AP Biology Practice Test 4

60 original multiple-choice questions covering all 8 AP Biology CED units. Choose one answer for each question. The full answer key is on the last page — worked explanations for every question are free on the test page at QuaidianPoint.com.

Name: _____ Class: _____ Score: _____ / 60

Chemistry of Life

Q1. Adhesion of water to the walls of xylem vessels contributes to water transport in plants. Which property of water molecules makes adhesion possible?

(A) Water molecules are nonpolar, so they stick to the walls by hydrophobic interactions
(B) Water molecules form hydrogen bonds with polar groups on the walls of the vessels
(C) Water molecules form covalent bonds with cellulose in the walls
(D) Water molecules are repelled by the walls, creating pressure that pushes water up

Q2. A monosaccharide has the formula C6H12O6. Which of the following is a monosaccharide with this formula?

(A) Sucrose, which is a disaccharide made of glucose and fructose
(B) Glucose, which is a six-carbon sugar used as an energy source
(C) Starch, which is a polysaccharide made of many glucose units
(D) Cellulose, which is a structural polysaccharide

Q3. Which statement best describes the structure of a phospholipid bilayer in a cell membrane?

(A) A single layer of phospholipids with tails facing the cytoplasm
(B) Two layers of phospholipids with tails facing outward toward water
(C) A layer of proteins with phospholipids attached to the outside only
(D) Two layers of phospholipids with hydrophobic tails facing inward and hydrophilic heads facing outward

Q4. A protein has four levels of structure. Which level is formed by hydrogen bonds between the backbone atoms of amino acids, producing alpha helices and beta sheets?

(A) Primary structure, which is the sequence of amino acids
(B) Tertiary structure, which is the overall three-dimensional shape
(C) Quaternary structure, which is the assembly of multiple polypeptides
(D) Secondary structure

Q5. Which nitrogenous base is found in RNA but not in DNA?

(A) Thymine, which pairs with adenine in DNA
(B) Uracil, which pairs with adenine in RNA
(C) Guanine, which pairs with cytosine in both
(D) Adenine, which is found in both DNA and RNA

Q6. A triglyceride is hydrolyzed by an enzyme. What are the products of this reaction?

(A) Three glycerol molecules and one fatty acid
(B) Glucose and water, because the fat is broken into sugars
(C) Amino acids, because the fat is a protein
(D) Glycerol and three fatty acids

Q7. Which statement correctly describes the bonding between the two strands of DNA?

(A) Adenine pairs with cytosine through three hydrogen bonds, and guanine pairs with thymine through two
(B) Adenine pairs with guanine, and cytosine pairs with thymine
(C) All base pairs are held together by the same number of hydrogen bonds
(D) Adenine pairs with thymine through two hydrogen bonds

Cell Structure and Function

Q8. A protein is synthesized in the cytoplasm and needs to enter the nucleus. Which feature allows it to pass through the nuclear envelope?

(A) A signal peptide that directs it to the endoplasmic reticulum
(B) A nuclear localization signal that is recognized by proteins at the nuclear pore
(C) A hydrophobic tail that lets it diffuse through the nuclear membrane
(D) A carbohydrate tag added by the Golgi apparatus

Q9. Which statement best explains why small cells are more efficient than large cells at exchanging materials with their environment?

(A) Small cells have more mitochondria than large cells
(B) Large cells have a higher surface-area-to-volume ratio because they have more membrane
(C) Cell size does not affect the rate of material exchange
(D) Small cells have a higher surface-area-to-volume ratio

Q10. A marine fish lives in salt water, which is hypertonic to its body fluids. How does the fish maintain its water balance?

(A) It drinks salt water and excretes excess salt through specialized chloride cells in its gills
(B) It never drinks water, so it avoids taking in salt
(C) It produces large amounts of dilute urine to remove salt
(D) It absorbs water through its skin by osmosis from the sea

Q11. The inner membrane of a mitochondrion is highly folded into cristae. What is the functional advantage of this folding?

(A) It increases the surface area available for the electron transport chain and ATP synthase
(B) It prevents oxygen from entering the mitochondrion
(C) It stores glucose for cellular respiration
(D) It allows the mitochondrion to divide by binary fission

Q12. Which type of cell junction forms a seal between adjacent animal cells, preventing substances from leaking between them?

(A) Tight junctions, which fuse the membranes of neighboring cells to block passage between them
(B) Gap junctions, which allow ions to pass directly between cells
(C) Desmosomes, which anchor cells together but allow fluids to pass
(D) Plasmodesmata, which connect plant cells only

Q13. A cell is treated with a drug that blocks aquaporins. Which process is most directly affected?

(A) The rapid movement of water across the plasma membrane by osmosis
(B) The active transport of sodium ions out of the cell
(C) The diffusion of oxygen across the membrane
(D) The synthesis of proteins on ribosomes

Q14. Ribosomes are found in both prokaryotic and eukaryotic cells. Which statement about ribosomes is correct?

(A) They are membrane-bound organelles found only in eukaryotes
(B) They produce ATP for the cell
(C) They are the sites of protein synthesis in all cells
(D) They store genetic information in the form of DNA

Cellular Energetics

Q15. An allosteric activator binds to an enzyme and increases its activity. How does it produce this effect?

(A) It binds to the active site and blocks the substrate from entering
(B) It binds to a site other than the active site and stabilizes the active shape of the enzyme
(C) It breaks the enzyme into smaller pieces that work faster
(D) It changes the substrate into a different molecule

Q16. Which statement best describes an endergonic reaction in a cell?

(A) It releases energy, has a negative ΔG, and proceeds spontaneously
(B) It requires no energy input and produces ATP directly
(C) It is always catalyzed by enzymes that lower its activation energy to zero
(D) It absorbs energy, has a positive ΔG

Q17. In the Calvin cycle, how many turns of the cycle are required to produce one molecule of glucose (G3P exported as glucose)?

(A) One turn, because each turn produces one glucose molecule
(B) Three turns, because each turn fixes two CO_2 molecules
(C) Twelve turns, because glucose has twelve hydrogen atoms
(D) Six turns, because each turn fixes one CO_2 and six carbons are needed for glucose

Q18. A plant is exposed to bright light, but its stomata are closed. Which process is most likely to be limited, and why?

(A) The light reactions, because closed stomata block light from reaching the chloroplasts
(B) The Calvin cycle, because closed stomata reduce CO_2 entry into the leaf
(C) Glycolysis, because the plant cannot produce glucose without open stomata
(D) Fermentation, because oxygen cannot escape from the leaf

Q19. Which stage of cellular respiration produces the most NADH, and where does it occur?

(A) The citric acid cycle, in the mitochondrial matrix
(B) Glycolysis, in the cytoplasm
(C) Oxidative phosphorylation, on the inner mitochondrial membrane
(D) Fermentation, in the cytosol

Q20. A researcher measures ATP production in isolated mitochondria. When oxygen is removed, ATP production falls sharply. Which conclusion is best supported?

(A) Glycolysis requires oxygen to produce ATP
(B) Oxidative phosphorylation requires oxygen as the final electron acceptor
(C) The citric acid cycle produces ATP only in the presence of oxygen
(D) Fermentation cannot occur without oxygen

Q21. Which statement correctly compares lactic acid fermentation and alcoholic fermentation?

(A) Both produce the same end product, lactic acid
(B) Both regenerate NAD+ from NADH so glycolysis can continue
(C) Alcoholic fermentation produces oxygen, while lactic acid fermentation consumes it
(D) Lactic acid fermentation occurs in yeast, while alcoholic fermentation occurs in muscle cells

Cell Communication and Cell Cycle

Q22. A signal molecule binds to an intracellular receptor in the cytoplasm. Which type of molecule is the signal most likely to be?

(A) A large protein hormone, because it needs a cytoplasmic receptor
(B) A steroid hormone
(C) A neurotransmitter, because it acts only on surface receptors
(D) A hydrophilic sugar, because it diffuses freely through membranes

Q23. A researcher adds a drug that inhibits adenylyl cyclase to a cell. What is the most likely effect on a cAMP-dependent signaling pathway?

(A) The pathway will be strengthened, because cAMP accumulates in the cell
(B) The pathway will be unaffected, because adenylyl cyclase is not involved in cAMP signaling
(C) The pathway will be weakened, because less cAMP is produced to activate protein kinase A
(D) The cell will produce more cAMP from a different enzyme

Q24. In the cell cycle, the G2 checkpoint primarily verifies which condition?

(A) That the cell has enough nutrients to begin DNA replication
(B) That chromosomes are attached to the spindle fibers
(C) That the cytoplasm has divided into two cells
(D) That DNA has been replicated completely and without damage before mitosis begins

Q25. During mitosis, sister chromatids separate during which phase?

(A) Prophase, when chromosomes first condense
(B) Metaphase, when chromosomes align at the cell equator
(C) Anaphase, when spindle fibers pull sister chromatids to opposite poles
(D) Telophase, when the nuclear envelope reforms

Q26. A cell receives a signal to divide, but a mutation prevents the production of the cyclin needed for the G1 to S transition. What is the most likely outcome?

(A) The cell will enter S phase early and replicate its DNA twice
(B) The cell will arrest in G1 and will not enter S phase
(C) The cell will skip G1 and divide immediately
(D) The cell will complete mitosis without replicating its DNA

Q27. Which statement best describes the function of the mitotic spindle?

(A) It is a protein that replicates DNA during S phase
(B) It is the structure that divides the cytoplasm during cytokinesis
(C) It is made of microtubules that attach to chromosomes and separate them into daughter cells
(D) It is the organelle that produces ATP for cell division

Q28. Apoptosis is important during development. Which example best illustrates its role?

(A) The rapid division of cells to form a tumor
(B) The fusion of two cells to form a zygote
(C) The production of new blood cells in bone marrow
(D) The removal of webbing between fingers in a developing human embryo

Q29. A cell in a tissue is damaged and releases signals that cause nearby cells to divide and replace it. Which process best describes this response?

(A) Apoptosis of all neighboring cells
(B) Differentiation of the damaged cell into a new tissue type
(C) Regeneration through growth factor signaling and cell division
(D) Meiosis to produce replacement gametes

Heredity

Q30. A diploid cell with 2n = 6 chromosomes undergoes meiosis. How many chromosomes will each gamete contain, and how many chromatids will each chromosome have immediately after meiosis II?

(A) 6 chromosomes, each with two chromatids
(B) 3 chromosomes, each with two chromatids
(C) 3 chromosomes, each with one chromatid
(D) 12 chromosomes, each with one chromatid

Q31. A cross between two plants heterozygous for height (Tt x Tt) produces 100 offspring. Approximately how many tall offspring are expected?

(A) 25, because only homozygous dominant plants are tall
(B) 50, because half the offspring receive the dominant allele
(C) 100, because tall is dominant over short
(D) 75, because the dominant phenotype appears in three quarters of the offspring

Q32. A woman with blood type A and a man with blood type B have a child with blood type O. What are the genotypes of the parents?

(A) The woman is I^A I^A and the man is I^B I^B
(B) Both parents are heterozygous: the woman is I^A i and the man is I^B i
(C) The woman is I^A I^B and the man is ii
(D) Both parents are type O, because O is recessive

Q33. A trait is controlled by multiple genes, each contributing a small effect, and the phenotype shows a continuous range of variation. This is an example of what?

(A) Polygenic inheritance
(B) Pleiotropy, because one gene affects many traits
(C) Epistasis, because one gene masks another
(D) Codominance, because both alleles are expressed

Q34. A single gene affects both the color of a flower and the shape of its leaves. This is an example of what?

(A) Polygenic inheritance, because many genes affect one trait
(B) Epistasis, because one gene masks another
(C) Pleiotropy, because one gene influences multiple phenotypic traits
(D) Incomplete dominance, because the heterozygote shows a blend

Q35. A researcher crosses fruit flies heterozygous for two linked genes and counts the offspring. The recombinant phenotypes are rare compared with the parental phenotypes. What does this indicate?

(A) The genes are close together on the same chromosome
(B) The genes are on different chromosomes and assort independently
(C) The genes are far apart on the same chromosome, so crossing over is frequent
(D) The genes are not inherited at all

Q36. A pedigree shows a trait that is passed from father to all of his daughters but to none of his sons. Which inheritance pattern does this suggest?

(A) X-linked dominant
(B) Autosomal recessive, because the trait appears in all daughters
(C) Y-linked, because the trait is passed through males
(D) Mitochondrial, because the trait is passed only through females

Q37. In a dihybrid cross, the genes for seed shape and seed color are on different chromosomes. What is the probability that an offspring of a dihybrid cross (RrYy x RrYy) will be homozygous recessive for both genes?

(A) 1/4, because the recessive phenotype appears in one quarter of offspring
(B) 1/8, because the two genes assort together
(C) 1/16, because the probability of rr is 1/4 and of yy is 1/4
(D) 9/16, because the dominant phenotypes are most common

Gene Expression and Regulation

Q38. Which statement correctly describes the difference between the leading strand and the lagging strand during DNA replication?

(A) The leading strand is synthesized continuously toward the replication fork
(B) The leading strand is synthesized in fragments, while the lagging strand is synthesized continuously
(C) The leading strand is synthesized by RNA polymerase, while the lagging strand is synthesized by DNA polymerase
(D) Both strands are synthesized continuously in the same direction

Q39. A DNA molecule is replicated semiconservatively. What does this mean?

(A) Each new DNA molecule contains two newly synthesized strands
(B) Each new DNA molecule contains one original strand and one newly synthesized strand
(C) Each new DNA molecule contains two original strands
(D) The DNA is not replicated at all, but repaired instead

Q40. During transcription, RNA polymerase binds to which region of a gene?

(A) The terminator, which signals the end of the gene
(B) An intron, which is removed during splicing
(C) The ribosome binding site, which starts translation
(D) The promoter, which signals the start of the gene

Q41. A polypeptide is being synthesized on a ribosome. Which molecule brings the next amino acid to the ribosome?

(A) Transfer RNA, which carries a specific amino acid and has an anticodon matching the mRNA codon
(B) Messenger RNA, which carries the genetic code from the nucleus
(C) Ribosomal RNA, which forms the structure of the ribosome
(D) DNA, which is copied directly into protein

Q42. Which type of mutation has the least effect on the resulting protein?

(A) A frameshift mutation, because it changes the reading frame
(B) A silent mutation
(C) A nonsense mutation, because it creates a premature stop codon
(D) A missense mutation, because it changes one amino acid

Q43. In eukaryotes, transcription factors bind to which DNA regions to regulate gene expression?

(A) Introns, which are removed from the final mRNA
(B) Telomeres, which protect the ends of chromosomes
(C) Origins of replication, which start DNA copying
(D) Enhancers and promoters

Q44. A cell differentiates into a muscle cell. Which statement best explains how this happens despite all cells having the same DNA?

(A) Different genes are expressed in different cell types
(B) Muscle cells lose the genes they do not need during development
(C) Muscle cells gain new genes through mutation
(D) All cells express the same genes, but muscle cells use them differently

Q45. A researcher inserts a gene for insulin production into bacteria using a plasmid. Which technique is this an example of?

(A) Polymerase chain reaction, because the gene is amplified
(B) Gel electrophoresis, because the DNA is separated by size
(C) Gene therapy, because the gene is inserted into a human patient
(D) Recombinant DNA technology

Natural Selection

Q46. A population of moths has light and dark forms. Before industrial pollution, light moths were common because they blended with lichen-covered trees. After pollution darkened the trees, dark moths became common. This is an example of what?

(A) Directional selection
(B) Stabilizing selection, because the intermediate form was favored
(C) Disruptive selection, because both extremes were favored
(D) Genetic drift, because the change was random

Q47. In a Hardy-Weinberg population, the frequency of the dominant allele is 0.8. What is the frequency of the recessive phenotype?

(A) 0.2, because the recessive allele frequency equals the recessive phenotype frequency
(B) 0.64, because p squared is the dominant phenotype frequency
(C) 0.04, because q = 0.2 and q squared = 0.04
(D) 0.16, because the heterozygote frequency is 2pq

Q48. A population of 50 individuals has an allele frequency of 0.5. After a random event kills many individuals, the frequency changes to 0.9. Which mechanism best explains this change?

(A) Natural selection, because the surviving individuals were better adapted
(B) Genetic drift, because random events in a small population can greatly change allele frequencies
(C) Gene flow, because new individuals entered the population
(D) Mutation, because new alleles were created by the event

Q49. Two populations of birds live in the same forest but sing different songs, so females only mate with males singing their own song. Which reproductive barrier is this?

(A) Behavioral isolation
(B) Geographic isolation, because the populations live in different places
(C) Mechanical isolation, because their reproductive structures differ
(D) Hybrid inviability, because their offspring die before birth

Q50. A cladogram shows a node that represents the most recent common ancestor of two species. What does the node indicate?

(A) The species that is the direct ancestor of all other species on the tree
(B) The time when the two species went extinct
(C) The number of mutations that separate the two species
(D) The point where the two lineages diverged from a shared ancestor

Q51. The wings of a bat and the wings of an insect are both used for flight but have very different structures. These wings are best described as what?

(A) Analogous structures
(B) Homologous structures, because they share a common ancestor
(C) Vestigial structures, because they no longer function
(D) Embryological structures, because they develop from the same tissue

Q52. A researcher uses a molecular clock to estimate when two species diverged. What assumption does this method rely on?

(A) That all species evolve at exactly the same rate in every gene
(B) That fossil evidence is always more accurate than molecular evidence
(C) That mutations accumulate at a relatively constant rate over time in the molecules being compared
(D) That mutations never occur in the molecules being compared

Q53. Which statement best describes the endosymbiotic theory for the origin of eukaryotic cells?

(A) Eukaryotic cells evolved directly from viruses that infected prokaryotes
(B) The nucleus was originally a separate organism that joined with a prokaryote
(C) Mitochondria and chloroplasts were once free-living bacteria that were engulfed by a host cell
(D) Eukaryotic cells formed when prokaryotes fused their DNA together

Ecology

Q54. A plant bends away from a touch stimulus. This response is called what?

(A) Phototropism, a growth response to light
(B) Gravitropism, a growth response to gravity
(C) Thigmotropism, a growth response to touch
(D) Chemotropism, a growth response to chemicals

Q55. Which of the following best describes the difference between gross primary productivity and net primary productivity?

(A) Gross primary productivity is the energy available to herbivores, while net primary productivity is the energy available to producers
(B) Gross and net primary productivity are the same measurement
(C) Gross primary productivity is the total energy captured by photosynthesis
(D) Net primary productivity is always greater than gross primary productivity

Q56. A population of bacteria doubles every 20 minutes. Starting with 100 bacteria, how many will there be after 1 hour?

(A) 300, because the population increases by 100 each 20 minutes
(B) 600, because the population triples in one hour
(C) 800, because the population doubles three times: 100 to 200 to 400 to 800
(D) 200, because the population doubles only once per hour

Q57. Which interaction is best described as one species benefiting while the other is neither helped nor harmed?

(A) Mutualism, because both species benefit
(B) Parasitism, because one species is harmed
(C) Commensalism, such as a barnacle attached to a whale
(D) Competition, because both species are harmed

Q58. A community of organisms in a pond is studied over several years. After a drought, the pond dries up, and a new community forms when it refills. Which ecological concept does this best illustrate?

(A) Climax community, because the community never changes
(B) Competitive exclusion, because one species outcompetes all others
(C) Carrying capacity, because the pond can support only a fixed number of organisms
(D) Disturbance and succession

Q59. Which of the following is a density-independent factor that can limit population growth?

(A) A hurricane that destroys a habitat regardless of population size
(B) Competition for food that intensifies as density rises
(C) Disease that spreads faster in crowded populations
(D) Predation that increases when prey are abundant

Q60. The introduction of the brown tree snake to Guam led to the extinction of many native bird species. What does this best illustrate?

(A) The benefit of a keystone species to a community
(B) The harmful effect of an invasive species on native biodiversity
(C) The process of primary succession on an island
(D) The effect of a mutualistic relationship on a population

Answer Key

Q1: B	Q11: A	Q21: B	Q31: D	Q41: A	Q51: A
Q2: B	Q12: A	Q22: B	Q32: B	Q42: B	Q52: C
Q3: D	Q13: A	Q23: C	Q33: A	Q43: D	Q53: C
Q4: D	Q14: C	Q24: D	Q34: C	Q44: A	Q54: C
Q5: B	Q15: B	Q25: C	Q35: A	Q45: D	Q55: C
Q6: D	Q16: D	Q26: B	Q36: A	Q46: A	Q56: C
Q7: D	Q17: D	Q27: C	Q37: C	Q47: C	Q57: C
Q8: B	Q18: B	Q28: D	Q38: A	Q48: B	Q58: D
Q9: D	Q19: A	Q29: C	Q39: B	Q49: A	Q59: A
Q10: A	Q20: B	Q30: C	Q40: D	Q50: D	Q60: B

Worked explanations for all 60 questions: quaidianpoint.com/ap-biology-practice-test-4/