

# Arizona State University (ASU) BIO181 General Biology I Exam 1 Practice (Sample)

Study Guide



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## Questions

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1. What is a chromosome?
  - A. A structure composed of RNA and protein
  - B. A structure composed of DNA and protein that contains genetic information
  - C. A structure that synthesizes proteins
  - D. A small organelle that breaks down fatty acids
2. What source does the plasma membrane utilize to obtain new lipids?
  - A. None of the above
  - B. Environmental sources
  - C. Ribosomes
  - D. Endoplasmic reticulum
3. Which description best matches the law of segregation?
  - A. A. Traits are combined from both parents equally
  - B. B. Alleles for a trait separate during gamete formation
  - C. C. Only dominant alleles are expressed in offspring
  - D. D. Traits are inherited independently of one another
4. What is the role of calcium as a second messenger in cells?
  - A. To inhibit cellular processes
  - B. To promote cell division
  - C. To mediate intracellular signaling
  - D. To enhance energy production
5. What defines a keystone species?
  - A. Species that are the most abundant in an ecosystem
  - B. Species that have a minimal impact on their ecosystem
  - C. Species that have a disproportionately large impact on ecosystem structure
  - D. Species that are always at the top of the food chain

6. Which of these cell types primarily plays a role in the immune response?
- A. Lymphocyte
  - B. Fibroblast
  - C. Chondrocyte
  - D. Adipocyte
7. How do mitosis and meiosis differ in their outcomes?
- A. Mitosis produces two genetically identical cells; meiosis produces one genetically diverse cell.
  - B. Mitosis results in four genetically identical cells; meiosis results in two genetically diverse cells.
  - C. Mitosis produces two genetically identical daughter cells; meiosis produces four genetically diverse gametes.
  - D. Mitosis results in four genetically diverse cells; meiosis results in one genetically identical cell.
8. Which category of cells is described as constantly undergoing the cell cycle?
- A. Muscle cells
  - B. Neurons
  - C. Skin cells
  - D. Adipose cells
9. Which statement is false about cancer cells?
- A. Cancer cells are anchorage-dependent
  - B. Cancer cells have uncontrolled division
  - C. Cancer cells can survive without attachment to a substrate
  - D. Cancer cells can invade other tissues
10. Which component is a histone kinase responsible for during the cell cycle?
- A. Promoting mitosis.
  - B. Condensing DNA into chromosomes.
  - C. Regulating cytokinesis.
  - D. Inducing DNA replication.

## Answers

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

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## Explanations

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## 1. What is a chromosome?

- A. A structure composed of RNA and protein
- B. A structure composed of DNA and protein that contains genetic information
- C. A structure that synthesizes proteins
- D. A small organelle that breaks down fatty acids

A chromosome is correctly defined as a structure composed of DNA and protein that contains genetic information. This definition accurately captures the fundamental role of chromosomes in genetics, as they serve as the carriers of genetic material in living organisms. Each chromosome consists of a long DNA molecule that is tightly coiled around proteins known as histones. This organization is crucial for DNA packaging within the cell nucleus and also for the proper distribution of genetic material during cell division. The presence of both DNA and protein within a chromosome is essential for several processes. The DNA holds the genes, which determine inherited characteristics, while the associated proteins play key roles in maintaining the structure of the chromosome, regulating gene expression, and ensuring the correct segregation of chromosomes during cell division. While the other options mention structures related to cellular function, they do not accurately describe a chromosome. The focus on the combination of DNA and protein in option B is what makes it the correct answer, highlighting the chromosomal role in storing and transmitting genetic information.

## 2. What source does the plasma membrane utilize to obtain new lipids?

- A. None of the above
- B. Environmental sources
- C. Ribosomes
- D. Endoplasmic reticulum

The correct source from which the plasma membrane obtains new lipids is the endoplasmic reticulum. The endoplasmic reticulum, specifically the smooth endoplasmic reticulum, is responsible for the synthesis of lipids, including phospholipids and cholesterol, which are essential components of cellular membranes. This process plays a crucial role in maintaining the integrity and functionality of the plasma membrane. As new lipids are synthesized in the endoplasmic reticulum, they can be incorporated into the plasma membrane, allowing the cell to grow and adapt to its environment. The endoplasmic reticulum also facilitates the transfer of these lipids to other membranes within the cell. While environmental sources and ribosomes may play roles in other aspects of cellular function, they are not the primary sources for the lipid components of the plasma membrane. Environmental sources typically refer to nutrients taken up by the cell rather than direct lipid incorporation, and ribosomes are involved in protein synthesis, not lipid production. Thus, the endoplasmic reticulum is the key organelle involved in supplying new lipids to the plasma membrane.

### 3. Which description best matches the law of segregation?

- A. A. Traits are combined from both parents equally
- B. B. Alleles for a trait separate during gamete formation
- C. C. Only dominant alleles are expressed in offspring
- D. D. Traits are inherited independently of one another

The law of segregation specifically dictates that alleles for a given trait separate from each other during the process of gamete formation, a crucial concept in Mendelian genetics. This means that when an organism produces gametes (such as sperm or eggs), the two alleles for each gene present in that organism will split so that each gamete carries only one allele. This ensures that offspring will receive one allele from each parent, leading to genetic variation. This principle reflects the physical behavior of chromosomes during meiosis, where homologous chromosomes (and therefore the alleles they carry) are separated into different gametes. This foundational aspect of inheritance lays the groundwork for understanding more complex patterns of inheritance and genetic diversity in populations.

### 4. What is the role of calcium as a second messenger in cells?

- A. To inhibit cellular processes
- B. To promote cell division
- C. To mediate intracellular signaling
- D. To enhance energy production

Calcium acts as a second messenger in cells primarily by mediating intracellular signaling pathways. This role is essential because calcium ions can rapidly change concentrations in response to various stimuli, thus triggering specific cellular responses. When a signaling molecule binds to a receptor on the cell membrane, it can lead to a release of calcium ions from intracellular storage, such as the endoplasmic reticulum, or increase their influx from outside the cell. This sudden change in calcium levels can activate or deactivate various proteins and enzymes, thereby orchestrating a wide array of cellular functions including muscle contraction, neurotransmitter release, and the regulation of metabolic pathways. The versatility of calcium as a second messenger allows it to participate in a multitude of signaling cascades, making it a critical component in the communication and function of cells. The other options do not accurately capture the primary role of calcium in cellular signaling. While calcium might influence cell division and energy production indirectly through its signaling pathways, these are not its primary roles as a second messenger.

## 5. What defines a keystone species?

- A. Species that are the most abundant in an ecosystem
- B. Species that have a minimal impact on their ecosystem
- C. Species that have a disproportionately large impact on ecosystem structure
- D. Species that are always at the top of the food chain

A keystone species is defined by its disproportionately large impact on the structure and function of an ecosystem relative to its abundance. This concept was introduced by the ecologist Robert Paine, who highlighted that certain species play critical roles in maintaining the health and stability of their environments, even if they exist in relatively low numbers. For instance, predatory keystone species can regulate the populations of other species, preventing any one group from dominating the ecosystem. By maintaining this balance, they support a diverse array of organisms and contribute to the complexity of food webs. In contrast, species that are abundant do not necessarily have a keystone role if their presence does not significantly affect other ecosystem components. Additionally, keystone species are not defined by their position in the food chain; they can be predators, herbivores, or even plants, depending on the specific interactions in their environment. Thus, the critical aspect that designates a species as a keystone is its vital role in shaping the ecological community.

## 6. Which of these cell types primarily plays a role in the immune response?

- A. Lymphocyte
- B. Fibroblast
- C. Chondrocyte
- D. Adipocyte

Lymphocytes are a critical component of the immune response, acting as the body's defense mechanism against infections and diseases. They are a type of white blood cell that identifies and attacks pathogens, such as bacteria and viruses. Specifically, there are various subtypes of lymphocytes, including T cells, which help destroy infected cells, and B cells, which produce antibodies that neutralize pathogens. Their primary role in recognizing antigens and orchestrating the immune response makes them essential to maintaining health and combating infections. In contrast, fibroblasts, chondrocytes, and adipocytes serve different functions within the body. Fibroblasts are involved in the production of collagen and the structural framework of tissues, chondrocytes are cells found in cartilage that maintain its health and integrity, and adipocytes are specialized cells that store energy in the form of fat. While these cell types are crucial for other bodily functions, they do not directly participate in the immune response like lymphocytes do.

## 7. How do mitosis and meiosis differ in their outcomes?

- A. Mitosis produces two genetically identical cells; meiosis produces one genetically diverse cell.
- B. Mitosis results in four genetically identical cells; meiosis results in two genetically diverse cells.
- C. Mitosis produces two genetically identical daughter cells; meiosis produces four genetically diverse gametes.
- D. Mitosis results in four genetically diverse cells; meiosis results in one genetically identical cell.

Mitosis and meiosis are two distinct forms of cell division that serve different purposes in living organisms. Mitosis is responsible for producing two daughter cells that are genetically identical to the original cell, maintaining the same chromosome number. This process is crucial for growth, repair, and asexual reproduction in multicellular organisms. In contrast, meiosis is a specialized form of cell division that occurs during the formation of gametes (egg and sperm cells) in sexually reproducing organisms. Meiosis consists of two rounds of division, resulting in four non-identical cells, each with half the chromosome number of the original cell. This reduction in chromosome number and the introduction of genetic variation through processes such as crossing-over and independent assortment are key to sexual reproduction, making each gamete genetically unique. The correct answer highlights that mitosis results in two genetically identical daughter cells, while meiosis produces four genetically diverse gametes, reinforcing the distinct roles these processes play in the life cycle and genetic diversity of organisms.

## 8. Which category of cells is described as constantly undergoing the cell cycle?

- A. Muscle cells
- B. Neurons
- C. Skin cells
- D. Adipose cells

Skin cells are constantly undergoing the cell cycle due to their high turnover rate. This is essential for maintaining the protective barrier that skin provides against environmental damage and pathogens. Skin cells are continuously shed and replaced, making it vital for them to divide and replicate regularly through processes like mitosis. In contrast, muscle cells typically have a very limited capacity for division after they have fully differentiated, as they are specialized cells that focus on contraction rather than proliferation. Neurons are also largely post-mitotic, meaning they do not generally divide after development to form new neurons. Adipose cells, while they can divide, do not do so at the high rates observed in skin cells, as their primary function relates to storage and energy regulation rather than continuous renewal. Therefore, skin cells are the category that exemplifies constant cycling through the cell cycle, driven by the need for regular replacement and repair.

9. Which statement is false about cancer cells?

- A. Cancer cells are anchorage-dependent
- B. Cancer cells have uncontrolled division
- C. Cancer cells can survive without attachment to a substrate
- D. Cancer cells can invade other tissues

The statement that cancer cells are anchorage-dependent is false. In normal cell biology, anchorage dependence is a vital property of many types of cells, meaning they require attachment to a solid surface or extracellular matrix to grow and divide. This mechanism ensures that cells only proliferate in their proper locations within tissues. In contrast, cancer cells often lose this property. They can grow and divide without being attached to a substrate, allowing them to proliferate inappropriately and invade surrounding tissues. This lack of anchorage dependence contributes to the aggressive nature of cancer, as it facilitates uncontrolled growth and the potential for metastasis—spreading to other parts of the body. The other statements accurately reflect characteristics of cancer cells. They have uncontrolled division, enabling them to proliferate and form tumors. They also exhibit the ability to survive without the normal requirements for attachment, which is a feature that distinguishes them from healthy cells. Additionally, cancer cells can invade other tissues, which is a hallmark of malignancy and illustrates their capacity to disrupt normal cellular organization.

10. Which component is a histone kinase responsible for during the cell cycle?

- A. Promoting mitosis.
- B. Condensing DNA into chromosomes.
- C. Regulating cytokinesis.
- D. Inducing DNA replication.

A histone kinase plays a crucial role in the regulation of the cell cycle, particularly during mitosis. One of its primary functions is to add phosphate groups to histone proteins, which alters the structure of chromatin. This phosphorylation leads to the condensation of DNA into tightly packed chromosomes, a necessary process for ensuring proper segregation of genetic material during cell division. During the prophase of mitosis, histone kinases are active in modifying the histones associated with DNA, allowing for the chromatin to become more compact. This condensation is essential for the correct organization and distribution of chromosomes to the daughter cells. By facilitating this process, histone kinases enable the organization of genetic material, which is vital for successful mitosis and ultimately for cell division continuity. In summary, the role of histone kinases in promoting the condensation of DNA into chromosomes is fundamental for the proper execution of the cell cycle and ensures that genetic information is accurately passed on during cell division.