

University of Central Florida (UCF) BSC2010C Biology I Practice Exam 3 (Sample)

Study Guide



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Questions

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1. Which best describes the function of ribonucleic acid (RNA)?
 - A. RNA is responsible for storing genetic information
 - B. RNA synthesizes proteins based on DNA templates
 - C. RNA has no role in protein synthesis
 - D. RNA is the main component of chromosomes
2. Which regulators do not apply to cancer cells?
 - A. Density dependence and apoptosis
 - B. Anchorage dependence and density dependence
 - C. Apoptosis and cell cycle checkpoints
 - D. All of the above
3. What occurs during kinesis in cell division?
 - A. Chromosomes are replicated
 - B. Cells undergo physical movement
 - C. Chromatids are separated
 - D. Cell membranes are reformed
4. Which process is primarily associated with the mitochondria?
 - A. Photosynthesis
 - B. Cellular respiration
 - C. Protein synthesis
 - D. Lipid metabolism
5. Which type of tumors are often benign and do not spread?
 - A. Malignant tumors
 - B. Benign tumors
 - C. Carcinomas
 - D. Metastatic tumors

6. What does a high level of MPF and CDK indicate in the cell cycle?
- A. The cell is preparing for DNA replication
 - B. The cell is ready to transition into division
 - C. The cell is undergoing repair mechanisms
 - D. The cell is in resting phase
7. What is between meiosis I and meiosis II?
- A. A small G1 phase
 - B. No phase occurs
 - C. A complete cellular division
 - D. An S phase
8. Where does the Calvin Cycle occur in plant cells?
- A. In the chloroplast membrane
 - B. In the stroma of the chloroplast
 - C. In the cytoplasm
 - D. In the thylakoid lumen
9. What is the primary function of biochemicals in the cell cycle?
- A. Stimulate the transitions through the cell cycle
 - B. Inhibit cell growth
 - C. Repair DNA damage
 - D. Facilitate nutrient absorption
10. During which phase of meiosis II do chromosomes begin to de-condense?
- A. Anaphase
 - B. Telophase
 - C. Metaphase
 - D. Prophase

Answers

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1. B
2. B
3. C
4. B
5. B
6. B
7. A
8. B
9. A
10. B

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Explanations

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1. Which best describes the function of ribonucleic acid (RNA)?

- A. RNA is responsible for storing genetic information
- B. RNA synthesizes proteins based on DNA templates
- C. RNA has no role in protein synthesis
- D. RNA is the main component of chromosomes

Ribonucleic acid (RNA) plays a crucial role in the synthesis of proteins, serving as a messenger between DNA and the protein-making machinery of cells. The process of protein synthesis involves transcription, where RNA is synthesized from a DNA template, and translation, where the RNA is used as a blueprint to assemble amino acids into a polypeptide chain, resulting in a protein. RNA carries the coded information from the DNA, which is housed in the cell nucleus, and transports it to the ribosomes, the sites of protein synthesis in the cell. This function is pivotal because it bridges the gap between the genetic instructions carried by DNA and the actual formation of proteins, which perform a multitude of functions necessary for the life of the cell and, by extension, the organism. Various types of RNA are involved in this process, including messenger RNA (mRNA), transfer RNA (tRNA), and ribosomal RNA (rRNA), each playing specific roles during transcription and translation. Storing genetic information is primarily the role of DNA, while RNA is instead involved in the active expression of genes by facilitating protein synthesis. The statement regarding RNA having no role in protein synthesis is inaccurate, as RNA's primary function is fundamentally linked to this process. Lastly, while RNA

2. Which regulators do not apply to cancer cells?

- A. Density dependence and apoptosis
- B. Anchorage dependence and density dependence
- C. Apoptosis and cell cycle checkpoints
- D. All of the above

Cancer cells are characterized by their ability to grow and divide uncontrollably, often disregarding the normal regulatory mechanisms that govern cell behavior. Anchorage dependence refers to the requirement for cells to be attached to a solid surface to grow and proliferate. Normal cells require this attachment to regulate their life cycle properly, but cancer cells can grow without being anchored, allowing them to invade other tissues and spread throughout the body. Density dependence is another regulatory mechanism that prevents overcrowding of cells. In normal tissue, when cells become too densely packed, growth is inhibited. This regulation is lost in cancer cells, which continue to divide regardless of cell density, leading to tumor formation. Apoptosis, or programmed cell death, is a critical process that helps maintain healthy tissue by removing damaged or unnecessary cells. Many cancer cells develop mechanisms to evade apoptosis, allowing them to survive and proliferate despite genetic damage that would normally trigger cell death. Cell cycle checkpoints are regulatory pathways that ensure the proper progression of the cell cycle. They monitor the DNA for damage and ensure that cells only proceed to the next phase of the cycle when they are ready. Cancer cells often have mutations that impair these checkpoints, leading to unchecked cell division. Considering these aspects, it is evident that both anchorage dependence and density dependence do not apply to cancer cells.

3. What occurs during kinesis in cell division?

- A. Chromosomes are replicated
- B. Cells undergo physical movement
- C. Chromatids are separated
- D. Cell membranes are reformed

Kinesis in the context of cell division refers specifically to the separation of chromatids during mitosis. After the chromosomes have aligned along the metaphase plate during metaphase, kinesis describes the process in anaphase where the sister chromatids are pulled apart toward opposite poles of the cell. This critical step ensures that each daughter cell receives an identical set of chromosomes, maintaining genetic consistency through cell division. While the other options describe important processes in cell division, they do not accurately define kinesis. Chromosome replication occurs prior to mitosis, during the S phase of the cell cycle, and is vital for ensuring that there are two complete sets of chromosomes available for distribution. Physical movement of cells may refer to various cellular activities, but in the specific context of kinesis, it pertains to the movement of chromatids. Lastly, the reformation of cell membranes is involved in the final stages of cell division, specifically during cytokinesis, but does not pertain to the process of kinesis during the separation of chromatids.

4. Which process is primarily associated with the mitochondria?

- A. Photosynthesis
- B. Cellular respiration
- C. Protein synthesis
- D. Lipid metabolism

The process primarily associated with the mitochondria is cellular respiration. This is a vital metabolic pathway in which cells convert biochemical energy from nutrients into adenosine triphosphate (ATP), using oxygen in the process. The mitochondria are often referred to as the "powerhouses" of the cell because they house the enzymes and structures necessary for the Krebs cycle (or citric acid cycle) and the electron transport chain, both crucial stages of cellular respiration. In cellular respiration, glucose and other organic molecules undergo oxidation to produce energy, while byproducts such as carbon dioxide and water are expelled. This energy production is vital for cellular functions, supporting everything from muscle contraction to neurotransmission. While photosynthesis occurs in chloroplasts and is responsible for converting light energy into chemical energy in plants, protein synthesis takes place primarily on ribosomes, and lipid metabolism is mainly associated with the endoplasmic reticulum and other cell compartments. Hence, cellular respiration's intricate relationship with the mitochondria solidifies it as the correct choice in this context.

5. Which type of tumors are often benign and do not spread?

- A. Malignant tumors
- B. Benign tumors
- C. Carcinomas
- D. Metastatic tumors

Benign tumors are characterized by their non-cancerous nature, which means they typically grow slowly, do not invade surrounding tissues, and do not spread to other parts of the body. This limited growth pattern differentiates them from malignant tumors, which are cancerous and can invade nearby tissues and metastasize, or spread, to other organs through the bloodstream or lymphatic system. Benign tumors can often be encapsulated, allowing them to be surgically removed with little risk of recurrence. Their presence may still cause health issues depending on their location and size, but they are generally considered less dangerous than their malignant counterparts. In contrast, carcinomas refer specifically to malignant tumors that arise from epithelial tissue, and metastatic tumors exist as a result of cancer cells spreading from a primary site to form new tumors elsewhere in the body.

6. What does a high level of MPF and CDK indicate in the cell cycle?

- A. The cell is preparing for DNA replication
- B. The cell is ready to transition into division
- C. The cell is undergoing repair mechanisms
- D. The cell is in resting phase

A high level of MPF (Maturation Promoting Factor) and cyclin-dependent kinase (CDK) indicates that the cell is ready to transition into division. MPF is a complex of cyclin B and CDK1, which is essential for the cell to progress from the G2 phase of the cell cycle into mitosis. When MPF levels are elevated, it signals that the cell has successfully completed the necessary preparations during the earlier phases of the cycle, and is now poised to initiate the processes involved in cell division, such as chromatin condensation, spindle formation, and ultimately, the separation of chromosomes. The presence of high levels of these proteins indicates that key checkpoints have been passed and that the cellular machinery is primed for mitotic entry, which is crucial for the accurate distribution of genetic material into daughter cells. Consequently, this stage is critical in ensuring that cell division occurs properly and that cellular proliferation is regulated effectively.

7. What is between meiosis I and meiosis II?

- A. A small G1 phase
- B. No phase occurs
- C. A complete cellular division
- D. An S phase

The correct answer highlights that there is a brief interphase that occurs between meiosis I and meiosis II, which is sometimes referred to as a small G1 phase. This brief phase is crucial because during this time, the cell does not replicate its DNA again. Instead, the chromosomes formed during meiosis I remain in their replicated state (as chromatids). This phase allows for a short period where the cell can prepare for the second meiotic division. While cells undergo G1, the focus is on ensuring that the cell is ready for the upcoming meiosis II, rather than duplicating the DNA. This is an important distinction from the entire interphase that occurs before meiosis I, where DNA replication happens during the S phase. Understanding this differentiation between the phases helps clarify the structure and timing of meiosis as a whole within the cell cycle.

8. Where does the Calvin Cycle occur in plant cells?

- A. In the chloroplast membrane
- B. In the stroma of the chloroplast
- C. In the cytoplasm
- D. In the thylakoid lumen

The Calvin Cycle occurs in the stroma of the chloroplast. The stroma is the fluid-filled space surrounding the thylakoids, where the light-independent reactions of photosynthesis take place. This process utilizes the ATP and NADPH produced during the light reactions, which occur in the thylakoid membranes. The Calvin Cycle is responsible for converting carbon dioxide into glucose through a series of enzyme-driven reactions, primarily involving ribulose biphosphate (RuBP) and the enzyme RuBisCO. This location is crucial because the stroma contains the necessary enzymes and substrates required for carbon fixation and the synthesis of carbohydrate molecules. The conditions in the stroma allow for the proper functioning of these enzymatic reactions, making it an essential site for the synthesis of organic compounds in plants.

9. What is the primary function of biochemicals in the cell cycle?

- A. Stimulate the transitions through the cell cycle
- B. Inhibit cell growth
- C. Repair DNA damage
- D. Facilitate nutrient absorption

The primary function of biochemicals in the cell cycle is to stimulate the transitions between the various phases of the cycle, such as from G1 to S phase and from G2 to mitosis. These biochemicals include cyclins and cyclin-dependent kinases (CDKs), which work together to ensure that cells progress through the cell cycle at the appropriate times. The regulation of these transitions is crucial for proper cell division and growth, as it ensures that each phase is completed correctly before the cell moves on to the next stage. By coordinating these processes, biochemicals help maintain cellular integrity and function, ultimately influencing growth and development. While the inhibition of cell growth, DNA repair, and nutrient absorption are important biological processes, they are not the primary role of the biochemicals specifically related to the regulation and transitions of the cell cycle. The emphasis on stimulating transitions highlights the vital role of these biochemicals in ensuring that the cell cycle proceeds in a controlled and timely manner.

10. During which phase of meiosis II do chromosomes begin to de-condense?

- A. Anaphase
- B. Telophase
- C. Metaphase
- D. Prophase

In meiosis II, chromosomes begin to de-condense during telophase. This phase follows anaphase, when sister chromatids are pulled apart to opposite poles of the cell. As the telophase progresses, the chromatids reach the poles, and a nuclear envelope starts to form around each set. During this process, the chromosomes, which are initially tightly packed, start to unwind and de-condense back into chromatin. This de-condensation is crucial for the eventual stage where the cell can move into cytokinesis and ultimately prepare for subsequent cellular processes. Telophase marks a transition point where the genetic material is no longer in a highly condensed form, which is necessary for proper gene expression and cell function going forward.