

Ch.2 Self-Quiz Biology Questions and Answers PDF

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What is the primary function of the ribosome in the cell?

- DNA replication
- Protein synthesis ✓
- Lipid synthesis
- Energy production

The ribosome is essential for protein synthesis in the cell, translating messenger RNA (mRNA) into polypeptide chains that fold into functional proteins.

Which of the following are functions of proteins in the cell?

- Enzyme catalysis ✓
- Genetic information storage
- Structural support ✓
- Energy storage

Proteins play crucial roles in the cell, including acting as enzymes, providing structural support, facilitating transport, and regulating cellular processes.

Explain the process of DNA replication and the role of enzymes involved in this process.

The process of DNA replication begins with the unwinding of the double helix by the enzyme helicase, which separates the two strands of DNA. DNA polymerase then synthesizes new strands by adding complementary nucleotides to each template strand. Other enzymes, such as primase, lay down RNA primers to initiate synthesis, while ligase seals any gaps between Okazaki

fragments on the lagging strand. This results in two identical DNA molecules, each containing one original and one newly synthesized strand.

Which of the following is a characteristic of prokaryotic cells?

- Presence of a nucleus
- Membrane-bound organelles
- Circular DNA ✓
- Large size compared to eukaryotic cells

Prokaryotic cells are characterized by the absence of a nucleus and membrane-bound organelles, making them simpler in structure compared to eukaryotic cells.

Which organelles are involved in energy conversion within the cell?

- mitochondria ✓
- Ribosomes
- Chloroplasts ✓
- Golgi apparatus

The main organelles involved in energy conversion within the cell are mitochondria and chloroplasts. Mitochondria convert nutrients into ATP through cellular respiration, while chloroplasts convert sunlight into chemical energy via photosynthesis.

Discuss the importance of the cell membrane's structure in maintaining homeostasis within the cell.

The cell membrane's selective permeability allows it to control the internal environment of the cell, ensuring that essential nutrients enter, waste products exit, and the overall balance of ions and molecules is maintained.

What is the main purpose of photosynthesis?

- To produce ATP for cellular activities
- To convert solar energy into chemical energy ✓

- To break down glucose into simpler molecules
- To recycle carbon dioxide in the atmosphere

The main purpose of photosynthesis is to convert light energy into chemical energy stored in glucose, which serves as food for plants and other organisms. This process also produces oxygen as a byproduct, essential for the survival of aerobic life forms.

Which processes are part of cellular respiration?

- Glycolysis ✓
- Calvin cycle
- Krebs cycle ✓
- Electron transport chain ✓

Cellular respiration consists of three main processes: glycolysis, the citric acid cycle (Krebs cycle), and oxidative phosphorylation (electron transport chain and chemiosmosis). These processes work together to convert glucose into ATP, the energy currency of the cell.

Describe the differences between aerobic and anaerobic respiration in terms of energy yield and by-products.

Aerobic respiration yields approximately 36-38 ATP molecules per glucose molecule and produces carbon dioxide and water as by-products. In contrast, anaerobic respiration yields only 2 ATP molecules per glucose molecule and produces by-products like lactic acid in animals or ethanol and carbon dioxide in yeast.

Which stage of cellular respiration produces the most ATP?

- Glycolysis
- Krebs cycle
- Electron transport chain ✓
- Fermentation

The electron transport chain is the stage of cellular respiration that produces the most ATP, generating approximately 28 to 34 ATP molecules per glucose molecule. This process occurs in the inner

mitochondrial membrane and utilizes the energy from electrons transferred through a series of proteins.

Which macromolecules are primarily involved in cell membrane structure?

- Carbohydrates
- Proteins ✓**
- Lipids ✓**
- Nucleic acids

Cell membrane structure is primarily composed of phospholipids, proteins, and cholesterol, which work together to create a fluid and dynamic barrier. These macromolecules contribute to the membrane's selective permeability and functionality.

Analyze how mutations in DNA can affect protein synthesis and potentially lead to diseases.

Mutations can lead to changes in the mRNA sequence during transcription, which may result in the production of abnormal proteins during translation, ultimately causing various diseases.

What is the role of the Golgi apparatus in the cell?

- DNA replication
- Protein modification and sorting ✓**
- Energy production
- Photosynthesis

The Golgi apparatus is responsible for modifying, sorting, and packaging proteins and lipids for secretion or delivery to other organelles. It plays a crucial role in processing and transporting cellular materials.

Which of the following statements about enzymes are true?

- Enzymes are consumed in the reactions they catalyze.
- Enzymes lower the activation energy of reactions. ✓**
- Enzymes are specific to their substrates. ✓**

- Enzymes can be reused multiple times. ✓

Enzymes are biological catalysts that speed up chemical reactions in living organisms without being consumed in the process. They are specific to substrates and function optimally under certain conditions such as temperature and pH.

Evaluate the impact of environmental factors on enzyme activity, providing examples of how temperature and pH can alter enzyme function.

Temperature affects enzyme activity by increasing reaction rates up to an optimal point, beyond which enzymes may denature; for example, most human enzymes function best around 37°C. Similarly, pH levels can alter enzyme shape and function, with pepsin operating optimally at a low pH in the stomach, while other enzymes like amylase function better at a neutral pH.

What is the primary role of chlorophyll in photosynthesis?

- Absorb carbon dioxide
- Absorb light energy ✓
- Release oxygen
- Store glucose

Chlorophyll is essential for photosynthesis as it absorbs light energy, primarily from the sun, which is then used to convert carbon dioxide and water into glucose and oxygen.

Which of the following are stages of the Calvin cycle?

- Carbon fixation ✓
- Reduction phase ✓
- Glycolysis
- Regeneration of RuBP ✓

The Calvin cycle consists of three main stages: carbon fixation, reduction, and regeneration of ribulose biphosphate (RuBP). These stages work together to convert carbon dioxide into glucose during photosynthesis.

Describe the role of ATP in cellular processes and explain how it is generated and utilized within the cell.

ATP (adenosine triphosphate) is generated mainly through cellular respiration, specifically in the mitochondria during processes like glycolysis, the Krebs cycle, and oxidative phosphorylation. It is utilized by cells to power various functions, including muscle contraction, nerve impulse propagation, and the synthesis of macromolecules.

Which type of bond holds the two strands of DNA together?

- Ionic bonds
- Covalent bonds
- Hydrogen bonds ✓**
- Peptide bonds

The two strands of DNA are held together by hydrogen bonds between complementary nitrogenous bases. These bonds are crucial for the stability and structure of the DNA double helix.

Which components are part of the nucleotide structure?

- Phosphate group ✓**
- Amino acid
- Nitrogenous base ✓**
- Pentose sugar ✓**

Nucleotides are the building blocks of nucleic acids and consist of three main components: a phosphate group, a five-carbon sugar (ribose or deoxyribose), and a nitrogenous base (adenine, thymine, cytosine, guanine, or uracil). Together, these components form the structure of DNA and RNA.

Discuss the significance of the fluid mosaic model in understanding cell membrane dynamics.

The fluid mosaic model signifies that cell membranes are composed of a phospholipid bilayer with embedded proteins that can move laterally, facilitating dynamic interactions and functions essential for cellular life.

What is the main function of the lysosome in the cell?

- Protein synthesis
- Digestion of macromolecules ✓
- Energy production
- Photosynthesis

Lysosomes are membrane-bound organelles that contain digestive enzymes to break down waste materials and cellular debris. They play a crucial role in cellular cleanup and recycling processes.

Which processes are involved in gene expression?

- Transcription ✓
- Translation ✓
- DNA replication
- RNA splicing ✓

Gene expression involves two main processes: transcription, where DNA is converted into messenger RNA (mRNA), and translation, where mRNA is used to synthesize proteins. These processes are essential for the regulation and expression of genes in cells.

Explain how the principles of Mendelian genetics apply to modern genetic research and the study of hereditary diseases.

Modern genetic research applies Mendelian genetics by using the principles of segregation and independent assortment to study how traits and diseases are inherited, allowing researchers to identify genetic markers associated with hereditary diseases and develop targeted therapies.

Which phase of the cell cycle is characterized by DNA replication?

- G1 phase
- S phase ✓
- G2 phase
- M phase

The S phase, or synthesis phase, of the cell cycle is where DNA replication occurs, resulting in the duplication of the genetic material in preparation for cell division.

Which of the following are functions of carbohydrates in biological systems?

- Energy storage ✓
- Structural support ✓
- Catalysis of reactions
- Cell recognition ✓

Carbohydrates serve several essential functions in biological systems, including providing energy, serving as structural components, and playing roles in cell recognition and signaling.

Analyze the relationship between structure and function in enzymes, providing examples of how enzyme structure can influence its activity.

Enzyme structure directly influences its activity through the shape and properties of the active site, which determines substrate binding and catalytic efficiency. For instance, the enzyme lactase has a specific structure that allows it to effectively break down lactose, while any structural changes can lead to reduced or lost activity.

What is the main function of the nucleolus within the nucleus?

- DNA replication
- Ribosome production ✓**
- Lipid synthesis
- Protein degradation

The nucleolus is primarily responsible for the synthesis and assembly of ribosomal RNA (rRNA) and ribosome subunits, which are essential for protein synthesis in the cell.