Harvard Undergraduate Science Olympiad India
2026 Final Round
9-10th Grade
Biology Section: Exam

Instructions:

- This test is one hour long and has 50 questions.
- Each question has five answer choices and each question has exactly one correct selection.
- Each question is worth 1 point.
- The tiebreaker is the sum of the scores on questions 27, 31, 40, and 50
- Don’t spend too much time on any single question.

Best of luck! You’ve got this!

Question 1: During photosynthesis, the oxygen released comes directly from:

A) Carbon Dioxide
B) Glucose
C) NADH
D) Water
E) ATP

Question 2: Which factor typically directly limits *primary* productivity in a pelagic ocean ecosystem?

A) Light availability
B) Pressure
C) Salinity
D) Nutrient availability
E) Niche partitioning

Question 3: A point mutation could not produce which of the following results?

A) Missense mutation
B) Nonsense mutation
C) Silent mutation
D) Frameshift mutation
E) Chromosomal inversion

Question 4: Which of the following observations does not directly support the endosymbiotic theory of mitochondrial origin?

A) Mitochondria have double membranes
B) Mitochondria contain circular DNA
C) Mitochondria possess 80S ribosomes
D) Mitochondria are capable of replicating independently
E) Mitochondrial genomes contain protein-coding sequences

Question 5: Thomas Hunt Morgan studied inheritance patterns using which of the following model organisms?

A) *Pisum Sativum*
B) *Mus Musculus*
C) *Drosophila Melanogaster*
D) *Arabidopsis Thaliana*
E) *Escherichia coli*

Question 6: Gregor Mendel studied inheritance patterns using which of the following model organisms?

A) *Pisum Sativum*
B) *Mus Musculus*
C) *Drosophila Melanogaster*
D) *Arabidopsis Thaliana*
E) *Escherichia coli*

Question 7: Which structure connects bones to bones?

A) Ligament
B) Cartilage
C) Tendon
D) Synovial fluid
E) Marrow

Question 8: Which molecule is the final electron acceptor in aerobic respiration?

A) Carbon dioxide
B) Glucose
C) Oxygen
D) NAD^+
E) Water

Question 9: Which molecule is the final electron acceptor in aerobic respiration?

A) Carbon dioxide
B) Glucose
C) Oxygen
D) NAD^+
E) Water

Question 10: Which molecule is the final electron acceptor in photosynthesis?

A) Carbon Dioxide
B) Oxygen
C) NAD^+
D) $NADP^+$
E) Water

Question 11: Which structure carries oxygenated blood from the lungs to the heart?

A) Pulmonary vein
B) Pulmonary artery
C) Aorta
D) Vena cava
E) Capillary

Question 12: Which part of the flower produces pollen?

A) Stigma
B) Ovary
C) Carpel
D) Filament
E) Anther

Question 13: A plant tissue is composed of thin-walled, living cells that are loosely packed, allowing for gas exchange, storage of starch, and wound repair. Which tissue is being described?

A) Parenchyma
B) Collenchyma
C) Sclerenchyma
D) Xylem
E) Cambium

Question 14: A plant tissue consists of cells with thick, lignified secondary cell walls that provide rigid structural support. These cells are dead at maturity and are commonly found in seed coats and vascular tissues. Which tissue is being described?

A) Parenchyma
B) Collenchyma
C) Sclerenchyma
D) Phloem
E) Epidermis

Question 15: Which cellular structure is most directly responsible for symplastic transport in plants?

A) Middle lamella
B) Plasmodesmata
C) Cell wall
D) Tonoplast
E) Phragmoplast

Question 16: Which component of a nucleotide determines whether it is part of DNA or RNA?

A) Phosphate group
B) Nitrogenous base only
C) Sugar molecule
D) Hydrogen bonds
E) Covalent bonds

Question 17: Which change would most likely decrease transpiration in a plant?

A) Increased wind speed
B) Open stomata
C) High temperature
D) High humidity
E) Large leaf surface area

Question 18: Which of the following processes occurs first during mitosis?

A) Separation of sister chromatids
B) Separation of homologous chromosomes
C) DNA Replication
D) Breakdown of the nuclear membrane
E) Division of cytoplasm

Question 19: Which structure prevents plant cells from bursting in hypotonic environments?

A) Tonoplast
B) Cell membrane
C) Cell wall
D) Chloroplast
E) Plasmodesmata

Question 20: Which type of selection favors intermediate phenotypes?

A) Directional selection
B) Disruptive selection
C) Artificial selection
D) Sexual selection
E) Stabilizing selection

Question 21: Which molecule is directly produced during the light-dependent reactions of photosynthesis?

A) Glucose
B) Carbon dioxide
C) Calvin cycle enzymes
D) NADPH
E) FADH2

Question 22: Which structure attaches chromosomes to spindle fibers?

A) Centromere
B) Telomere
C) Chromatin
D) Nucleolus
E) Kinetochore

Question 23: During which phase of mitosis do chromosomes align at the cell's equatorial plane?

A) Prophase
B) Metaphase
C) Anaphase
D) Telophase
E) Cytokinesis

Question 24: Which plant hormone is most closely associated with cell elongation?

A) Auxin
B) Abscisic acid
C) Gibberellin
D) Cytokinin
E) Ethylene

Question 25: Which structure regulates the movement of substances into and out of the nucleus?

A) Nuclear pore complex (NPC)
B) Nuclear lamin proteins
C) Chromatin
D) Nucleolus
E) Rough ER

Question 26: Which organelle is primarily involved in lipid synthesis?

A) Rough endoplasmic reticulum
B) Smooth endoplasmic reticulum
C) Golgi apparatus
D) Lysosome
E) Mitochondrion

Question 27: A competitive inhibitor reduces enzyme activity primarily by:

A) Lowering V_{max}
B) Increasing K_m
C) Denaturing the enzyme
D) Binding irreversibly to the enzyme
E) Reducing substrate concentration

Question 28: The driving force for ATP synthesis during oxidative phosphorylation is:

A) Electron transfer to oxygen
B) NADH oxidation
C) Proton electrochemical gradient
D) Substrate-level phosphorylation
E) Glucose oxidation

Question 29: Which molecule donates electrons directly to photosystem I?

A) Water
B) Oxygen
C) NADPH
D) Plastocyanin
E) Cytochrome c

Question 30: Which of the following molecules is most responsible for modulating membrane fluidity?

A) Cholesterol
B) Phosphatidylserine
C) Phosphatidylcholine
D) Acetylcholine
E) Inositol 3 phosphate (IP3)

Question 31: Suppose you have a gene that consists of 300 codons. Which of the following mutations would result in the greatest protein dysfunction?

A) A missense mutation at codon 12
B) A nonsense mutation at codon 299
C) A deletion of 6 nucleotides at codons 39 and 40.
D) An insertion of 1 nucleotide between codons 3-4
E) A complete duplication of codons 20-25.

Question 32: Which of the following is **NOT** an assumption of Hardy-Weinberg equilibrium?

A) Random mating
B) Infinite population size
C) Natural selection favors one allele over another
D) No mutation
E) No immigration or emigration

Question 33: All of the following enzymes are responsible for synthesizing nucleic acids. Which does **NOT** require a DNA template strand?

A) DNA Polymerase I
B) DNA Polymerase II
C) DNA Polymerase III
D) RNA polymerase
E) Telomerase

Question 34: Which epigenetic modification typically represses transcription?

A) Histone acetylation
B) DNA methylation
C) Chromatin loosening
D) Promoter binding
E) Enhancer activation

Question 35: Which molecule directly binds the ribosomal A site?

A) mRNA
B) rRNA
C) tRNA
D) DNA
E) RNA polymerase

Question 36: Which factor determines the reading frame during translation?

A) Stop codon
B) Start codon
C) Promoter
D) Enhancer
E) 5’ cap

Question 37: Which hormone directly lowers blood glucose concentration?

A) Glucagon
B) Epinephrine
C) Cortisol
D) Insulin
E) Aldosterone

Question 38: Which nephron structure is responsible for filtration?

A) Loop of Henle
B) Collecting duct
C) Glomerulus
D) Proximal tubule
E) Distal tubule

Question 39: Which ion movement triggers muscle contraction?

A) Na^+ influx
B) K^+ efflux
C) Ca^{2+} release
D) Cl^- influx
E) Mg^{2+} uptake

Question 40: A decrease in enzyme K_m indicates:

A) Lower enzyme affinity
B) Higher enzyme affinity
C) Lower V_{max}
D) Competitive inhibition
E) Enzyme denaturation

Question 41: Which experimental technique best *quantifies* gene expression levels?

A) DNA microarray
B) Gel electrophoresis
C) Western blot
D) RT-qPCR
E) Whole genome sequencing (WGS)

Question 42: Which experimental technique separates DNA based on size?

A) PCR
B) Southern blot
C) Western blot
D) Gel electrophoresis
E) Chromatography

Question 43: Which consequence is most likely if a point deletion disrupts the TATA box of a eukaryotic gene?

A) Failure of ribosome binding
B) Failure of transcription initiation
C) Frameshift during transcription
D) Frameshift during translation
E) Improper mRNA splicing

Question 44: Which molecule directly regulates the lac operon in response to lactose availability?

A) Glucose
B) cAMP
C) Lactose
D) CAP protein
E) Allolactose

Question 45: Which plant hormone is most directly involved in fruit ripening?

A) Auxin
B) Cytokinin
C) Ethylene
D) Abscisic acid
E) Gibberellin

Question 46: Which tissue is primarily responsible for lateral growth in woody plants?

A) Shoot Apical meristem
B) Vascular cambium
C) Root Apical meristem
D) Ground meristem
E) Protoderm

Question 47: Which condition most strongly promotes genetic drift?

A) Small population size
B) Large population size
C) High mutation rate
D) Strong natural selection
E) High gene flow

Question 48: Which process is directly inhibited during cyanide poisoning?

A) Glycolysis
B) Fermentation
C) Citric acid cycle
D) Electron transport chain
E) ATP synthase

Question 49: Which observational result would best support directional selection?

A) Reduced variation
B) Two distinct phenotypic peaks
C) Shift in mean phenotype
D) No phenotypic change
E) Random mating

Question 50: Which feature best distinguishes prokaryotic transcription from eukaryotic transcription?

A) Use of RNA polymerase
B) Presence of promoters
C) Coupling with translation
D) Use of ribosomes
E) Requirement for nucleotides