EMRS TGT Tier II Descriptive Science Sample Questions with Model Solution 4 English

Q1. Describe the structure and function of mitochondria. Explain why they are called the powerhouse of the cell.

Answer

Introduction

Mitochondria are double-membraned cell organelles present in most eukaryotic cells. They play a central role in cellular respiration and energy production, making them essential for survival of living organisms.

Structure

Each mitochondrion has an outer membrane and a highly folded inner membrane. The folds of the inner membrane are called cristae, which increase surface area for biochemical reactions. The inner region enclosed by the membrane is called the matrix, containing enzymes, mitochondrial DNA, and ribosomes. The presence of their own DNA allows mitochondria to replicate independently within the cell.

Function

Mitochondria are the site of aerobic respiration. During respiration, glucose is broken down in the presence of oxygen to produce ATP (adenosine triphosphate), carbon dioxide, and water. ATP acts as the energy currency of the cell and powers activities such as muscle contraction, nerve impulse transmission, and biosynthesis.

Conclusion

Because mitochondria generate most of the usable energy required by the cell, they are rightly known as the "powerhouse of the cell." Their structural adaptations ensure efficient energy production necessary for life processes.

Q2. Explain the process of respiration in humans. How is oxygen transported in the body?

Answer

Introduction

Respiration is a vital life process through which organisms obtain energy from food. In humans, respiration involves breathing and cellular breakdown of glucose to release energy.

Process of Respiration

Respiration occurs in two stages: external respiration and internal respiration. During breathing, oxygen enters the lungs and reaches the alveoli, where it diffuses into the bloodstream. Oxygen is transported to body tissues where it participates in cellular respiration within mitochondria. Glucose combines with oxygen to release energy, producing carbon dioxide and water as by-products.

Transport of Oxygen

Oxygen is transported mainly by haemoglobin present in red blood cells. Haemoglobin binds with oxygen to form oxyhaemoglobin in the lungs. This compound travels through blood vessels to tissues, where oxygen is released for energy production. Carbon dioxide produced in cells is transported back to the lungs for exhalation.

Conclusion

Human respiration ensures continuous energy supply to cells. Efficient oxygen transport by haemoglobin enables survival and supports all metabolic activities.

Q3. Explain Mendel's law of segregation with the help of a monohybrid cross.

Answer

Introduction

Mendel's law of segregation is a fundamental principle of heredity which explains how traits are transmitted from parents to offspring. It is also known as the law of purity of gametes.

Statement of the Law

According to this law, the two alleles of a trait separate during gamete formation, so each gamete receives only one allele.

Monohybrid Cross Explanation

Consider tall (T) and dwarf (t) pea plants. When a pure tall plant (TT) is crossed with a pure dwarf plant (tt), the first filial generation consists entirely of tall plants (Tt). When these hybrid plants are self-pollinated, the second generation shows both tall and dwarf plants in a 3:1 ratio.

This occurs because during gamete formation, T and t separate and combine randomly during fertilisation.

Conclusion

Mendel's law of segregation explains how traits remain distinct and predictable across generations, forming the basis of classical genetics.

Q4. Explain the mechanism of food transport in plants and its importance for growth and survival.

Answer

Introduction

Plants synthesise food in leaves through photosynthesis. This food must be transported to other parts of the plant for growth and storage.

Mechanism of Transport

Food is transported through phloem tissue by a process known as translocation. Sugars produced in leaves move from source (photosynthetic tissues) to sink (roots, fruits, stems). The movement occurs due to pressure differences created by active loading of sugars into phloem tubes.

Water enters phloem by osmosis, creating high pressure at the source. This pressure pushes food solution toward areas of lower pressure, where sugars are used or stored.

Importance

Efficient transport ensures that growing tissues receive nutrients for cell division and development. It supports fruit formation, root growth, and energy storage.

Conclusion

Translocation through phloem enables distribution of nutrients throughout the plant, ensuring coordinated growth and survival.

Q5. Describe the process of excretion in human beings. Explain how kidneys maintain internal balance in the body.

Answer

Introduction

Excretion is the removal of metabolic wastes from the body. In humans, kidneys play a crucial role in eliminating nitrogenous wastes and maintaining homeostasis.

Process of Excretion

Blood enters the kidneys through renal arteries. Each kidney contains millions of nephrons, the functional units of excretion. In the nephron, blood is filtered in the glomerulus. Useful substances such as glucose and salts are reabsorbed, while waste products like urea remain in the filtrate. The filtrate forms urine, which passes through ureters to the urinary bladder and is expelled through the urethra.

Maintenance of Internal Balance

Kidneys regulate water balance, salt concentration, and pH of blood. They adjust urine volume depending on body needs, thus maintaining fluid and electrolyte balance.

Conclusion

Through filtration, reabsorption, and secretion, kidneys remove wastes and regulate internal conditions, ensuring proper functioning of the body.