General Science and Ability

Q What is dengue? Give abrief account of its causative agents and its symptoms?

Answer

Dengue:

Dengue is the viral illness transmitted primarily by mosquitos particularly the Aedes Aegypti and Aedes Albopictus species. It is prevalent in tropical and subtropical regions around the world especially during the rainy season when mosquito populations thrive.

Causative Agents:

Dengue is caused by dengue virus which belongs to flavivirus family. There are four distinct serotypes of the family (DENV-1, DENV-2, DENV-3 and DENV-4)

Infection with one serotype gives protection to that specific type but not the others. This leads to more serious virus and illness if a person is infected by a different serotype later

Symptoms:

The symptoms of typicolly dengue range from 4 to 10 days after being bitten by infected mosquito

1. High fever
2. Nausea and vomiting
3. Severe headache
4. Joint and muscle pain
5. Fatigue (Extreme tiredness)
6. Skin rash (A rash may develop as a symptom)
7. Mild bleeding (bleeding and gum bleeding)

Some times and in some cases Dengue can leads to (dengue hemorrhagic fever) which can lead to serious complications and even death. such as bleeding

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

Mitochondria:

Mitochondria are called the powerhouse of the cell because they produce energy which is required by the cells. They are unique and they are present in all eukaryotic cells

Structure of Mitochondria:

Outer membrane:

The outer layer is smooth and acts as a protective barrier.

It contains proteins called porins that allow small molecules ions to pass

Inner membrane:

1) Inner membrane is folded into structure called cristae.
2) These folds increase the surface area required for energy production.
3) The inner membrane is impermeable to most substance which helps create a environment inside the mitochondria

Intermembrane space:

This is the space between outer and inner membrane that requires a key role in energy production.

Matrix:

The innermost space is filled with gellike fluid that is matrix.
. Matrix contains enzymes, ribosomes, mitochondrial DNA. that is needed for metabolic process.

Functions of Mitochondria:

Mitochondria are primarily responsible for producing ATP (Adenosine Triphosphate) The main energy currency of the cell.
They do this through several key processes.

Cellular Respiration:

Mitochondria plays a key role in converting nutrients into Adenosine Triphosphate (ATP) following three of the steps.

Glycolysis: Occurs in cytoplasm. where glucose is broken down into Pyruvate

Krebscycle: Pyruvate enters mitochondria & produce electron carries NADH and FADH located in inner membrane. It uses NADH and FADH2 to create proton gradient

ETC. flow back to matrix through ATP synthase to produce

Regulation of metabolism:

Mitochondria help regulate various metabolic pathway including the breakdown of fats and metabolism of ammonia.

Apoptosis:

Mitochondria can release proteins that trigger cell death which are damaged or no longer needed. This is important for maintaining healthy tissue.

Calcium storage:

Mitochondria stores calcium ions which is important for signaling function.

Heat production:

In some specialized cells like the brown fat cell, mitochondria generate heat instead of ATP through a process called non-shivering thermogenesis.

Q) Why are mitochondria called the power house of cell?

Mitochondria are referred as the power house of the cell because they are the site for main ATP production through cellular respiration. ATP serves as a vital energy source for many cellular respiration including muscle contraction, nerve impulse or biosynthesis of molecules. Without mit cell would struggle to produce the e needed for life.

PART B

1 Explain functions of enzymes in detail with examples?

Enzymes are biological catalysts that accelerates the chemical reaction in the body. They are crucial for various physiological processes and play a key role in digestion, metabolism and DNA replication.

Catalysis:
Enzymes lower the activation energy required for reaction to occur. This mean reaction can occur faster and at lower temperature.

Example
Amylases:
This enzyme is found in Saliva that catalyzes the breakdown of starch into simple sugars like maltose and glucose.

Specificity
Enzymes that are highly specific mean they catalyzes specific type of reaction that fit in the specific type of substrate

Example
lactase: This enzyme is found in sugar in milk. It is the break down of lactose into glucose and galactose.

Regulation:

Enzyme activity can be regulated by various factors including temperature pH and and concentration of substrates or inhibitors. This regulation allows cell to control metabolic pathways and respond to change in environment.

Example:
Phospho FructoKinase:

This enzyme plays a key role in glycolysis and regulated by the level of ATP and ADP in the cell. High level of ATP inhibit activity where high level of ADP activates it helping the cell to manage it.

CoFactor and Coenzyme:

Many enzymes require additional molecules to function properly. Cofactors are usually metallions or zinc ions like magnesium) while coenzymes are organic molecules that is derived from vitamins.

Example:
Hexokinase:

This enzyme which catalyzes the phosphorylation of glucose requires magnesium ion to help stabilize the negative charge of ATP.

Enzyme Substrate Complex Formation

Chymotrypsin: This digestive enzyme cleaves peptide bonds in proteins. Binds to substrate and catalyzes the reaction and

releasing smaller peptides.

Feedback Inhibition:
In many metabolic pathways, the end product can inhibit an earlier step preventing overproduction of substances

Threonine Deaminase: This enzyme is involved in biosynthesis of amino acid isoleucine when isoleucine is high it binds to threonine deaminase and inhibits it

Energy Transformation:
Enzymes are responsible for transforming energy from one to another which is crucial for cellular processes.

ATP Synthatase: Essential for production of ATP during cellular respiration. It utilizes the proton gradient that is generated by electron transport chain to synthetize ATP from ADP and inorganic phosphate

Q Are earthquakes and volcanic eruptions interconnected? If yes then how?

Ans Yes earthquake and volcanic eruptions are interconnected because they occur as a result of tectonic plates.

Tectonic plate movement:
Earthquakes are caused by the movement of tectonic plates. When these plates shift this creates stress that leads to earthquake volcanic eruptions occurs at plate boundaries specially at divergent or convergent boundaries

Magma movement:

The movement of magma within the earth can trigger earthquakes. As magma ascends through crust, it cause the surrounding rocks to fracture leading to seismic activity. This occurs before the volcanic eruption as pressure of accumulating magma increases.

Aftershock and Volcanic activity

After a significant earthquake, there can be increased volcanic eruption in the region. Earthquake may change the pressure and stress conditions in crust allowing to more magma to flow.

Monitoring and Prediction.

Seismologist often monitor seismic activity around volcanoes to predict eruptions. Increased seismic activity can indicate that magma is moving towards surface providing warning of potential eruption.

Question no.4:

What is noise pollution? Give its harmful effects and ways to curb:

Noise pollution definition:

Noise pollution refers to unwanted or harmful effects of sound in the environment of [illegible] / resulting from industrial activities traffic construction and urbanization

Harmful effects:

Health Issues:

Prolong exposure to loud noise will lead to hearing loss hypertension, stress and sleep disturbance

Impaired Communication:

Excessive noise can hinder ineffective communication leading to misunderstanding

Impact on Wildlife:

Disrupt animal behavior by affecting mating, feeding and navigation

Reduced Quality of lify:

Overall it will create irritability and diminsed and decreesed sense of overall wellbeing

Q What is the importance of fiber in diet:

Digestive health: Fiber aids in digestion by promoting regular bowel movements & preventing constipation

Management of health by weight control

High fibers also fulfilling which can control appetite

Blood Sugar level Control

Soluble fiber slower the absorption of sugar

Improve heart health.

Soluble fiber can lower the cholesterol level

Nutrient Intake: ~~Fiber [illegible]~~ [illegible]

Characteristics of balanced food platter:-

1 Fruits & Vegetables.

2 Whole grains.

3 Proteins.

4 Dairy alternatives:

Proportionality

Fruits & vegetables: It make half of the plate

Grains: Fill about a quarter of plate

Proteins: Fill about quarter of plate

Healthy Fats: Healthy fats like olive oil, avocados and nuts in proportion

Last Section.

Internet Standards:

Internet standards are technical specifications and guidelines that ensure interoperability, functionality and security of internet and its various components

Purpose of Internet Standards.

Interoperability: Different systems and devices can work together

Consistency: Provide uniformity.

Security:
Establish protocol for safe data transmission and protection against threat

Key Organizations:
IETF Internet engineering task force
Develop and promote voluntary internet standards particularly related to TCP/IP protocol

W3C (World Wide Web Consortium)
Focus on standards of web including HTML, CSS and accessibility guidelines

ISO (International Organization for Standardization)
Develop international standards that include internet technology

Types of Standards:
Protocol: Set rules for data communication eg HTTP for web traffic, SMTP for email)

Format: Define data structure (eg JSON, XML) that data can be read and processed by different systems

Security Standard:
Establish guidelines for secure communication.
eg (HTTPS, SSL/TLS)

Importance of Standards:
Innovation: Provide a foundation for developers to create new application and services

User trust: Enhance Security, privacy, fostering trust among users and business

Global reach: Enable a universally accessible internet that can be used by anyone or anywhere

Fat Soluble Vitamins:

They are group of vitamins that dissolve in fats and oil allowing them to be stored in body's fat tissue and liver. There are four main types of fat soluble vitamin A D, E and K

Vitamin A Essential for vision, immune function and health

Vitamin D
Bone absorption and calcium absorption
~~Regulate calcium and phosphorus in body~~

Vitamin E
Act as antioxident protecting cells from oxidative damage. Vital for immune system and skin health

Vitamin K:
Crucial for blood clotting & bone health in prevent of blood clots

Sources:

Vitamin A:
Carrots, Sweet potato, Spinach, liver

Vitamin D:
Exposure to sunlight
Fatty fish, dairy product

Vitamin E:
Nuts, seeds, vegetable oil, green leafy vegetables

Vitamin K:
leafy green (such as kale & spinach)
broccoli and fermented food