

General Science And Abilities

CSS-2016

Question #3(A)

Write a short note on artificial intelligence?

↳ Artificial Intelligence:

Artificial intelligence, commonly abbreviated as AI, is a rapidly evolving field of computer science that aims to develop machines capable of performing tasks that typically require human intelligence. Artificial intelligence term was presented by John McCarthy in 1956 at Dartmouth conference, Massachusetts Institute of Technology (MIT). The objective of AI is to create intelligent systems that can help learn, reason, perceive, and make decisions to mimic human cognitive abilities.

↳ Examples:

Some of the examples of AI are Siri (Apple's virtual assistant), Alexa (Amazon's virtual assistant), Google Assistant, IBM Watson (AI platform for various industries) and different chatbots etc.

↳ Key Components of AI:

1- Machine Learning:-

Machine learning is a core aspect of AI, enabling machines to learn from data and improve their performance over time without being explicitly programmed. Algorithms analyze patterns in data, allowing AI systems to recognize and respond to new inputs.

2- Natural language processing (NLP):-

NLP enables machines to understand and interpret human language, both written and spoken. It empowers AI to communicate, process and generate human like language.

3- Computer Vision:-

AI driven computer vision systems enables machines to interpret and understand visual information from images or videos, mimicking human visual perception.

4- Robotics:-

Robotics combines AI with mechanical engineering to create autonomous

machines that can perform physical tasks in the real world.

↳ Applications of AI:

AI is transforming various industries and sectors, revolutionizing the way we work and live. Some prominent applications includes:

1- Virtual Assistants: AI powered virtual Assistants like Siri, Alexa, Google Assistant help users with tasks, answer queries and control smart devices through natural language interaction.

2- Recommendation System: AI Algorithms analyze user behaviour and preferences to provide personalized recommendations for products, services or content, as seen in streaming platforms and e-commerce sites.

3- Autonomous Vehicles: AI plays a vital role in the development of self-driving cars, enabling vehicles to navigate and make decisions based on real-time data and sensor inputs.

4- Health care: AI is utilized for medical diagnosis, drug discovery, personalized

treatment plans, and disease prediction, improving healthcare outcomes and patient care.

5- Finance: AI is employed in Fraud detection, credit scoring, algorithmic trading, and customer service in the financial sector, enhancing efficiency and risk management.

6- Gaming: AI algorithms are used to create intelligent and adaptive virtual opponents, enhancing the gaming experience and challenge.

↳ Challenges and Ethical Considerations:

As AI advances, it also raises ethical and societal concerns. Key challenges includes:

1- Bias and Fairness: AI algorithms can perpetuate biases present in training data, leading to unfair and discriminatory outcomes.

2- Privacy and security: AI systems handling sensitive data need robust measures to ensure privacy and protection against potential breaches.

3- Job displacement: The automation of

certain tasks through AI may lead to job displacement and require reskilling of the workforce.

4- Transparency and accountability: Ensuring transparency and accountability of AI decision-making processes is crucial to building trust in AI systems.

↳ Conclusion:

Artificial intelligence is revolutionizing the way we interact with technology and transforming various industries. While its potential benefits are vast, responsible development and ethical considerations are essential to harness AI's full potential for betterment of society.

CSS 2016 Q#3(B)

Write a short Note on:-

i- Fiber Optics ii- GPS

i- Fiber Optics:-

Optical fiber is the technology that is associated with the transmission of information as light pulses over a long distance along a

long distance glass tube or plastic wire or fibre.

→ The basic structure of optical fibers:-

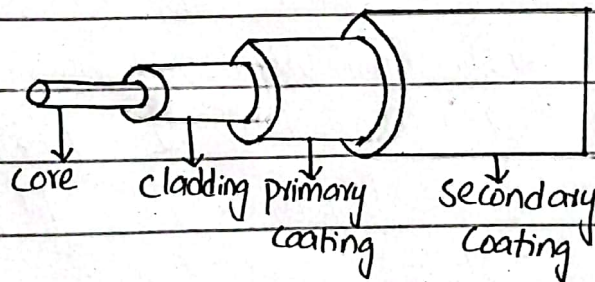
Optical Fiber consists of four layers:-

1- Core: Made up of glass.

2- Cladding: is a reflective layer made up of glass or plastic.

3- Coating: Covers as a plastic layer

4- Jacket: to bundle all fibers in one cable.



→ Types of the optical Fibers:-

There are many types of optical fibers. However the most significant types are:-

1- Single Mode index Fiber:-

A Fiber that is designed to carry ^{not} more than one signal at a time. Its core diameter is 50 μm .

2- Multi Mode index Fiber:-

A Fiber that is designed to

carry more than one signal at a time. Its core diameter is $50 - 100 \mu\text{m}$.

3. Multi-mode graded index Fibers

It is a type of optical fiber where the refractive index is higher at the axis of the core and then it decreases gradually towards the core-cladding interface. Its core diameter is upto $1000 \mu\text{m}$.

→ Working of fiber optics:

In the fiber optic system the transmitter turns information into light and send it through optical fibers. As light moves at a high speed through the core, light bounces off the cladding either by the phenomenon of total internal reflection or continuous refraction. If the fiber has a curve or bends in it, the light can bounce off the cladding and follow the cladding by turning the corner. At the end of the fiber, the receiver accepts the light and turns the light into sound, pictures or computer codes.

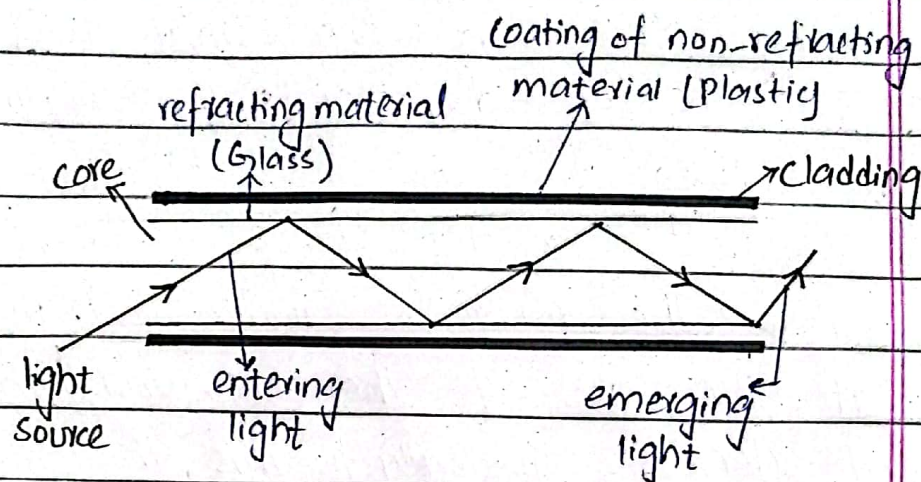


Fig: Working of Optical Fiber

→ Uses of Optical fiber:-

- i- They are used as light guides, imaging tools and also as laser for surgeries.
- ii- Fiber is used for transmitting and receiving purposes in telecommunication.
- iii- They are used as hydrophones for SONAR and seismic waves, as wiring in submarines, aircrafts and other vehicles and for field networking too.
- iv- They are used for imaging in hard to reach areas, as wiring where EMI is an issue, as sensory devices to make temperature, pressure and other measurement, and as wiring in automobiles and

in industrial settings.

ii- Global Positioning System:-

The Global positioning system (GPS) is the state-based navigation system that uses satellites and receivers to synchronize location, velocity and time data for air, land and sea travel.

→ The invention of GPS:-

USA initiated the GPS project in 1973 to overcome the limitations of previous navigation systems. It became fully operational in 1995. Bradford Parkinson, Roger L. Easton, and Ivan are credited for this invention.

Components of GPS:-

GPS is made up of three different components that are called segments, which work together and provide location information. These three segments are given below:-

1- Space Satellites:-

Satellites circulating the earth transmit signals to users on geographical

position and time of the day.

2- Ground controls:-

It is made-up of earth-based monitor stations, master control and ground antennae. It controls activities including tracking and operating the satellites in space and monitoring transmission.

3- User equipments:-

GPS receivers and transmitters including items like watches, smartphones and telematics devices. GPS is a dependable and powerful tool for business and organization in many different industries.

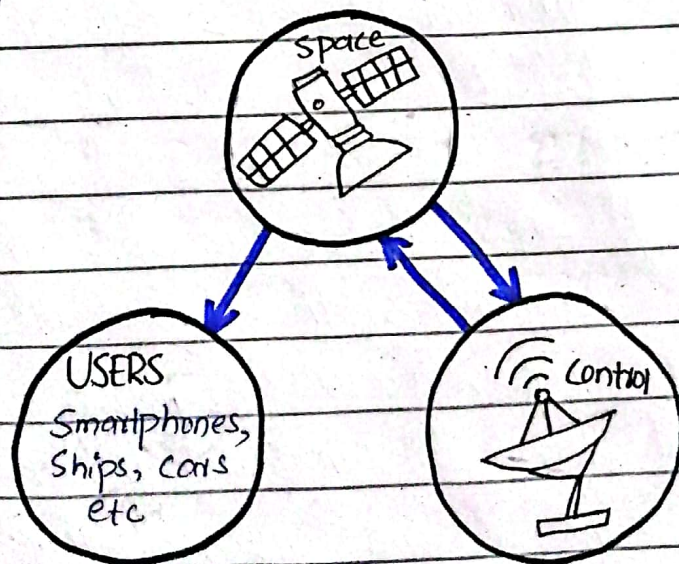


Fig: GPS components

CSS-2016

Q#5 (A)

Comment, 'Liver is the chief chemist in human body'.

↳ Why Liver is chief chemist in human body?

The statement "the liver is the chief chemist in the human body" is a fitting analogy to describe the essential and diverse roles that the liver plays in maintaining overall health and homeostasis. The liver is a vital organ and one of the largest in human body, weighing upto **1.4 kg**, and is known as the heaviest organ of the body. The liver is located in the right upper quadrant (**RUQ**) of the abdomen under the diaphragm. It performs a multitude of complex chemical functions critical for proper bodily functions and metabolism. It perform more than 500 chemical functions in our body.

↳ Key functions of the liver:

1- Detoxification: The liver plays a central role in detoxifying the

body by metabolizing and eliminating various harmful substances, including drugs, alcohol, and toxins.

2- Metabolism of nutrients: The liver metabolizes carbohydrates, proteins, and fats, regulating blood glucose levels and producing energy as needed.

3- Bile Production: The liver produces bile, a fluid that aids in fat digestion and absorption in the small intestine.

4- Storage of Nutrients: The liver stores important nutrients such as vitamins (A, D, B12) and minerals (iron) for future use.

5- Synthesis of proteins: It synthesizes various proteins, including clotting factors and albumin, essential for blood clotting and maintaining osmotic pressure.

6- Immune function: The liver is involved in the body's immune response, helping to remove and destroy foreign substances, like bacteria and viruses.

7 → Metabolism of Drugs and Hormones:

The liver processes drugs and hormones, playing a crucial role in drug metabolism and hormone regulation.

8 → Storage of Glycogen: The liver stores excess glucose in the form of glycogen, which can be quickly converted back to glucose when needed for energy.

9 → Cholesterol Regulation: The liver is involved in regulating cholesterol levels by synthesizing and eliminating cholesterol as needed.

10 - Production of plasma proteins: The liver produces several plasma proteins necessary for various bodily functions, like human serum albumin, osmolyte and carrier proteins, and various globulins etc.

Conclusion:-

The liver's multifunctional nature indeed makes it comparable to a "chief chemist" as it participates in numerous biochemical processes,

involving detoxification, storage, filtration and regulation of different body parts, maintaining the body's balance and ensuring proper physiological functions.

Any disruption to Liver's health can have far-reaching consequences, affecting digestion, metabolism, and overall well being. Therefore, it is crucial to maintain a healthy lifestyle, including a balanced diet, regular exercise to support the liver's vital functions and ensure optimal health.

Q#5(B)

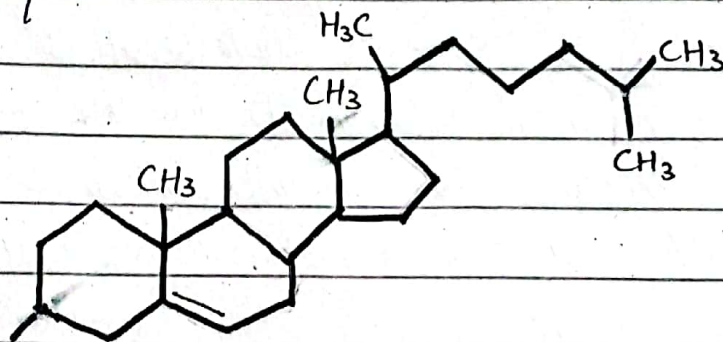
What is cholesterol? Discuss its importance, normal blood level and dangers of elevated levels with references to the

↳ Cholesterol:

Cholesterol is a type of the lipid (fat) that is essential for various physiological processes in the human body. It is crucial component of the cell membrane, helps in the production of hormones, vitamin D

and bile acids necessary for fat digestion, and aids in nerve functions.

Cholesterol is synthesized in the liver and can also be obtained from certain foods we eat. It is transported through bloodstream in the form of lipoproteins.



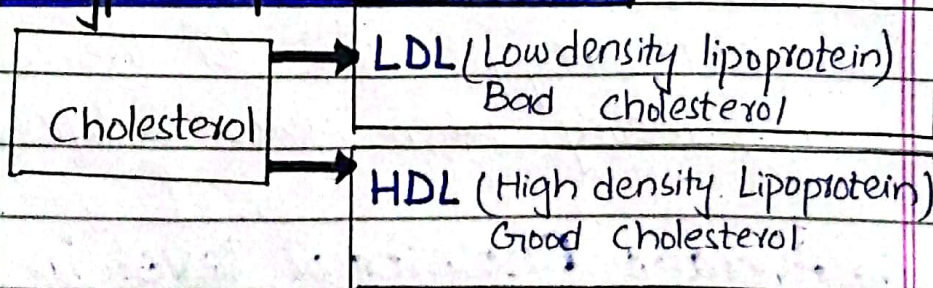
HO

- Structure of Cholesterol

↳ Sources of cholesterol:

Meat, cheese, Fish, Eggs, Butter and low-fat Milk.

↳ Types of cholesterol:



↳ Importance of Cholesterol:

Cholesterol serves several important functions:

1- Hormone Production: Cholesterol is a

precursor for the synthesis of steroid hormones, including cortisol, aldosterone and sex hormones (estrogen and testosterone).

2-Cell Structure: Cholesterol is a structural component of cell membrane, maintaining their integrity and fluidity.

3-Vitamin D Synthesis: Cholesterol is converted into vitamin D in the skin upon exposure to sunlight, which is vital for calcium metabolism and bone health.

4-Bile acid Synthesis: Cholesterol is converted into bile acid in the liver, which are necessary for digestion and absorption of dietary fats.

5) Source of energy: Triglycerides are significant energy sources for the body, mainly when glucose is deficient.

↳ Average Cholesterol level in Blood:

Cholesterol levels are measured in milligrams (mg) of cholesterol per deciliter (DL) of blood.

↳ HDL (High density-Lipoproteins)	40mg/dL
↳ LDL (low density-Lipoproteins)	Less than 100mg/dL
↳ VLDL (very low density-Lipoproteins)	2-30mg/dL
↳ Cholesterol	<200mg/dL
↳ Triglycerides	150 mg/dL

↳ Dangers of Elevated Cholesterol levels

Elevated cholesterol levels, especially high levels of low-density lipoproteins (LDL) cholesterol, commonly referred as "bad cholesterol", can pose several health risks:

1- Atherosclerosis:- High LDL cholesterol levels contribute to the development of atherosclerosis, a condition in which cholesterol plaques build up in the arterial walls, narrowing the blood vessels. This restricts blood flow and can lead to heart attacks and strokes.

2- Coronary Heart Diseases:- (CHD)
 High LDL cholesterol is a major risk factor for CHD, a condition in

which the arteries supply the heart become narrowed or blocked, reducing blood flow to the heart muscles.

3- Peripheral Artery Disease (PAD):

Elevated cholesterol can also cause atherosclerosis in arteries supplying other parts of the body, leading to PAD, which affects blood flow to the limbs.

4- Cholesterol Gallstones:

High cholesterol levels can contribute to the formation of gallstones, which are solid particles that form in the gallbladder.

5- Xanthomas:

Elevated cholesterol can result in the formation of Xanthomas, which are fatty deposits under the skin.

CSS-2016 Q#10 (A)

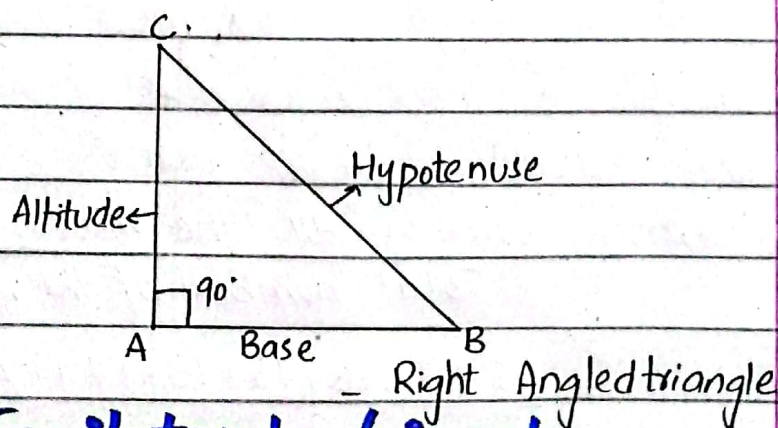
Define and draw the following:

i- Right Angle triangle ii- Equilateral triangle

i- Right Angle Triangle:-

A right angled triangle is a

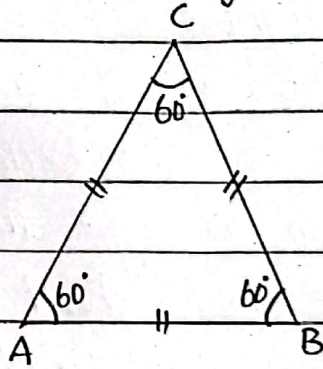
type of triangle that has one of its angles equal to **90 degrees**. The hypotenuse is the longest side always opposite the right angle. Its base is the one that adjoins the right angle and it is the bottom line which also form an angle θ with the hypotenuse. The third line is known as the height/leg/altitude which is opposite to the angle θ . This line is always perpendicular to the line containing the base.
→ Sum of all the angles in the triangle must be 180° .



ii- Equilateral triangle

An equilateral triangle, in geometry, is a triangle that has all the three sides equal in length. Also, the three angles are congruous

where each angle is equal to **60 degrees**. Therefore, it is also known as equiangular triangle.



- Equilateral triangle

Q# 10 (B)

There are nine students in a group having age 15, 15, 16, 16, 16, 17, 17, 18, 19. Calculate mean, median, mode and range of their ages also defines the above mentioned terms.

$$1) \text{ Mean} = \frac{\text{Sum of All the values}}{\text{Total number of the values}}$$
$$= \frac{15 + 15 + 16 + 16 + 16 + 17 + 17 + 18 + 19}{9}$$

$$= \frac{149}{9}$$

$$\text{mean} = 16.55$$

$$2) \text{ Median: Middle value of arranged data}$$
$$= \underline{15}, \underline{15}, \underline{16}, \underline{16}, \underline{16}, \underline{17}, \underline{17}, \underline{18}, \underline{19}$$

$$\text{Median} = 16$$

3) Most Frequent value = Mode

$$\text{Mode} = 16$$

4) Range = Highest value - Lowest value

$$= X_m - X_o$$

$$= 19 - 15$$

$$\text{Rang} = 4$$

Definitions:-

Mean: Sum of all the values divided by total number of values.

Median: is the middle value of arranged data.

Mode: is the most frequent value of the data.

Range: is the difference between the maximum and minimum value of the data.
