

General Science And Ability

Part-II

Section-1

Q # 2

(a)

What is dengue? Give a brief account of its causative agent and its symptoms.

Dengue :-

Dengue is a mosquito-borne viral disease that has rapidly spread in all regions in recent years. Dengue virus is transmitted by female mosquitoes mainly of the species Aedes aegypti and to a lesser extent, Ae. albopictus. This mosquito also transmits chikungunya, yellow fever and Zika infection. Dengue is widespread throughout the tropics, with local variations in risk influenced by rainfall.

Causative Agent :-

Dengue is caused by the dengue virus which belongs to the Flavivirus genus. There are four distinct serotypes of the virus (DENV-1, DENV-2, DENV-3, and DENV-4). Infection with one

Serotype provides immunity to that specific serotype but not to others, which can increase the risk of severe disease upon subsequent infections.

Severe dengue was first organized in the 1950s during dengue epidemics in the Philippines and Thailand. Today, severe dengue affects most Asian and Latin American countries and has become a leading cause of hospitalization and death among children and adults in these regions.

Symptoms:-

Symptoms of dengue typically appear 4 to 10 days after being bitten by an infected mosquito and can include.

High fever:-

Sudden onset, often reaching ($40^{\circ}\text{C}/104^{\circ}\text{F}$)

Severe headache:-

Intense pain behind the eyes.

Joint and muscle pain:- "breakbone fever."

Nausea and vomiting:- Digestive discomfort.

Fatigue:- Extreme tiredness and weakness

Skin rash:- May appear 3 to 4 days after fever onset.

Mild bleeding:- Such as nosebleeds or gum

bleeding in some cases.

In severe cases, dengue can progress to dengue hemorrhagic fever or dengue shock syndrome, which can be life-threatening and require immediate medical attention. Symptoms of severe dengue may include severe abdominal pain, persistent vomiting, rapid breathing and bleeding gums or nose.

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Discuss structure and function of mitochondria. How is it the power house?

Mitochondria:-

Mitochondria are very important organelles. They are present only in Eukaryotic cells. They are involved in the manufacturing and supply of energy to the cell. Therefore, mitochondria may be called as powerhouse of the cell. The size and number of mitochondria is different in different cells.

Structure Of Mitochondria:-

The mitochondria may be vesicle rod or filament shaped. Mitochondria are bounded by two membranes. The outer

membrane is smooth. The inner membrane forms many infoldings, called cristae. The inner surface of cristae contains small knob like structure, called F_1 particles. These F_1 particles are suspended inside the matrix.

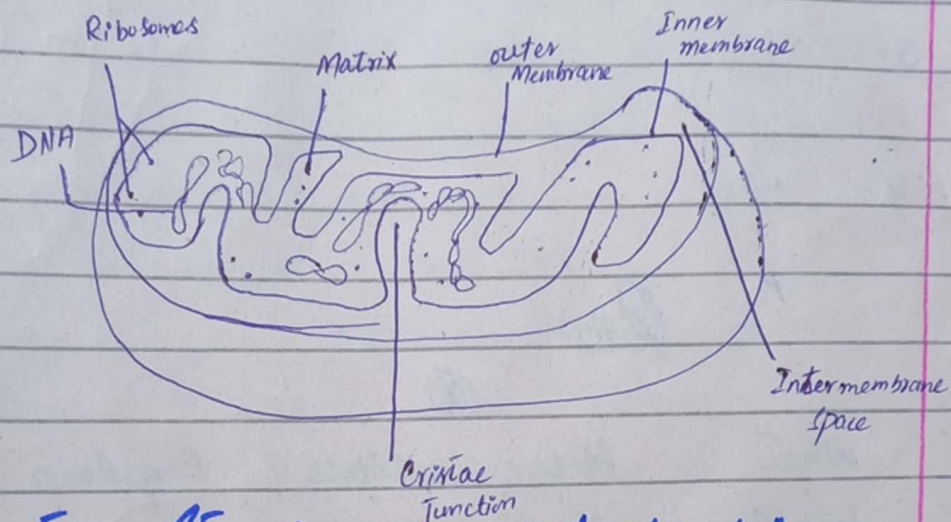


Fig. Structure of mitochondria

Mitochondria are self-replicating organelles. It means new mitochondria are formed by the division of the old mitochondria.

Function of mitochondria:-

- 1- Regulate most important metabolic activity of the cell. These are Krebs cycle, aerobic respiration, fatty acids metabolism etc. Energy is released from organic food during these cell metabolic processes. This energy is transferred to energy rich compound

ATP. ATP provides energy to cell on demands and ATP is broken into ADP. This ADP absorbs energy from mitochondria and again becomes ATP.

- 2- Promote growth of new cells and cell multiplication.
- 3- Helps in detoxifying ammonia in the liver cells.
- 4- Plays an important role in apoptosis

Q#3

①

What is lunar eclipse? Explain in detail with apt diagrams.

Lunar Eclipse:-

A Lunar Eclipse occurs when the earth passes directly b/w the sun and the moon, causing the Earth's shadow to block the sunlight that normally reflects off the moon's surface. This phenomenon can only happen during a full moon when the sun, Earth and moon are aligned in a straight line or nearly so.

Types of Lunar Eclipses:-

1. Total Lunar Eclipse:-

The entire moon passes through the Earth's umbral region. During a total lunar eclipse, the moon can take on a reddish hue, often referred to as a "Blood Moon", due to Rayleigh scattering of sunlight through the Earth's atmosphere.

2. Partial Lunar Eclipse:-

Only a portion of the moon enters the Earth's Umbra, while the rest remains illuminated by direct sunlight. This results in a part of the moon appearing darkened.

3. Penumbral Lunar Eclipse:-

The moon passes through the Earth's penumbra (the outer part of the shadow), leading to a subtle shading on the moon's surface. This type is often difficult to observe as the change is not very dramatic.

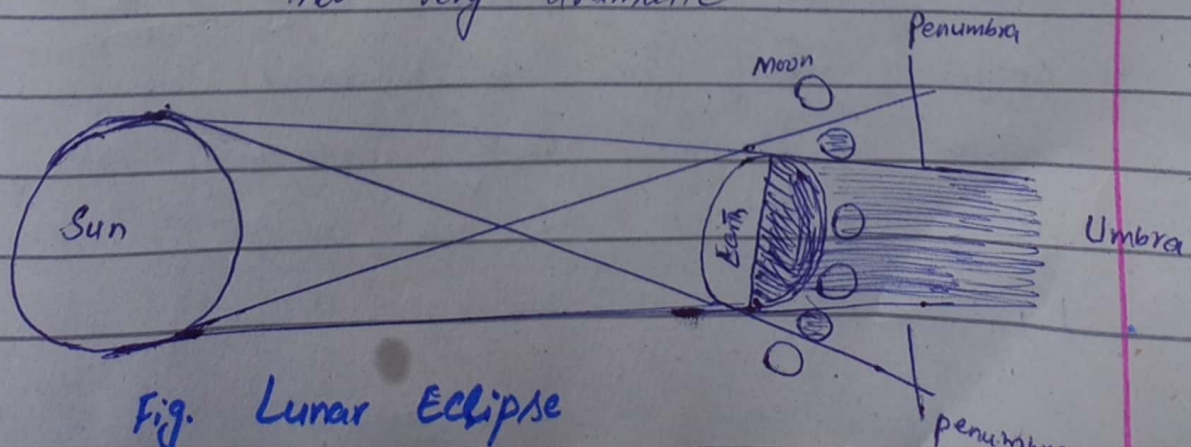


Fig. Lunar Eclipse

(b)
Explain Function of enzymes in detail with examples.

Enzymes:-

Enzymes are biological catalysts that facilitate and accelerate chemical reactions in living organisms.

Function of Enzymes:-

1- Catalysis:- Enzymes speed up reactions by lowering the activation energy required for the reaction to occur. This allows biological processes to happen at rates necessary for life.

e.g. Catalase enzyme catalyzes the breakdown of hydrogen peroxide into water and oxygen.

2. Specificity:-

Enzymes are highly specific to their substrates due to the unique shape of their active sites, which allows them to bind only to particular substrate. e.g. Sucrose specifically catalyzes the hydrolysis of sucrose into glucose and fructose.

3- Enzyme activity can be regulated through various mechanisms, ensuring metabolic pathways are responsive to the cell's needs.

4- Many enzymes require additional non-protein molecules called **Co-factors** (often metal ions) or **Coenzymes** (organic molecules, typically derived from vitamins to be active)

5- **Metabolic pathways:-**

Enzymes function in metabolic pathways where the product of one reaction serves as the substrate for the next, facilitating complex biological processes. e.g. In Krebs cycle, multiple enzymes such as **citrate synthase** and **isocitrate dehydrogenase** work sequentially to convert acetyl-CoA into energy rich molecules like ATP, NADH and $FADH_2$.

(d)

Are earthquakes and volcanic eruptions interconnected? If yes, when how?

Ans:

Yes, earthquakes and volcanic eruptions are interconnected, primarily due to the dynamics of tectonic plates and the movement of magma beneath the Earth's surface.

1- **Tectonic Activity:-**

Plate boundaries:- Both earthquakes and volcanic eruptions often occur along tectonic plate boundaries. These boundaries can be convergent (where plates collide), divergent (where plates move apart),

or transform (where plates slide past each other).

Stress Accumulation:- As tectonic plates move, stress accumulates in the Earth's crust. When this stress exceeds the strength of rocks, it results in an earthquake. This same tectonic activity can also create conditions for volcanic eruptions.

2. Magma Movement:-

Seismic Activity:- The movement of magma within the Earth's crust can cause pressure to build up. As magma rises, it can fracture surrounding rock, leading to earthquakes. These small earthquakes often occur before a volcanic eruption.

Eruption Triggers:- The fracturing of rock can also create pathways for magma to reach the surface, resulting in a volcanic eruption. Thus, seismic activity can precede volcanic eruptions, indicating that magma is moving towards the surface.

3. Volcanic Earthquakes:-

Types of Earthquakes:- Volcanic eruptions can produce specific types of earthquakes, known as volcanic earthquakes. These are typically caused by the movement of magma and the

fracturing of rocks as pressure builds.

Monitoring:-

Scientists often monitor seismic activity around volcanoes as a means of predicting eruptions. Increased earthquake frequency and intensity can signal that an eruption is imminent.

4. Geological Features:-

Some large volcanic systems can create calderas, the large depressions formed after a volcanic eruption. The formation and collapse of these structures can also induce earthquakes.

In subduction zones, where one tectonic plate moves under another, both earthquakes and volcanic activity are prevalent. The descending plate can melt and create magma, which may lead to volcanic eruptions, while the same processes can generate significant seismic activity.

Conclusion:-

Earthquakes and volcanic eruptions are interconnected through the complex interactions of tectonic processes and magma movement.
Monitoring (processes and magma movement)

seismic activity is crucial for predicting volcanic eruptions, helping to mitigate hazards associated with both phenomena.

Section-II