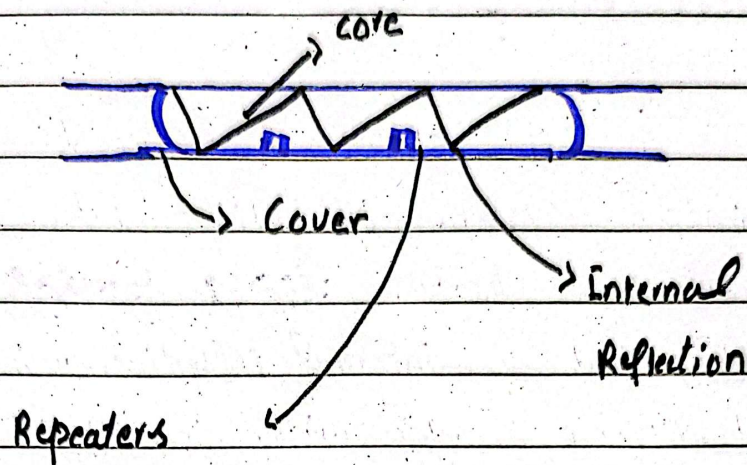
6. In the ability portion, explain analytical ability questions in words. For a 5-mark part, show all steps and provide clear explanations.

Good luck for CSS 2026 — you're going to ace it, in sha Allah! 🌟

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3. Diagram:-



4. Advantages:-

→ Fast Communication

As compared to the traditional copper wire communication, fiber optics through internal reflection and light pulses provide very fast communication.

→ No Network Lag

Optics are designed in a way that they not only

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support large data transmission, but also are lag-resistant. Therefore, these optics are replacing the copper wires.

→ Supports all Types of Communication

Copper wires were designed for a specific type of communication. In other words if it was good at PCL exchange, it would create lag in telephone exchange. However, fiber optics support all types of communication.

5. High Speed Data Transmission

High speed data transmission in fiber optics is possible due to the use of light pulses that move through internal reflection and further pushed by repeaters. Copper wires are not light or pulse-oriented and, therefore, does not support high data or speed transmission.

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(b)

1. Earthquake:-

Earthquake refers to the abrupt release of seismic waves in the asthenosphere region of the earth in the wake of the break up of the bond or joint of two tectonic plates. In their rotation, the tectonic plates create bonds with other plates. When the bond breaks, earthquake takes place.

2. Causes:-

Add in the form of points

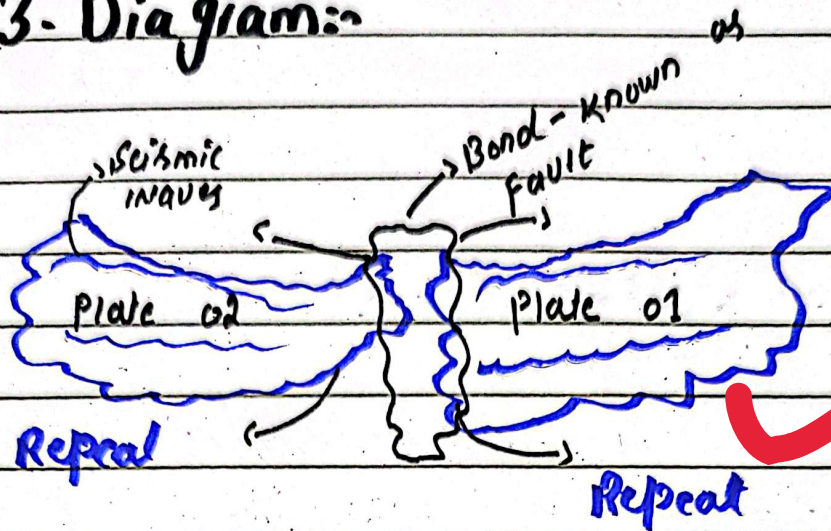
There are seven tectonic plates in the asthenosphere region of the earth. These plates are in circulation, and in the process, they form bonds with other plates — just like atoms in a valence shell. Since these plates are in motion, their bond becomes temporary. As the bonds break, seismic waves are released that result in the jerking of the earth's crust. This phenomenon is

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Known as earthquake-

3. Diagram:-



4. Seismic Waves and Measurement

→ Body waves

Body waves are those waves which travel through the interior of the earth-

→ Rayleigh waves

Rayleigh waves travel from the interior to the surface of the earth-

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→ Mercalli Scale

Mercalli scale measures the total amount of destruction that the earthquake has caused.

→ Richter Scale

Richter scale measures the total amount of the motion of the earth. It rates it on scale of 1 to 9 and gives its result on a seismograph.

5. Reducing the Impact Through Earthquake-Resistant Construction

Through earthquake-resistant construction, the impact of the earthquake can be reduced. It can happen so while the collapse of the infrastructure is prevented that often become the cause of the death of the people. This can also reduce the economic

Explain properly

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cost-

6. Effects of Earthquake

(i) It takes lives of people and create psychological traumas-

3 (ii) Infrastructure of the region collapses that can have economic and human casualties-

C

1. Balanced Diet:-

Definition

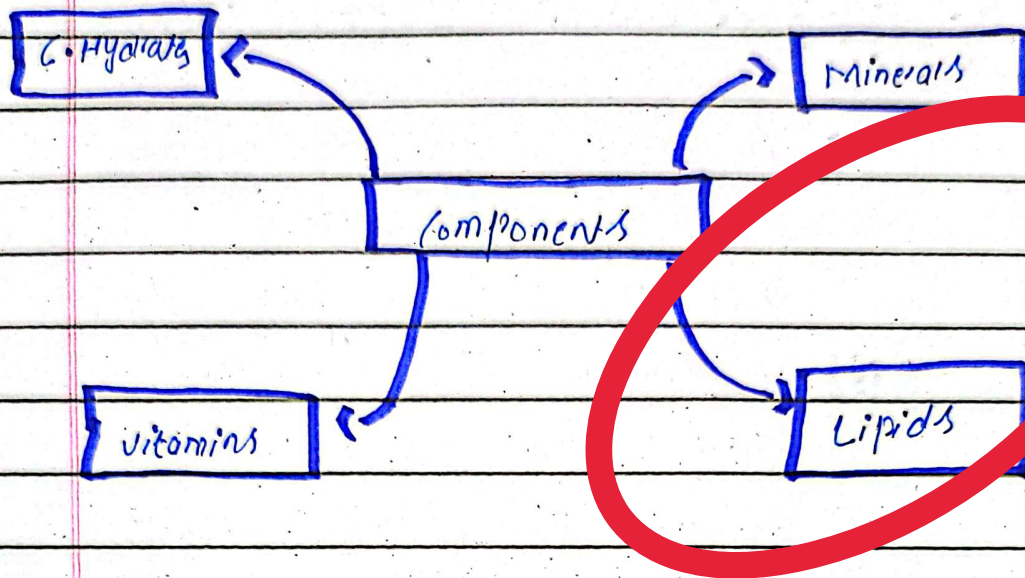
Balanced Diet (BD) refers to the consumption of required amount of nutrients that the body needs. The human body carries nutrients which are needed to be fulfilled through external sources. The completion of all the required nutrients refers to BD-

These nutrients needed for BD can be obtained through carbohydrates, lipids, vitamins, minerals-

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→ Components of BD



2. BD: maintaining A Good Health:-

BD fulfills all the needed requirement of human body i.e., vitamins, carbohydrates and lipids. Human body needs macro and micro-nutrients to remain healthy. A BD can only fulfills these nutrients, keeping human healthy.

3. Importance of macronutrients and Micronutrient

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- i) Both macronutrients and micronutrients help fulfil all the components of BD, keeping human healthy.
- ii) These nutrients prevent chronic diseases.
- iii) They provide needed amount of energy.

4. Preventing Chronic Diseases:-

For example, the deficiency of vitamins lead to diseases such as depression, ricket and anemia among others - taking BD prevents such chronic diseases -

Similarly, the antioxidants avoid the mutation of cells - these antioxidants are obtained from proteins that avoid such harmful phenomenon - many examples can be adopted that how BD prevent chronic diseases -

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d

1. Sources of water pollution:-

→ Radioactivity

Radioactivity from uranium and plutonium are often left in water — that makes water pollution.

→ Erosion in water

Just like land, erosion in the land of the water can also create water pollution.

→ Human waste

Human waste is dumped in water which creates water pollution and disturbance to the eco-system.

→ Sedimenty Rocks

The rocks of the

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land or water itself fall in
the water that creates pollution -

2. Effects:-

→ Disturbance in Marine Life

marine ecosystem gets
disturb from water pollution

→ Water-Born Diseases

Due to pollution in
water, water-born diseases are born
that can create chronic diseases -

3. Impact on Human Health and Environment:-

→ Human Health

Human health becomes highly
vulnerable to water-born diseases - It
can lead to diseases that are
highly infectious - several viruses are
also born due to pollution
in water -

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→ Human Environment

Human environment, its marine life and the marine ecology gets highly disturb- it can lead to reliance on under the earth water that can lead to excessive drilling which may itself pollute the earth-

5. Prevention:-

- i) It is important to make measures to prevent nuclear power plants from radioactivity in water-
- ii) Human waste must not be dumped in water, but other suitable measures must be explored-
- iii) Land erosion and the fall of rocks in water are the features of land pollution- Land pollution in tandem with water pollution must be solved-

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Q.3

a

1. Big Bang Theory:-

The Big Bang Theory postulates that the entire universe was ~~once~~ a **singularity**—it then expanded and created the entire universe—

→ Radiation Era

In the radiation era within $0-35$ seconds after the explosion the universe expanded with the speed of light—

→ Matter Era

In the matter era and fusion, all the celestial bodies were formed. After almost 10 billion years our solar system came into existence—

2. Explaining the origin and evolution of the universe:-

The Big Bang Theory says that the entire universe was

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a tiny singularity. with explosion,
many celestial bodies and human
solar system was made-

It, arguably, takes an
atomistic and evolutionary account
of human universe-

3. Dark Matter and Dark Energy and Expansion

→ Dark Matter

Dark matter played a
vital role in the expansion of
the universe - just like gravity, it
has the potential to give celestial
bodies and make them exist - if
there had no dark matter the galaxies
would have fled in the universe -

→ Dark Energy

Dark energy works against
the gravity - unlike dark matter, it
pulls away the objects. In this process,
it expands the universe.

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4. Key evidence supporting the Big Bang:

→ The Holy Quran

The holy Quran affirms that the Allah almighty made the universe from a single dense point and expanded it.

→ The Big crunch theory

The big crunch theory says that the universe will again turn into a singularity — ending all the existence — arguably, the theory affirms that the universe was created from a singularity.

b

1. Galaxy:

A galaxy is a huge celestial body that encompasses a

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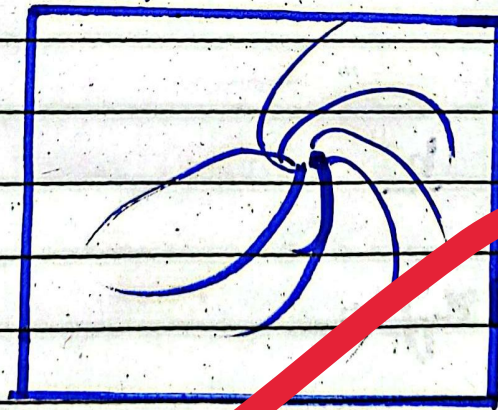
Solar system, Black Holes and it evolves- According to NASA, there are two trillion galaxies in the universe. The galaxy in which our solar system rests is known as Milky Way Galaxy.

2. Classification:-

→ Spiral Galaxy

Spiral galaxies are shaped in a spiral form- They have no central and concentration of bulge of stars- Milky Way is a spiral galaxy.

Diagram:-



"Spiral - called because of its shape in a spiral form"

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→ Elliptical Galaxies

Elliptical galaxies are shaped in an elliptical way - unlike spiral galaxy, elliptical have concentration of stars in its center.

Diagram

elliptical
Galaxies



→ Irregular Galaxies

~~Irregular galaxies have no distinct shape. They can vary in their structure.~~

3. Structure and Composition of Milky Way

→ A Spiral Galaxy

A spiral galaxy like shape Milky Way carries -

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→ A Solar System :

The milky way galaxy holds a solar system of 8 planets-

Avoid being generic

5. Formation and Evolution of Galaxies:-

The galaxies are formed billions of years ago. In their formation, stars play a very vital role. Their stars shape their structure.

With the passage of millions of years, galaxies evolve in a way that the gravitational bonds collapse at its centre itself in a black hole.

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1. Remote Sensing:-

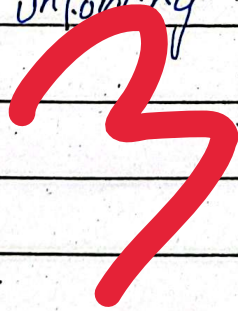
Remote sensing refers to the acquisition of information from a distance. Particularly, remote sensing is associated with taking information from space-

→ Aerial Photography

In aerial photography, the reflections are gauged through photographs and sent it on the earth-

5. Monitoring Disasters and Environment changes:-

Sitting in the space, remote sensing have a visual idea of the situation on the earth. Through the analysis of the reflection, remote sensing can give the sense of unfolding events on the earth-

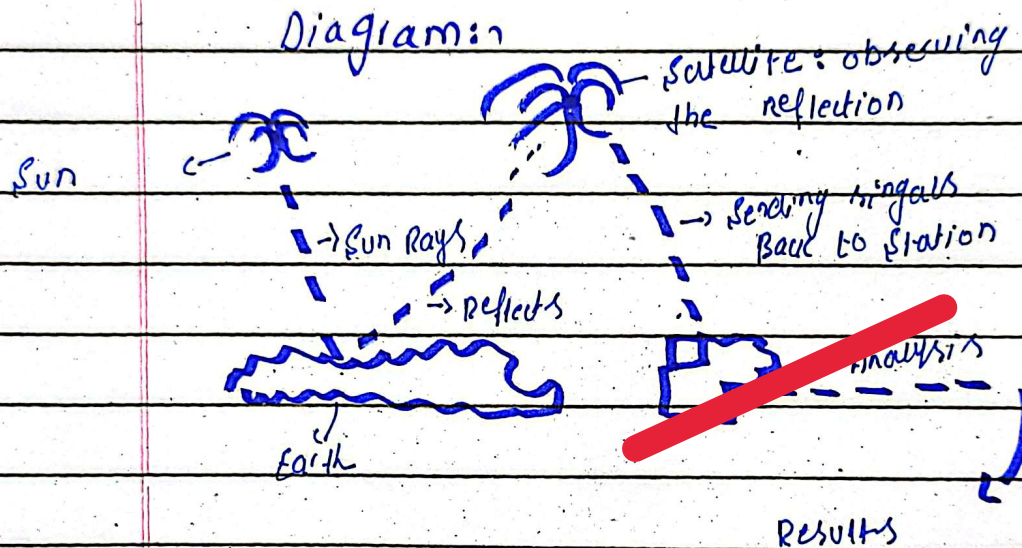


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2. usage in the observation of earth:-

From satellites, remote sensing is utilized to know the situation of climate and other parts on the earth-



3. Different Types:-

→ Satellite imaging

In this type, satellites take reflection and convert them into satellite based images-

and?