

DATE: 07/12/2024

(CSS-2024)

SECTION-I

QUESTION # 02

(A)

What is the Tuberculosis and Hepatitis? Explain briefly.

(a) TUBERCULOSIS:

i Understanding Tuberculosis:-

Tuberculosis (TB) is a bacterial respiratory infection primarily affecting the lungs but can also affect the intestine, bones, joints, lymph nodes, skin and other tissues of the body. According to **World Health Organization (WHO)** TB is the second most infectious disease after covid-19, leaving even HIV and AIDS behind. The infection has been responsible for around 1.3 million deaths world wide.

ii Causes of TB:

Following are some of the major causes of TB.

- Agent: Mycobacterium Tuberculosis
- Environment: Humid Seasons
- Weak immune system

→ Mycobacterium Tuberculosis

Agent

causes
of
TB

Host

Environment

- children & old people
- weak immune sys.
- In females above 35
- In Males above 45
- person with HIV is 100
- times more prone to TB

- Humid Season
- poor quality of life
- population explosion

iii Symptoms of TB:

Symptoms of Tuberculosis do not show up in the patient having latent Tuberculosis. Only the people having active TB exhibit the symptoms of the infection that include

- 1- Prolonged cough (sometimes with blood)
- 2- Fatigue
- 3- chest pain
- 4- Weakness
- 5- Night Sweats
- 6- Weight loss
- 7- Fever

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iv. Prevention & Treatment of TB:

For Prevention:-

The bacilli Calmette-Guérin (BCG) vaccine, which is the live attenuated vaccine form of *Mycobacterium bovis*, is the only effective vaccine.

For Treatment:-

Treatment of tuberculosis can take at least **two years**, and results are still poor. Second-line drugs that are used for the treatment of tuberculosis include

1. Azithromycin
2. clarithromycin
3. Ofloxacin
4. cycloserine etc.

And at the end, it is necessary for the patient to complete the course of medication, particularly in the case of multi-drug resistance TB where the patient may need to be hospitalized.

(b) HEPATITIS :-

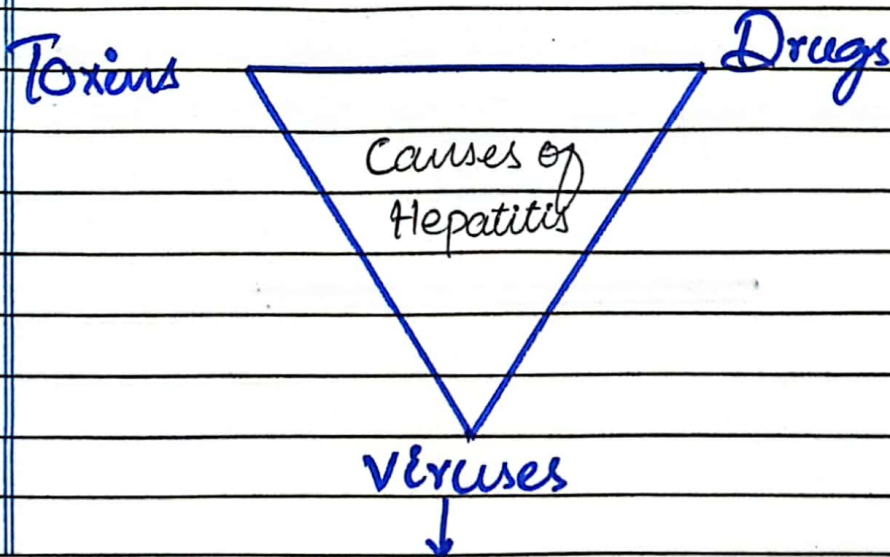
The word hepatitis comes from the Ancient Greek word "hepar," which means "liver," and the Latin suffix "itis," means "inflammation". The word originated in early 18 century.

i Understanding Hepatitis :-

Hepatitis is the inflammation of the liver mainly caused by any of the half a dozen of viruses and non-infectious agents leading to multiple health problems, some of which can be fatal.

ii Causes of Hepatitis:

Following five are the main strains of the hepatitis virus.



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Viruses:

- 1- HAV
- 2- HBV
- 3- HCV
- 4- HDV
- 5- HEV

Viruses

HAV HBV HCV HDV HEV

iii- Symptoms of Hepatitis :-

Symptoms and their intensity in Hepatitis may vary from one type to another, the **general symptoms** include.

- 1- Jaundice
- 2- Abdominal pain
- 3- Liver Enlargement
- 4- Fatigue
- 5- Low Grade Fever
- 6- Loss of Appetite

(iv) Prevention & Treatment of Hepatitis :

• For Prevention

Vaccines of all type of Hepatitis are available except Hepatitis C. To prevent from **HEV** virus, patients are advised to avoid,

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Q No. 02

- (B) Explain the mechanism of fiber optic cable for signal. Explain its construction.

Optical Fiber :-

The strands of glass, thread like, used to transmit light signals from one point to another point is named as optical fiber.

- Origin of Idea :

Since the invention of the telephone by **Alexander Graham Bell**, transmission of signals via beam of light or photon particles, became possible. Using this idea, optical fibre originated with the transmission capacity far greater than the other modes of communication, like copper wire and metallic wires.

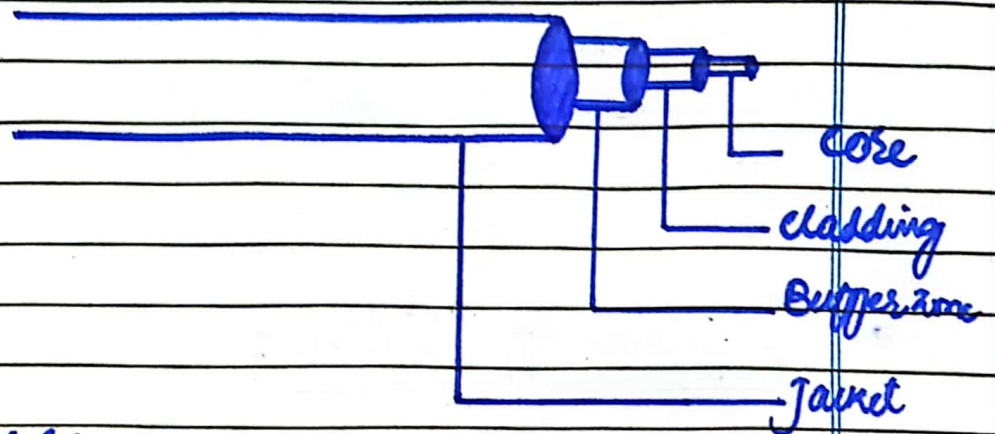
- Structure of optical Fiber

Structurally, optical fiber consists of,

- | | |
|-------------|-----------|
| 1- Core | 3- Buffer |
| 2- cladding | 4- Jacket |

1. Core :-

- Thin glass centre of the fibres where light travels.
- The core has a diameter of $10\mu\text{m} - 200\mu\text{m}$
- It has high density
- It has high refractive index



2. Cladding :-

- Plastic outer optical material surrounded by core.
- The refractive index of cladding is less than that of the core which is a must condition for the working of the optical fibers.
- It has low density

3. Buffer :-

A polymer layer surrounded by cladding.

4. Jacket:

It coats the whole optical fiber.

Mechanism of Action of optical Fiber :-

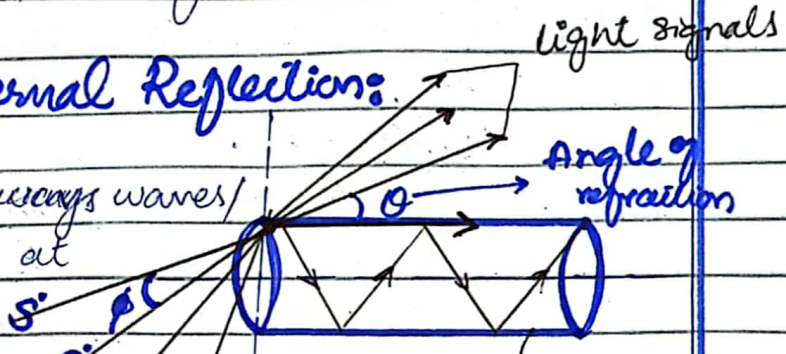
The propagation of light in an optical fibre requires that light should be totally confined within the fiber and not escape from it. This can be done by

- 1- Total internal reflection
- 2- Continuous Reflection

1. Total internal Reflection:

→ Bending of waves/waves/light signals at 90°.

→ The total internal reflection can only be achieved after reaching the critical angle.



Fiber Optics Communication System:

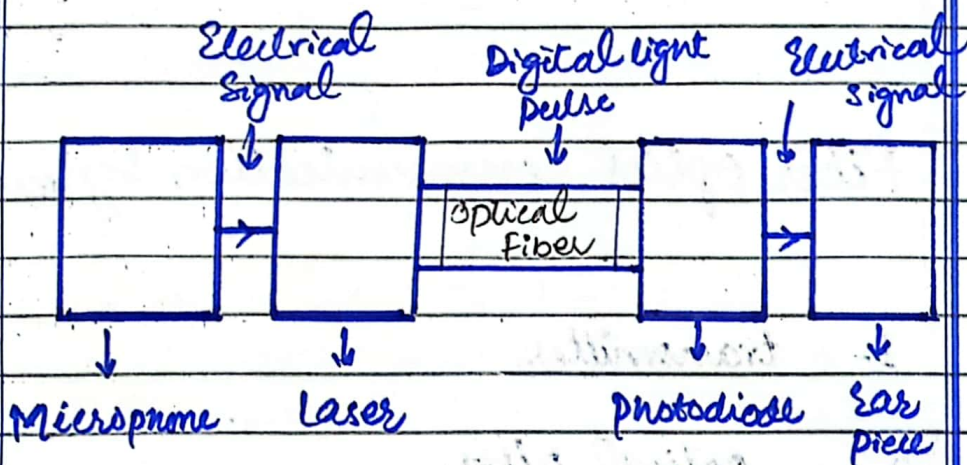
It consists of three major components,

- 1- A **transmitter** that converts electrical signals into light signals.
- 2- An **optical fiber** for guiding the signals
- 3- A **receiver** that captures the light signals at the other end of the fiber and reconverts them to electric signals.

Explanation:-

First an input device, like microphone, converts sound into electrical signal:

The electrical signals are then sent to transmitter, which includes a light source like semiconductor laser or LED. The transmitter modulates the light waves digitally. Here, a pulse of light means 1 and absence of light means 0. This digital light is transmitted into the optical fiber. These light signals are carried over long distances by optical fibers and repeater are placed at a certain distance to maintain the signals strength. At the end of the optical fiber, a photodiode converts the light signal back into electrical signals. Finally these electrical signals are converted into sound via earpiece.



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QNO.02

(c) Explain the difference between Middle latitude Cyclones and Tornadoes.

	<u>Mid-latitude Cyclones</u>	<u>Tornadoes</u>
i-	<u>Definition:-</u> Middle latitude cyclone is the dominant weather system in middle and high latitude (at 30-60° equator), characterized by rapidly swirling air masses around a low pressure core, which results in stormy and often destructive weather.	<u>Definition:-</u> A tornado is a small but intense vortex of a spinning column of air associated with the strong updraft of an intense thunderstorm that extends between the earth's surface and a cloud. It is also named as whirlwind or dust devil.
ii-	<u>Formation:</u> Middle-latitude cyclones are the result of the dynamic interaction of warm tropical and cold polar air masses at the polar front.	<u>Formation:</u> Tornadoes form when warm, humid air collides with cold, dry air.
iii-	<u>Rotation</u> clockwise in the Southern hemisphere and anti-	<u>Rotation</u> It also has the same rotation in

clockwise in Northern hemisphere

iv- Measuring Scale:-

The scale for measuring cyclones is called the Beaufort scale and Saffir-Simpson Scale.

v- Circumference :-

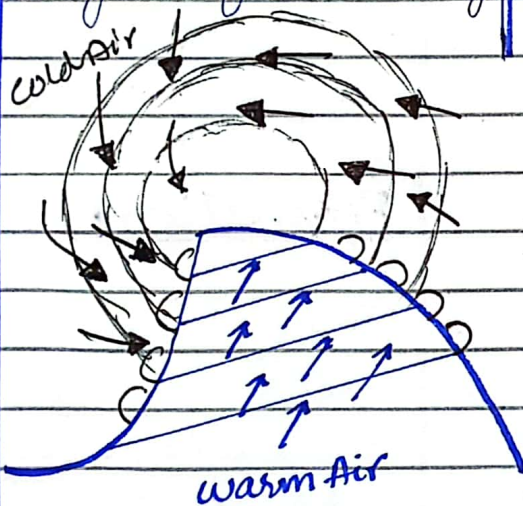
They have wide circumference.

vi Diameter

Diameter = 200 km

vii- Duration

They last for 3 to 10 days



Mid-latitude cyclone

the both hemisphere

Measuring Scale:-

The scale used for rating the strength of tornadoes is called the Fujita (F) and Enhanced Fujita (EF) Scale.

Circumference :-

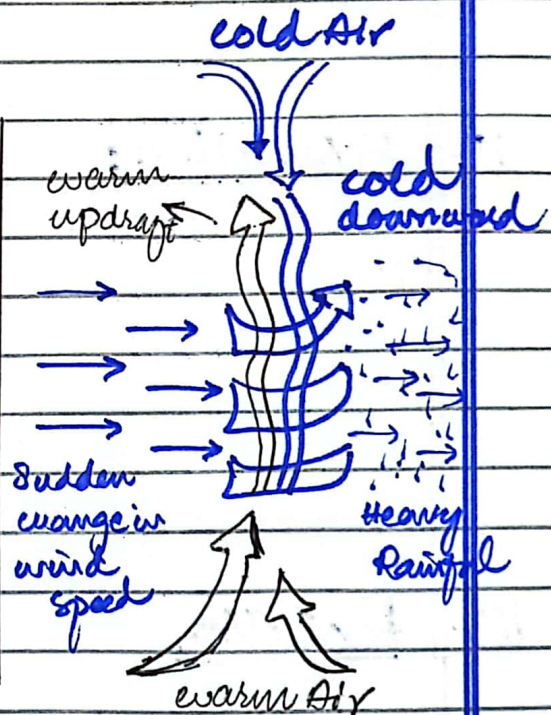
They have a small circumference.

Diameter

Diameter = 300-400 yards

Duration

They last for less than 10 minutes.



Tornado

Q.No. 02

(D) What is the difference between ionic and covalent bonding? Give examples.

Ionic Bond

i- Definition:-

The bond which is formed due to complete sharing of electrons between two or more atoms is called ionic bond.

ii- Electron Interaction

Electrons are transferred from one atom to another. Usually from **metal** to **non-metal**.

iii- Bond formation

Formed when one atom loses electrons - becoming a cation, and another gains electrons - becoming an anion.

iv- Electronegativity diff.

This difference is > 1.7 among the elements.

Covalent Bond

Definition:-

The bond which is formed due to mutual sharing of electron pair between atoms is named as covalent bond.

Electron Interaction

Electrons are shared equally (non-polar) or unequally (polar), between atoms.

Bond formation

Formed when two atoms come together and share electrons mutually.

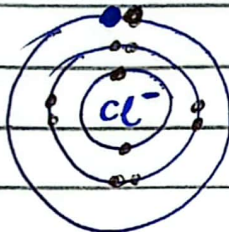
Electronegativity

This difference is less than 1.7 among the

NaCl

Na = 11

Cl = 17

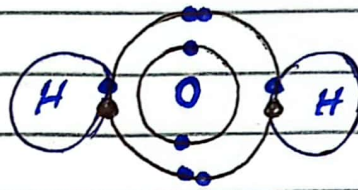
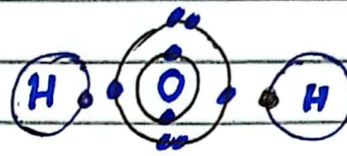


Ionic bond

H₂O (water)

H = 1

O = 8



Covalent bond

Q NO. 04

(A) What is role of carbohydrates and vitamins in body? Discuss briefly.

Carbohydrates:

"The word carbohydrate literally means hydrated carbons containing carbon, hydrogen, and oxygen. Chemically, carbohydrates are defined as poly-hydroxy aldehydes or ketones."

Examples:

Examples of carbohydrates include glucose, fructose, glycogen, and starch. They play both structural and functional roles.

Role of Carbohydrates

Structural role

Functional role

i- Structural Role of Carbohydrates:

Structural roles of carbohydrates are as follows.

- 1- Some carbohydrates are main constituents of cell walls in plants and microorganisms.

- 2- proteins and lipids form glycoproteins and glycolipids, respectively, that have a structural role in the extracellular matrix of animals and bacterial cell walls.

ii- Functional Role of Carbohydrates:

Functionally, carbohydrates play the following roles.

- 1- Simple carbohydrates are main source of energy in cells used to produce ATP (adenosine triphosphate), the energy currency of cell.
- 2- Excess energy is stored as another carbohydrate. Glycogen, in the liver that, at the time of need, is hydrolyzed back to its subunit Glucose.
- 3- By providing an easily accessible energy source, carbohydrates spare proteins from being utilized for energy. This allows proteins to be utilized for their primary cause such as construction and arranging of tissues etc.

• Role of Vitamins:

“vitamins are organic compounds that are essential for maintaining good health. They are needed in small amounts and must be acquired through the diet, because

They are not endogenously produced by body or produced in insufficient quantities."

Role of vitamins

Role of fat-soluble vitamins

Role of water-soluble vitamins

i- Role of fat-soluble vitamins:

Vitamins	Roles
VA	<ul style="list-style-type: none"> Improves the eyesight Maintains the integrity of skin, muscles, and mucous membranes Its deficiency causes Night blindness
Vitamin D	<ul style="list-style-type: none"> Helps in the growth of bones tissues. Assists in calcium and phosphate metabolism Its deficiency causes Rickets
Vitamin E	<ul style="list-style-type: none"> Helps body to produce better defense against diseases acts as anti-oxidant. (deficiency causes less fertility)
Vitamin K	<ul style="list-style-type: none"> Necessary for the synthesis of proteins involved in bone mineralization plays a key role in blood clotting Deficiency causes Non-clotting of blood

ii- Role of Water Soluble vitamins:

Vitamin	Roles
Vitamin B	<ul style="list-style-type: none">• Acts as cofactor in enzymatic reactions• Synthesize red blood cells, fat, and carbohydrates
Vitamin C	<ul style="list-style-type: none">• Deficiency causes Beriberi (B_1)→ An anti-oxidant inhibit aging process• Heals injuries by producing collagen• Deficiency causes Scurvy