

EST II

BIOLOGY

Date:

Test Center:

Room Number:

Student's Name:

National ID:

EST ID:

Duration : 60 minutes

60 Multiple Choice Questions

Instructions:

- Place your answers on the answer sheet. Mark only one answer for each of the multiple-choice questions.
- Avoid guessing. Your answers should reflect your overall understanding of the subject matter.
- Scientific calculators are allowed.

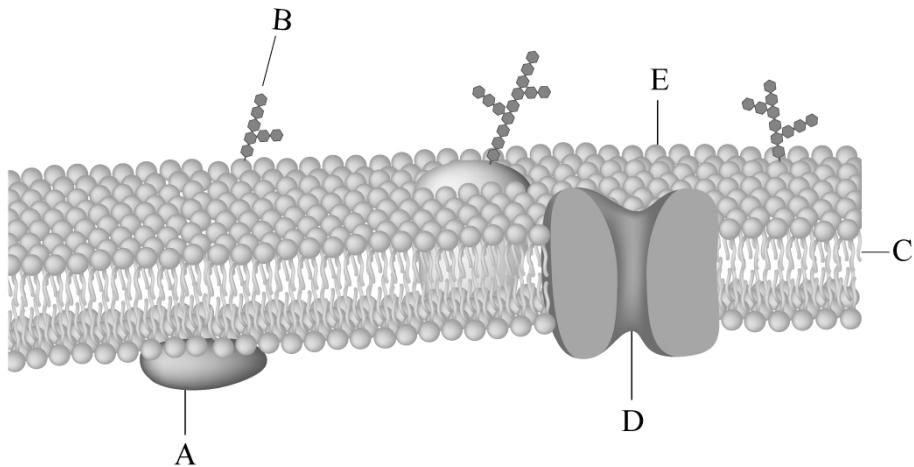
Part A

Directions:

- Each set of lettered choices below refers to the numbered questions or statements immediately following it.
- Select one lettered choice that best answers each question.
- A choice may be used once, more than once, or not at all in each set.

Questions 1 - 5

Refer to the following diagram of the cell membrane. For each description provided, select the corresponding membrane structure.



- Structure A
- Structure B
- Structure C
- Structure D
- Structure E

Question 1. Hydrophilic structure of the phospholipid bilayer

Question 2. Hydrophobic structure of the phospholipid bilayer

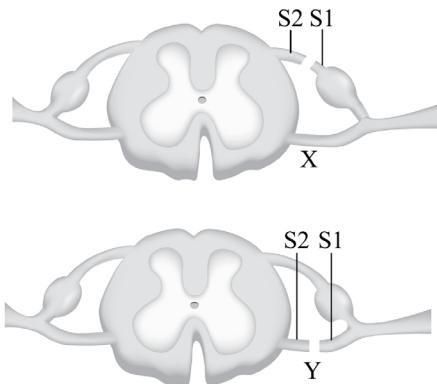
Question 3. Transmembrane protein

Question 4. Structure that helps cells stick to one another

Question 5. Forms the outer layer of the phospholipid bilayer

Questions 6 - 9

A scientist performs a set of experiments on a dog to study the direction of the reflex arc. Two sections, X and Y, are performed separately. After each section, two different stimulations, S1 and S2, are applied. Refer to the adjacent illustration, which represents the experiments, then choose the results that occur in each case from 6 to 9.



- A. No pain sensation + muscle contraction
- B. No pain sensation + no muscle contraction
- C. Pain sensation + no muscle contraction
- D. Pain sensation + muscle contraction
- E. Sensory neuron degenerates

Question 6. Section X + Stimulation S1

Question 7. Section X + Stimulation S2

Question 8. Section Y + Stimulation S1

Question 9. Section Y + Stimulation S2

Questions 10 - 14

Match each theory or related fields in evolution with the correct scientist.

- A. Charles Darwin
- B. Jean-Baptiste Lamarck
- C. Gregor Mendel
- D. Thomas Malthus
- E. James Hutton and Charles Lyell

Question 10. Species evolve over time by natural selection.

Question 11. Individuals with traits better suited to their environment are most likely to survive and reproduce.

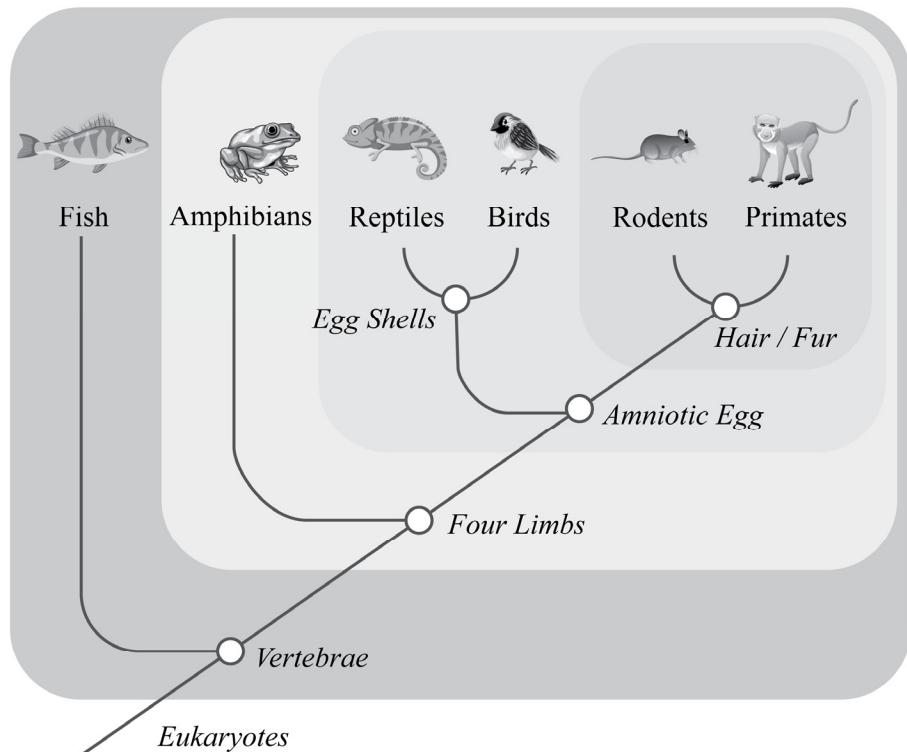
Question 12. Changes that occur to organisms during their lifetime are passed on to their offspring.

Question 13. Earth is very old and shaped by slow, continuous changes.

Question 14. Populations grow faster than resources, leading to competition due to limited resources.

Questions 15 - 18

Refer to the following cladogram. Match each set of animals to the most recent characteristic they share.



- A. Primates and rodents
- B. Fish, amphibians, reptiles, birds, rodents, and primates
- C. Reptiles, birds, rodents, and primates
- D. Reptiles and birds
- E. Amphibians, reptiles, birds, rodents, and primates

Question 15. Vertebrae

Question 16. Four limbs

Question 17. Amniotic egg

Question 18. Hair/ Fur

Part B

Directions:

- Ⓐ Each numbered question below is followed by five lettered answer choices.
- Ⓑ Select the single-lettered choice that best answers each question.

Question 19. Choose the correct sequence of biological organization levels, arranged from the largest to the smallest.

- A. Organism → Population → Ecosystem → Community → Biosphere
- B. Biosphere → Ecosystem → Population → Community → Organism
- C. Organism → Population → Community → Ecosystem → Biosphere
- D. Biosphere → Organism → Community → Ecosystem → Population
- E. Biosphere → Ecosystem → Community → Population → Organism

Question 20. A healthy couple plans to have a child. One parent is a carrier of an autosomal recessive disorder, while the other has a homozygous normal genotype. What is the probability their child will inherit the disorder?

- A. 0%
- B. 25%
- C. 50%
- D. 75%
- E. 100%

Question 21. Down syndrome can be described as:

- A. A mutation in a single gene on chromosome 21
- B. The presence of an extra copy of chromosome 21
- C. The loss of a section of chromosome 21
- D. The absence of chromosome 21
- E. A translocation between chromosomes 13 and 21

Question 22. Both the nervous system and the endocrine system transmit signals to organs and cells in the body. What is the main difference between these two systems in how they deliver signals?

- A. The nervous system mainly uses hormones, while the endocrine system mainly uses electrical signals.
- B. The nervous system transmits signals via blood, while the endocrine system uses synapses.
- C. The nervous system is faster than the endocrine system.
- D. The endocrine system affects only one target organ or cell, while the nervous system affects multiple cells or organs.
- E. The endocrine system sends signals that bind to the membrane receptors, while the nervous system sends signals that bind to intracellular receptors.

Question 23. Ecosystem X contains 4 bird species with a total of 100 individuals, while ecosystem Y contains 5 species with the same total number of individuals. Which ecosystem demonstrates greater biodiversity?

- A. Ecosystem X, because it has a larger population
- B. Ecosystem Y, because it has more species
- C. Ecosystem X, because it has more birds per species
- D. Ecosystem Y, because all species have equal population
- E. Ecosystem X, because the ratio of population over species is lower

Question 24. Non-disjunction is an error during meiosis that leads to:

- A. Crossing-over failure
- B. DNA replication errors
- C. Unequal chromosome distribution during cell division
- D. Mutation in a gene
- E. Production of codominant alleles

Questions 25 - 26

A somatic cell contains 30 chromosomes. It undergoes successive cell divisions until 64 cells are produced.

Question 25. How many cell divisions were required to produce 64 cells?

- A. 5 divisions
- B. 6 divisions
- C. 16 divisions
- D. 32 divisions
- E. 64 divisions

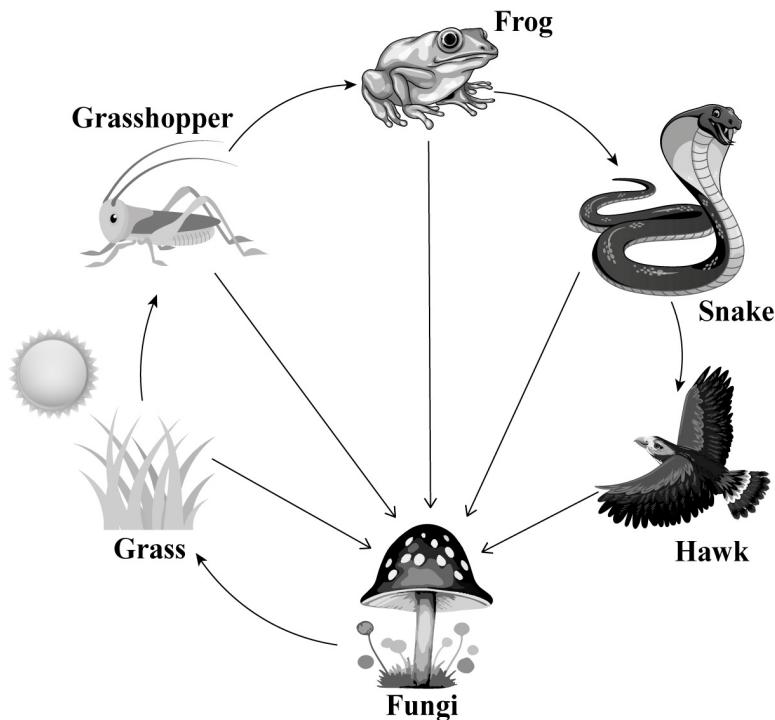
Question 26. How many chromosomes will each of the 64 cells contain?

- A. 15 chromosomes
- B. 30 chromosomes
- C. 46 chromosomes
- D. 60 chromosomes
- E. 90 chromosomes

Question 27. What would most likely happen if a disease eliminated most of the primary consumers in an ecosystem?

- A. The population of top consumers would increase.
- B. The number of producers would decrease.
- C. The number of producers would increase.
- D. Secondary consumers would become primary consumers.
- E. Nothing would change if only primary consumers disappeared.

Question 28. Refer to the following food chain:



The second consumer and the decomposers are, respectively:

- A. The grasshopper and the hawk
- B. The frog and the fungi
- C. The snake and the fungi
- D. The frog and the grass
- E. The hawk and the fungi

Question 29. Which abiotic factor(s) have the most direct influence on the distribution of specific fish species in a lake?

- A. The presence of algae in the lake
- B. The types of microorganisms present in the lake
- C. The temperature and oxygen levels
- D. The distribution of predators in the lake
- E. The type of food provided to fish by humans

Questions 30 - 32

In a population of peas at equilibrium, the yellow pea allele is dominant over the green pea allele. The probability of homozygote yellow peas is 0.45.

Question 30. The allele frequency of the dominant yellow allele peas is:

- A. 0.2
- B. 0.33
- C. 0.45
- D. 0.67
- E. 0.9

Question 31. The allele frequency of the recessive green allele peas is:

- A. 0.2
- B. 0.33
- C. 0.45
- D. 0.67
- E. 0.9

Question 32. The probability of heterozygous individuals is:

- A. 0.22
- B. 0.44
- C. 0.5
- D. 0.56
- E. 0.66

Question 33. A drug is designed to enhance the effect of acetylcholine at muscle receptors. Which of the following best explains its mechanism of action?

- A. It enhances the degradation of acetylcholine by specific enzymes in the synaptic cleft.
- B. It improves the reabsorption of acetylcholine into the presynaptic neuron.
- C. It strengthens the binding of acetylcholine to postsynaptic receptors.
- D. It decreases the secretion of acetylcholine from the presynaptic neuron.
- E. It enhances the secretion of an acetylcholine antagonist.

Question 34. A man with blood type A (genotype AO) and a woman with blood type B (genotype BO) are planning to have children. Which blood types could their children have?

- A. A and B only
- B. AB and O only
- C. A, B, AB, and O
- D. AB only
- E. O and B only

Question 35. Which of the following statements is/are true about sexual reproduction?

- I. Offspring resulting from sexual reproduction are genetically identical to one parent.
- II. The transmission of hereditary traits from one generation to the next depends only on the nutrition of the mother during gestation.
- III. The transmission of hereditary traits from parents to offspring is ensured through sexual reproduction.
- IV. Offspring can resemble their grandparents.

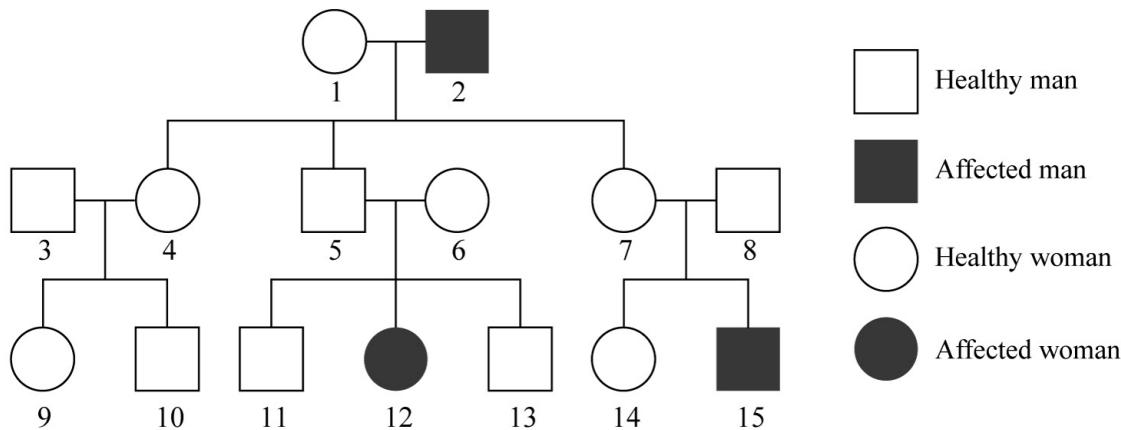
- A. I only
- B. II only
- C. I and III
- D. III and IV
- E. IV only

Question 36. The excretory system is important for maintaining homeostasis because:

- A. It has enzymes that regulate blood pressure.
- B. It enhances oxygen storage in the cells.
- C. It removes metabolic waste and balances water and salt levels.
- D. It defends the body against bacteria and viruses.
- E. It helps the cell synthesize proteins.

Questions 37 - 38

Examine the pedigree below.



Question 37. What is the most likely inheritance pattern?

- A. Y-linked
- B. X-linked recessive
- C. X-linked dominant
- D. Autosomal dominant
- E. Autosomal recessive

Question 38. The genotype of individuals 2 and 5 are, respectively

- A. $X^N X^n$ and $X^n Y$
- B. $X^n X^n$ and $X^N Y$
- C. NN and nn
- D. nn and Nn
- E. nn and NN

Question 39. Which of the statements below is/are correct about estrogen?

- I. Estrogen favors the development of reproductive organs.
- II. Estrogen favors the growth in size of newborn babies.
- III. Estrogen is a neurotransmitter similar to acetylcholine.
- IV. Estrogen favors the appearance of secondary sexual characteristics.

- A. II
- B. III
- C. I and III
- D. I and IV
- E. II and III

Question 40. A group of ducklings is raised in a laboratory without any exposure to water. When they are later introduced to a pond, they immediately begin swimming without prior practice. This is an example of:

- A. Habituation
- B. Trial-and-error learning
- C. Classical conditioning
- D. Imprinting
- E. Innate behavior

Questions 41 - 42

Refer to the following DNA sequences:

DNA transcribed strand AGAAACCACATGTGAGGT

Mutated DNA strand AGAAACCACATTTGAGGT

Question 41. The mutation shown above is called:

- A. Deletion
- B. Insertion
- C. Substitution
- D. Duplication
- E. Translocation

Question 42. The most likely consequence of this mutation on the protein is:

- A. Silent
- B. Nonsense
- C. Missense
- D. Chromosome duplication
- E. Attachment of a chromosome segment to another chromosome

Genetic code chart

		Second base					
		U	C	A	G		
First base	U	UUU Phe UUC UUA UUG	UCU Ser UCC UCA UCG	UAU Tyr UAC UAA Stop UAG	UGU Cys UGC UGA Stop UGG Trp	U C A G	
	C	CUU CUC CUA CUG	CCU CCC CCA CCG	CAU His CAC CAA CAG	CGU CGC CGA CGG	U C A G	
	A	AUU Ile AUC AUA AUG Met or Start	ACU Thr ACC ACA ACG	AAU Asn AAC AAA AAG	AGU Ser AGC AGA AGG	U C A G	
	G	GUU GUC GUA GUG	GCU Ala GCC GCA GCG	GAU Asp GAC GAA GAG	GGU GGC GGA GGG	U C A G	

Question 43. A patient presents with symptoms of kidney damage. A urine test was prescribed, and the results are shown below:

Parameter	Result	Normal range
Glucose	Present	Absent
Protein	Elevated	Absent
Red blood cells	Trace	Absent

Based on the analysis of these results, which structure in the nephron is most likely damaged?

- A. Loop of Henle
- B. Collecting duct
- C. Bowman's capsule
- D. Proximal tubule
- E. Glomerulus

Question 44. A scientist observes that a cell synthesizes proteins normally but cannot secrete them. To investigate, he removes specific organelles and records the effects on the cell's function in the table below:

Organelle	Effect on the cell when removed
Nucleus	Cell is unable to divide.
Ribosomes	Protein synthesis is reduced.
Mitochondria	Energy production is impaired.
Golgi apparatus	Proteins accumulate in the endoplasmic reticulum.

Based on this data, the secretion problem is most likely caused by a malfunction in the:

- A. Ribosomes
- B. Mitochondria
- C. Golgi apparatus
- D. Nucleus
- E. Endoplasmic Reticulum

Question 45. What is the most likely cause of variation in eye color among humans?

- A. All individuals are genetically identical.
- B. Only dominant alleles are expressed.
- C. Mutations and independent assortment occurred during meiosis.
- D. Each individual inherits only the genes of the father.
- E. The environment controls all eye color traits.

Question 46. An ecologist investigates how temperature affects interactions among squirrels, trees, and birds in a forest. At which level of biological organization is this study focused?

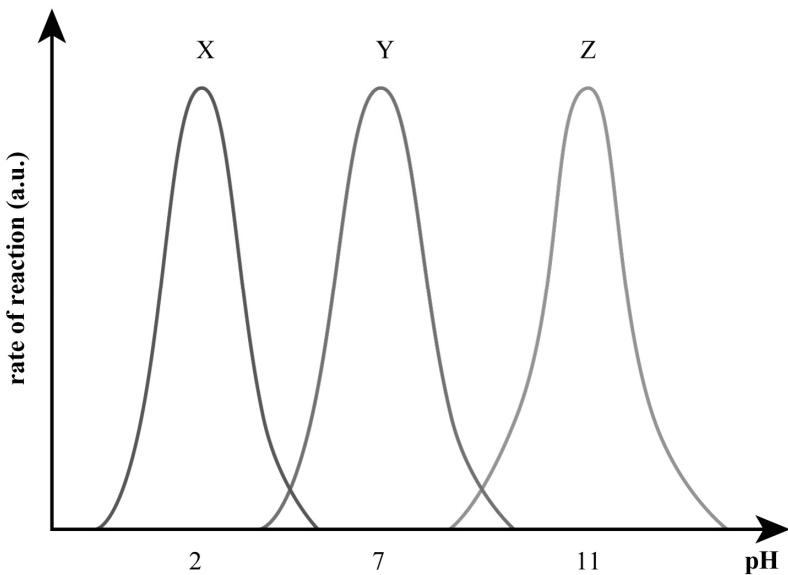
- A. Organism level
- B. Population level
- C. Community level
- D. Ecosystem level
- E. Biome level

Question 47. If a farmer applies pesticides that kill both pests and bees, what is the most likely effect?

- A. Reduction of plant reproduction, leading to less food for herbivores
- B. Increase of plant pollination and growth
- C. Increase of predator number, balancing the ecosystem
- D. Significant increase in soil fertility
- E. Increase of food availability for herbivores

Questions 48 - 49

The graph shows the activity of three enzymes (X, Y, and Z) across different pH values.



Question 48. A scientist adds enzyme Y to a solution with pH 2. How will this affect the enzyme's activity/reaction rate?

- A. The enzyme's activity increases due to acidity.
- B. The enzyme denatures and stops functioning, decreasing its activity.
- C. The enzyme maintains normal activity.
- D. The reaction slow but continues.
- E. The enzyme changes the substrate shape, increasing the reaction rate.

Question 49. Which of the following enzyme(s) would be extracted from the stomach?

- A. X only
- B. Y only
- C. Z only
- D. X and Z
- E. Y and Z

Question 50. A scientist observes a cell with no nucleus and no membrane-bound organelles. What type of cell is it?

- A. Fungal cell
- B. Plant cell
- C. Animal cell
- D. Bacterial cell
- E. Protozoan cell

Question 51. A botanist discovered an herb that produces a chemical substance preventing the formation of spindle fibers during cell division.

Which phase of mitosis would be directly affected?

- A. Prophase, since the chromosomes would fail to condense
- B. Metaphase, since the chromosomes would fail to align at the cell's equator
- C. Anaphase, since the chromosomes would fail to align at the cell's equator
- D. Telophase, since the nuclear envelopes would fail to re-form
- E. Interphase, since the chromosomes would fail to replicate

Question 52. Protein p53 is produced by the cell during the cell cycle to repair damaged DNA before replication. During which phase of the cell cycle is p53 primarily activated?

- A. Mitosis
- B. G₁ phase
- C. S phase
- D. G₂ phase
- E. Cytokinesis

Question 53. Genetic engineering is used to produce insulin for therapeutic purposes. What is the main advantage of this technique?

- A. It is highly effective on diabetic people and can be produced in large quantities.
- B. It is less effective on diabetic people but can be produced in large quantities.
- C. It requires collecting insulin from healthy human donors.
- D. It is highly effective on diabetic people but produced in small quantity.
- E. It is less stable than animal-derived insulin, requiring very low storage temperatures.

Question 54. A scientist uses fluorescent dyes to track the location of nucleic acids in a cell. Fluorescence is observed in the nucleus and parts of the cytoplasm. These nucleic acids are:

- A. DNA
- B. RNA
- C. Amino acids
- D. Thymines
- E. mtDNA

Question 55. Which cell structure is primarily responsible for producing ATP?

- A. Nucleus
- B. Ribosome
- C. Mitochondrion
- D. Golgi apparatus
- E. Endoplasmic reticulum

Question 56. Carbon returns to the atmosphere through:

- A. Photosynthesis
- B. Transpiration
- C. Respiration
- D. Nitrogen fixation
- E. Denitrification

Question 57. What is the immediate consequence when the kidneys stop functioning properly?

- A. Poor digestion
- B. Decreased oxygen level in the blood
- C. Buildup of wastes in the blood
- D. Increased insulin production
- E. Loss of involuntary response

Question 58. How can competition be reduced between two bird species that feed on similar seeds in overlapping territories?

- A. Both species nest in the same trees and feed at the same time.
- B. One species adapts to feed on larger seeds while the other feeds on smaller seeds.
- C. Both species increase their reproductive rates.
- D. Both species migrate to a new habitat with more food resources.
- E. One species abandons feeding to let the other survive.

Question 59. Yeast cells are placed in two flasks under different conditions. Flask 1 contains oxygen, while flask 2 lacks oxygen. Which product will be found only in flask 2?

- A. Carbon dioxide
- B. Ethanol
- C. Water
- D. ATP
- E. Glucose

Question 60. If a cell's mitochondrial DNA is damaged, which cellular process would be directly affected?

- A. Protein synthesis
- B. Cell division
- C. DNA replication
- D. Lipid synthesis
- E. Cellular respiration