



BRAINIACS OLYMPIAD

GRADES 11-12
BIOLOGY SAMPLE PAPER
THEORETICAL PART



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BIOLOGY SAMPLE PAPER-GLOBAL FINAL

Grades: 11-12

Time: 120 minutes

Total points: 100

Question 1

DNA molecules must be copied accurately before cells divide.

Indicate which of the following statements are true or false.

- A. Each new DNA molecule contains one original strand and one newly synthesized strand.
- B. Complementary base pairing ensures accurate copying of genetic information.
- C. DNA replication occurs only after cell division is completed.
- D. Errors during replication can introduce genetic mutations.

Answer

- A. True
 - B. True
 - C. False
 - D. True
-

Question 2

Hormones regulate many physiological processes in the human body.

Indicate which of the following statements are true or false.

- A. Hormones are chemical messengers transported through the bloodstream.
- B. Hormones can influence the activity of specific target cells.
- C. Hormones act only on cells located in the gland where they are produced.
- D. Hormonal regulation often involves feedback mechanisms.

Answer

- A. True
 - B. True
 - C. False
 - D. True
-

Question 3

Proteins perform many functions inside living cells.

Indicate which of the following statements are true or false.

- A. Proteins are composed of amino acids linked together by peptide bonds.
- B. The sequence of amino acids influences how a protein folds.
- C. Proteins cannot change their structure under any conditions.
- D. Changes in protein structure may affect protein function.

Answer

- A. True
 - B. True
 - C. False
 - D. True
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Question 4

Cells obtain energy through metabolic processes.

Indicate which of the following statements are true or false.

- A. ATP acts as an energy carrier in cells.
- B. Cellular respiration releases energy stored in glucose.
- C. Oxygen is required for all forms of cellular respiration.
- D. Energy released in metabolism can be used for cellular work.

Answer

- A. True
 - B. True
 - C. False
 - D. True
-

Question 5

Genetic mutations can alter DNA sequences in different ways.

Indicate which of the following statements are true or false.

- A. Mutations may change the sequence of nucleotides in DNA.
- B. Some mutations have no observable effect on organisms.
- C. All mutations are harmful to organisms.
- D. Mutations provide genetic variation that can influence evolution.

Answer

- A. True
- B. True
- C. False
- D. True

Question 6

During gene expression, information stored in DNA is used to produce proteins.

Indicate which of the following statements are true or false.

- A. Messenger RNA carries genetic information from DNA to ribosomes.
- B. Ribosomes read codons on mRNA during protein synthesis.
- C. Transfer RNA molecules help bring specific amino acids during translation.
- D. DNA directly assembles amino acids into proteins inside ribosomes.

Answer

- A. True
 - B. True
 - C. True
 - D. False
-

Question 7

Enzymes function as biological catalysts in metabolic reactions.

Indicate which of the following statements are true or false.

- A. Enzymes increase the rate of chemical reactions by lowering activation energy.
- B. Each enzyme typically interacts with specific substrate molecules.
- C. Enzymes are consumed and permanently destroyed during reactions.
- D. Changes in temperature or pH may influence enzyme activity.

Answer

- A. True
 - B. True
 - C. False
 - D. True
-

Question 8

Hormonal regulation helps maintain stable conditions in the body.

Indicate which of the following statements are true or false.

- A. Hormones are secreted by endocrine glands into the bloodstream.
- B. Hormones may affect target cells located far from the gland that produced them.
- C. Hormones act instantly in the same way as nerve impulses.
- D. Hormonal regulation helps maintain homeostasis in the body.

Answer

- A. True
 - B. True
 - C. False
 - D. True
-

Question 9

Modern biotechnology uses living cells and biological molecules for practical applications.

Indicate which of the following statements are true or false.

- A. Genetic engineering allows scientists to modify DNA sequences in organisms.
- B. Cloning can produce genetically identical organisms.
- C. Biotechnology cannot be used in agriculture or medicine.
- D. Some biotechnology techniques involve manipulating living cells in laboratories.

Answer

- A. True
 - B. True
 - C. False
 - D. True
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Question 10

Human activities can influence environmental systems.

Indicate which of the following statements are true or false.

- A. Loss of biodiversity can affect ecosystem stability.
- B. Habitat destruction may reduce the number of species in an ecosystem.

- C. Conservation strategies aim to protect species and ecosystems.
- D. Human activities have no influence on global environmental systems.

Answer

- A. True
- B. True
- C. True
- D. False

Question 11

Changes in DNA sequences can influence the proteins produced in cells.

Indicate which of the following statements are true or false.

- A. A change in a DNA sequence may alter the amino acid sequence of a protein.
- B. Some DNA changes may not affect the protein produced.
- C. All DNA mutations automatically destroy protein function.
- D. Mutations can influence inherited characteristics if they occur in reproductive cells.

Answer

- A. True
 - B. True
 - C. False
 - D. True
-

Question 12

Cells generate energy through processes occurring in specialized organelles.

Indicate which of the following statements are true or false.

- A. Mitochondria play a central role in cellular energy production.
- B. Cellular respiration converts chemical energy from nutrients into ATP.
- C. ATP molecules store and transfer usable energy within cells.
- D. Cells can perform metabolic reactions without energy input.

Answer

- A. True
 - B. True
 - C. True
 - D. False
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Question 13

The structure of ecosystems depends on interactions between different species.

Indicate which of the following statements are true or false.

- A. Species interactions can influence population sizes within ecosystems.
- B. Removal of an important species can alter ecosystem balance.
- C. Species interactions have no effect on ecosystem stability.
- D. Predation and competition are examples of ecological interactions.

Answer

- A. True
 - B. True
 - C. False
 - D. True
-

Question 14

The rate of chemical reactions inside cells depends on several factors.

Indicate which of the following statements are true or false.

- A. Increasing substrate concentration can increase reaction rate under some conditions.
- B. Enzymes help speed up biochemical reactions.
- C. Reaction rate is always constant regardless of environmental conditions.
- D. Temperature changes can influence reaction rates in biological systems.

Answer

- A. True
 - B. True
 - C. False
 - D. True
-

Question 15

Genetic variation can arise in populations through several biological processes.

Indicate which of the following statements are true or false.

- A. Mutation can introduce new genetic variants into populations.
- B. Genetic variation can influence how populations respond to environmental changes.

- C. All individuals in natural populations are genetically identical.
- D. Evolutionary processes can change allele frequencies over generations.

Answer

- A. True
 - B. True
 - C. False
 - D. True
-

Question 16. Gene Expression Analysis

A gene is actively expressed in a human liver cell.

Explain:

1. The process of **transcription** and how mRNA is produced.
 2. The role of **ribosomes and tRNA during translation**.
 3. How the **sequence of codons determines the amino acid sequence**.
 4. How an error during transcription or translation could affect the final protein.
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Question 17. Immune System Response Case Study

A virus enters the human body and infects respiratory cells.

Explain step by step:

1. How the **innate immune system responds first** to infection.
 2. The role of **white blood cells and antibodies** in the immune response.
 3. How the **immune system develops memory** after infection.
 4. Why vaccination can help protect against future infections.
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Question 18. Cellular Respiration Investigation

A scientist wants to test how **temperature affects the rate of cellular respiration in yeast**.

Design an experiment including:

1. A clear hypothesis.
 2. Independent, dependent, and controlled variables.
 3. A detailed step-by-step experimental method.
 4. The type of data that would be collected.
 5. A biological explanation for the expected results.
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Question 19. Stem Cell Biotechnology

Discuss:

1. What **stem cells** are and how they differ from specialized cells.
 2. The difference between **embryonic and adult stem cells**.
 3. One medical application of stem cells in treating disease.
 4. One ethical concern related to stem cell research.
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Question 20. Human Impact on Biodiversity

A large forest is partially cleared for agriculture.

Predict and explain:

1. How this change may affect **species diversity in the area**.
2. How food webs in the ecosystem may be altered.
3. The role of **conservation strategies** in protecting remaining species.
4. Possible long-term consequences for ecosystem stability.

Question 16 – Gene Expression Analysis (8 pts)

Component	Expected Elements	Points
Transcription	DNA → mRNA via RNA polymerase	2
Translation	ribosomes + tRNA build protein	2
Codon explanation	codon sequence determines amino acids	2
Error consequences	altered protein or malfunction	2

Question 17 – Immune Response Case Study (8 pts)

Component	Expected Elements	Points
Innate response	barriers, phagocytes	2
Adaptive response	antibodies and lymphocytes	2
Immune memory	memory cells enable faster future response	2
Vaccination explanation	stimulates immune memory safely	2

Question 18 – Cellular Respiration Investigation (8 pts)

Component	Expected Elements	Points
Hypothesis	temperature affects respiration rate	1
Variables	independent (temperature), dependent (CO ₂ production)	2
Method	yeast respiration setup measuring gas production	3
Data interpretation	higher temperature increases rate until enzyme denaturation	2

Question 19 – Stem Cell Biotechnology (8 pts)

Component	Expected Elements	Points
Definition	stem cells are undifferentiated cells	2
Types	embryonic vs adult	2
Medical application	tissue regeneration, disease treatment	2
Ethical issue	embryo use or consent concerns	2

Question 20 – Biodiversity and Habitat Loss (8 pts)

Component	Expected Elements	Points
Biodiversity impact	species loss or population decline	2
Food web impact	trophic interactions disrupted	2
Conservation strategies	protected areas, restoration	2
Long-term ecosystem effect	reduced stability and resilience	2