AP Biology Practice Test 1

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. Which property of water best explains why a large lake changes temperature much more slowly than the surrounding air?

(A) Water has a high specific heat
(B) Water is nonpolar, so it resists heating by reflecting most solar energy
(C) Water has a low specific heat, so it stores heat in its covalent bonds
(D) Water molecules are small, so they cannot absorb much thermal energy

Q2. A student adds a drop of acid to pure water and to a solution containing a bicarbonate buffer. The pH of the pure water falls sharply, while the pH of the buffer solution barely changes. Which statement best explains the buffer result?

(A) The buffer contains a weak acid and its conjugate base
(B) The buffer neutralizes all hydrogen ions by converting them into water molecules permanently
(C) The buffer raises the pH of the solution above 7 so acids cannot lower it
(D) The buffer prevents hydrogen ions from dissolving in the solution at all

Q3. Which feature of a water molecule accounts for its ability to form hydrogen bonds with neighboring water molecules?

(A) The oxygen and hydrogen atoms share electrons equally, making the molecule nonpolar
(B) The molecule has a linear shape that aligns its charges in one direction
(C) The oxygen atom carries a partial negative charge and each hydrogen carries a partial positive charge
(D) The oxygen atom has a full positive charge balanced by two negative hydrogens

Q4. Cohesion in water is most directly responsible for which phenomenon?

(A) Water evaporating from the surface of a leaf on a hot day
(B) Ice floating on the surface of a pond in winter
(C) Salt dissolving rapidly in a glass of warm water
(D) Water rising through narrow xylem vessels in a tall tree

Q5. Which statement correctly describes the relationship between a monosaccharide and a polysaccharide?

(A) A polysaccharide is formed by joining monosaccharides through dehydration synthesis
(B) A monosaccharide is formed by breaking a polysaccharide apart with dehydration synthesis
(C) A polysaccharide is a single sugar molecule folded into a ring structure
(D) Monosaccharides and polysaccharides are identical except that polysaccharides contain nitrogen

Q6. Cellulose, starch, and glycogen are all polymers of glucose, yet cellulose is indigestible by most animals while starch is easily digested. What best explains this difference?

(A) Cellulose contains glucose monomers with a different chemical formula than those in starch

(B) The glucose monomers in cellulose are joined by beta linkages that form straight chains

(C) Starch is made of glucose joined by peptide bonds, whereas cellulose uses glycosidic bonds

(D) Cellulose is a lipid, so digestive enzymes that break carbohydrates cannot act on it

Q7. A phospholipid is placed in water. Which arrangement is most likely to form spontaneously?

(A) A single layer with hydrophobic tails facing the water and heads facing inward

(B) A bilayer with hydrophilic heads facing the water and hydrophobic tails facing each other

(C) A bilayer with hydrophobic tails facing the water and hydrophilic heads facing inward

(D) A random mixture in which heads and tails are evenly distributed throughout the water

Q8. A protein loses its three-dimensional shape when heated to 80 degrees Celsius, and its function is lost. Which level of protein structure is most directly disrupted by this denaturation?

(A) The sequence of amino acids, because heat breaks the peptide bonds between them

(B) The overall folding of the polypeptide chain

(C) The joining of separate polypeptide chains into a single protein

(D) The formation of amino acids from smaller carbon compounds

Cell Structure and Function

Q9. A researcher labels a protein that is synthesized on ribosomes of the rough endoplasmic reticulum. Which path will the protein most likely follow to reach the outside of the cell?

(A) Smooth endoplasmic reticulum to lysosome to vacuole to plasma membrane

(B) Nucleus to ribosome to mitochondrion to plasma membrane

(C) Rough endoplasmic reticulum to Golgi apparatus to secretory vesicle to plasma membrane

(D) Golgi apparatus to rough endoplasmic reticulum to lysosome to plasma membrane

Q10. Which evidence best supports the endosymbiotic theory for the origin of mitochondria?

(A) Mitochondria have their own circular DNA and double membrane and divide by a process similar to binary fission

(B) Mitochondria are the largest organelles in animal cells and contain most of the cell DNA

(C) Mitochondria are found only in cells that carry out photosynthesis

(D) Mitochondria are enclosed by a single membrane derived from the nuclear envelope

Q11. A spherical cell has a radius of 10 micrometers. A second spherical cell has a radius of 20 micrometers. How does the surface-area-to-volume ratio of the larger cell compare with that of the smaller cell?

(A) It is twice as large, because both surface area and volume double when the radius doubles
(B) It is the same, because surface area and volume increase by the same factor
(C) It is half as large
(D) It is four times as large, because surface area depends on the square of the radius

Q12. A cell is placed in a solution, and water moves out of the cell by osmosis, causing the cell to shrink. Which statement about the solution is correct?

(A) The solution is hypotonic to the cell, so water moves toward the lower solute concentration outside
(B) The solution is hypertonic to the cell
(C) The solution is isotonic to the cell, and water moves out because of active transport
(D) The solution is hypertonic to the cell, so solutes move into the cell and drag water with them

Q13. The water potential of a plant cell is -0.4 MPa and the water potential of the surrounding soil solution is -0.1 MPa. In which direction will water move, and why?

(A) Into the soil solution from the cell, because water moves from higher to lower water potential
(B) Into the cell from the soil, because water moves from higher to lower water potential
(C) Into the cell from the soil, because water moves from lower to higher water potential
(D) There will be no net movement, because both potentials are negative

Q14. A red blood cell is placed in distilled water. It swells and bursts. Which process best explains this result?

(A) Active transport pumps water into the cell against its concentration gradient
(B) Facilitated diffusion moves solutes out of the cell, causing water to follow by osmosis
(C) Osmosis moves water into the cell
(D) The plasma membrane dissolves in distilled water, allowing the cytoplasm to escape

Q15. Which structural feature of the plasma membrane allows it to remain fluid while still maintaining its integrity?

(A) A rigid wall of cellulose fibers embedded in the lipid bilayer
(B) Phospholipids with unsaturated fatty acid tails and cholesterol molecules interspersed among them
(C) Proteins that form permanent covalent bonds between the two phospholipid layers
(D) A single layer of saturated phospholipids packed tightly together

Q16. Two cells are connected by gap junctions. Which statement best describes what gap junctions allow?

(A) Large proteins move from one cell nucleus directly into the neighboring cell nucleus
(B) Cells fuse into a single cell with one shared plasma membrane
(C) Small molecules and ions pass directly between the cytoplasms of adjacent cells
(D) Only water can pass between cells, through aquaporin channels in the junction

Cellular Energetics

Q17. An enzyme catalyzes the conversion of substrate S to product P. When a molecule binds to a site other than the active site and changes the shape of the active site so the substrate can no longer bind, this is an example of what?

(A) Competitive inhibition, because the inhibitor competes for the active site
(B) Noncompetitive inhibition
(C) Denaturation, because the enzyme is permanently destroyed by the molecule
(D) Feedback activation, because the product increases the enzyme activity

Q18. A graph shows the rate of an enzyme-catalyzed reaction increasing with substrate concentration and then leveling off. Which explanation best accounts for the plateau?

(A) The enzyme is denatured by high substrate concentration and stops working entirely
(B) The substrate is used up completely at the plateau, so no product can form
(C) The reaction becomes endergonic at high substrate concentration and reverses direction
(D) All active sites are occupied at high substrate concentration

Q19. Which statement best explains why ATP is an effective energy carrier in cells?

(A) Hydrolysis of ATP to ADP releases energy
(B) ATP stores energy in its stable phosphate bonds, which release energy only when the cell dies
(C) ATP is the only molecule in the cell that contains chemical energy
(D) Hydrolysis of ATP requires a large input of energy, which the cell recovers later

Q20. In the light-dependent reactions of photosynthesis, what is the role of water?

(A) Water provides carbon atoms that are fixed into sugars in the Calvin cycle
(B) Water absorbs light energy and transfers it directly to NADPH
(C) Water is produced when ATP is synthesized by chemiosmosis
(D) Water is split to replace electrons lost by photosystem II

Q21. A plant is grown in an environment with high light intensity but very low carbon dioxide concentration. Which process is most likely to increase, reducing the efficiency of photosynthesis?

(A) Fermentation, because the plant cannot carry out aerobic respiration without CO_2
(B) Chemiosmosis, because the thylakoid membrane becomes more permeable at low CO_2
(C) Glycolysis, because the Calvin cycle stops producing glucose entirely
(D) Photorespiration

Q22. During cellular respiration, most ATP is produced during which stage, and by what mechanism?

(A) Glycolysis, by substrate-level phosphorylation in the cytoplasm
(B) The citric acid cycle, by direct transfer of phosphate groups to ADP
(C) Oxidative phosphorylation
(D) Fermentation, by regenerating NAD^+ in the absence of oxygen

Q23. A muscle cell is exercising intensely and oxygen delivery cannot keep up with demand. Which metabolic pathway allows glycolysis to continue under these conditions?

(A) The citric acid cycle, which produces additional ATP without oxygen
(B) Oxidative phosphorylation, which uses lactate as a final electron acceptor
(C) Photosynthesis, which supplies the cell with extra glucose
(D) Lactic acid fermentation, which oxidizes NADH to regenerate NAD+

Q24. A researcher measures oxygen consumption and carbon dioxide production in germinating seeds kept in the dark. The respiratory quotient (CO_2 released divided by O_2 consumed) is approximately 1.0. Which substrate are the seeds most likely oxidizing?

(A) Lipid, because fats release more CO_2 than the oxygen they consume
(B) Carbohydrate, because complete oxidation of glucose produces equal amounts of CO_2 and O_2 exchanged
(C) Protein, because amino acids produce nitrogen gas that raises the ratio
(D) Nucleic acid, because DNA oxidation releases CO_2 without consuming oxygen

Cell Communication and Cell Cycle

Q25. A signaling molecule binds to a receptor on the surface of a liver cell, activating a G protein, which activates adenylyl cyclase. The resulting second messenger is cyclic AMP. Which outcome best illustrates signal amplification in this pathway?

(A) One activated receptor leads to many cAMP molecules, each activating protein kinase A
(B) One cAMP molecule binds directly to DNA and activates a single gene
(C) The receptor is internalized after binding, preventing any further signaling
(D) Adenylyl cyclase converts one ATP molecule into one cAMP molecule and then stops

Q26. A cell responds to a hormone only if it has the appropriate receptor. Which statement best explains why a hormone can affect liver cells but not muscle cells in the same organism?

(A) Muscle cells lack a plasma membrane, so hormones cannot reach them
(B) Only liver cells express the receptor protein that binds the hormone
(C) Liver cells produce the hormone themselves, while muscle cells cannot
(D) Hormones are destroyed in the bloodstream before they reach muscle cells

Q27. In a negative feedback system that regulates blood glucose, what happens when blood glucose rises above the set point?

(A) Insulin is released
(B) Glucagon is released, promoting the breakdown of glycogen and raising blood glucose further
(C) The pancreas stops producing all hormones until blood glucose falls on its own
(D) Cells stop taking up glucose, which keeps blood glucose high permanently

Q28. During the cell cycle, the G1 checkpoint primarily assesses which condition before allowing the cell to enter S phase?

(A) Whether all chromosomes are correctly attached to spindle fibers
(B) Whether DNA replication has been completed without errors
(C) Whether the cytoplasm has divided into two daughter cells
(D) Whether the cell is large enough, has sufficient nutrients

Q29. A cell is treated with a drug that prevents the formation of cyclin-dependent kinase complexes required for the G2 to M transition. What is the most likely outcome?

(A) The cell will skip mitosis and divide its cytoplasm immediately
(B) The cell will arrest in G2 and will not enter mitosis
(C) The cell will enter S phase repeatedly without dividing
(D) The cell will complete mitosis but fail to replicate its DNA

Q30. Apoptosis differs from necrosis in that apoptosis is best described as which of the following?

(A) An uncontrolled bursting of the cell that triggers inflammation in surrounding tissue
(B) A programmed, controlled process that dismantles the cell without damaging neighboring cells
(C) A form of cell division that produces two identical daughter cells
(D) A mutation that prevents the cell from ever dividing again

Q31. A growth factor binds to a receptor tyrosine kinase on a cell surface, triggering a phosphorylation cascade that promotes cell division. If a mutation makes the receptor active even without the growth factor, what is the most likely consequence?

(A) Cell death, because the receptor blocks all other signaling pathways
(B) Arrest of the cell cycle, because the cascade cannot be turned off by phosphatases
(C) Uncontrolled cell division
(D) Loss of the receptor from the membrane, because it is rapidly degraded

Q32. Two daughter cells are produced by mitosis. Compared with the parent cell, each daughter cell has which genetic characteristic?

(A) The same number of chromosomes and genetically identical DNA
(B) Half the number of chromosomes and a different combination of genes
(C) Twice the number of chromosomes because DNA is duplicated twice
(D) The same number of chromosomes but a completely new set of genes

Heredity

Q33. In meiosis, homologous chromosomes pair up and exchange segments during prophase I. What is the genetic consequence of this event?

(A) Crossing over doubles the number of chromosomes in each gamete
(B) Crossing over separates sister chromatids so each gamete receives one copy
(C) Crossing over eliminates all recessive alleles from the population
(D) Crossing over creates new combinations of alleles on chromosomes

Q34. A pea plant heterozygous for seed color (Yy) is crossed with a homozygous recessive plant (yy). What proportion of the offspring is expected to show the recessive phenotype?

(A) 1/2, because half the offspring receive the y allele from the heterozygous parent and y from the other parent
(B) 1/4, because the recessive allele appears only in one quarter of the gametes
(C) 3/4, because the dominant allele masks the recessive allele in most offspring
(D) All offspring, because the recessive allele is always expressed

Q35. A researcher performs a dihybrid cross between pea plants heterozygous for seed shape and seed color (RrYy x RrYy). Assuming independent assortment, what is the expected phenotypic ratio in the offspring?

(A) 1:1:1:1, because each gamete type is equally likely to fertilize
(B) 3:1, because only the dominant traits appear in the F2 generation
(C) 9:3:3:1, with nine round yellow, three round green, three wrinkled yellow
(D) 1:2:1, because the alleles segregate in a codominant pattern

Q36. A woman who is a carrier of an X-linked recessive disorder has children with a man who does not have the disorder. What is the probability that their son will have the disorder?

(A) 1/2, because a son receives his X chromosome from his mother, who has a 50 percent chance of passing the affected allele
(B) 1/4, because the disorder is recessive and appears only in homozygous individuals
(C) 0, because the father does not carry the disorder
(D) 1, because all sons of a carrier mother inherit the disorder

Q37. In a population of fruit flies, a gene has two alleles, A and a. The allele frequencies are p = 0.6 for A and q = 0.4 for a. Assuming Hardy-Weinberg equilibrium, what is the expected frequency of heterozygous individuals?

(A) 0.36, calculated as p squared
(B) 0.16, calculated as q squared
(C) 0.48, calculated as 2pq = 2 x 0.6 x 0.4
(D) 0.24, calculated as pq without doubling

Q38. A chi-square test is performed on the results of a monohybrid cross. The calculated chi-square value is 0.5 with 1 degree of freedom, and the critical value at p = 0.05 is 3.84. What is the correct conclusion?

(A) The observed results differ significantly, so the null hypothesis must be rejected
(B) The experiment is invalid because the chi-square value is less than 1
(C) The observed results do not differ significantly from the expected results
(D) The degrees of freedom are incorrect, so no conclusion can be drawn

Q39. Nondisjunction during meiosis I in a human can produce gametes with an abnormal chromosome number. If such a gamete is fertilized by a normal gamete, the resulting zygote will have which chromosome number for that chromosome?

(A) Exactly 46 chromosomes with no abnormality
(B) Four copies of every chromosome in the genome
(C) Three copies (trisomy) or one copy (monosomy) of that chromosome
(D) No copies of that chromosome at all

Gene Expression and Regulation

Q40. During DNA replication, the lagging strand is synthesized in short fragments. What are these fragments called, and which enzyme joins them together?

(A) Okazaki fragments, joined by DNA ligase
(B) Leading fragments, joined by DNA polymerase III
(C) Primers, joined by helicase
(D) Exons, joined by RNA polymerase

Q41. A DNA template strand has the sequence 3′-TAC GGC ATA-5′. What is the sequence of the mRNA transcribed from it?

(A) 5′-TAC GGC ATA-3′, because mRNA is identical to the template strand
(B) 3′-AUG CCG UAU-5′, because mRNA is synthesized in the 3′ to 5′ direction
(C) 5′-ATG CCG TAT-3′, because mRNA contains thymine instead of uracil
(D) 5′-AUG CCG UAU-3′

Q42. A mutation changes a single nucleotide in a coding region, converting a codon for one amino acid into a codon for a different amino acid. What type of mutation is this?

(A) A nonsense mutation, because it creates a stop codon
(B) A frameshift mutation, because it shifts the reading frame
(C) A missense mutation
(D) A silent mutation, because it does not change the protein

Q43. In the lac operon of E. coli, what happens when lactose is present and glucose is absent?

(A) The repressor remains bound to the operator, so the lac genes stay off
(B) The operon is transcribed only when glucose is present, regardless of lactose
(C) The lac genes are expressed only if lactose is converted into glucose first
(D) The repressor is inactivated by allolactose, RNA polymerase transcribes the operon

Q44. Which modification to chromatin is most closely associated with increased gene expression in eukaryotes?

(A) Methylation of histone proteins, which always tightly condenses chromatin and silences genes
(B) Removal of all histones from the DNA, which destroys the chromosome structure
(C) Addition of methyl groups to the promoter, which recruits RNA polymerase directly
(D) Acetylation of histone proteins

Q45. A researcher uses gel electrophoresis to separate DNA fragments. Which statement correctly describes how the fragments move?

(A) Longer fragments move farther because they carry more negative charge
(B) Shorter fragments move farther toward the positive electrode
(C) Fragments move toward the negative electrode because DNA is positively charged
(D) All fragments move the same distance regardless of size

Q46. A gene is normally expressed only in liver cells. A scientist finds that the gene DNA sequence is identical in liver and skin cells, but the gene is methylated in skin cells. What does this best illustrate?

(A) Skin cells have lost the gene entirely through deletion
(B) Liver cells have a mutation that creates a new gene
(C) Gene expression is regulated by epigenetic modification
(D) Methylation changes the DNA sequence so the gene cannot be read

Natural Selection

Q47. In a population of beetles, green beetles are better camouflaged on leaves than brown beetles, and birds eat more brown beetles. Over several generations, the frequency of the green allele increases. This is best described as an example of what?

(A) Genetic drift, because the change is caused by random chance alone
(B) Gene flow, because new alleles are introduced from another population
(C) Natural selection
(D) Mutation, because the green allele is created by the birds

Q48. A population of 1,000 individuals is in Hardy-Weinberg equilibrium. The frequency of the recessive allele a is 0.3. How many individuals in the population are expected to be homozygous recessive?

(A) 300, because 0.3 x 1,000 individuals carry the allele
(B) 90, because q squared = 0.09 and 0.09 x 1,000 = 90
(C) 600, because the dominant allele frequency is 0.7
(D) 9, because q squared is 0.09 and only 9 percent of 100 are recessive

Q49. A small group of birds colonizes an isolated island. By chance, the allele frequencies in the founders differ greatly from the mainland population. This phenomenon is called what?

(A) The bottleneck effect, which occurs when a population is reduced by a catastrophe
(B) Gene flow, because the birds carried alleles to a new location
(C) Directional selection, because island conditions favor different traits
(D) The founder effect, a form of genetic drift caused by a small founding population

Q50. Two populations of salamanders live on opposite sides of a river and can no longer interbreed. If they were once a single population, what most likely caused their separation into two species?

(A) Sympatric speciation, because the populations diverged while living in the same area
(B) Allopatric speciation
(C) Artificial selection, because humans bred the two groups separately
(D) Hybridization, because the two groups produced fertile offspring

Q51. A cladogram shows that species A and B share a more recent common ancestor with each other than either does with species C. Which statement is best supported?

(A) A and B are more closely related to each other than either is to C
(B) A and C share more derived characters than A and B
(C) B evolved directly from A
(D) C is the ancestor of both A and B

Q52. The forelimbs of humans, bats, and whales have the same basic bone structure but are used for different functions. These structures are best described as what?

(A) Analogous structures, because they evolved independently for similar functions
(B) Vestigial structures, because they no longer serve any function
(C) Convergent structures, because they arose from unrelated ancestors
(D) Homologous structures

Q53. A researcher compares the cytochrome c amino acid sequences of several species. Humans and chimpanzees differ by 0 amino acids, while humans and yeast differ by 44. What can be concluded?

(A) Cytochrome c is not a useful molecule for comparing species
(B) Humans and chimpanzees are more closely related to each other than either is to yeast
(C) Yeast and humans share a more recent common ancestor than humans and chimpanzees
(D) The number of differences is random and unrelated to evolutionary distance

Ecology

Q54. In an ecosystem, the total amount of energy captured by producers through photosynthesis, minus the energy they use in respiration, is known as what?

(A) Gross primary productivity, the total energy captured before respiration
(B) Secondary productivity, the energy stored by herbivores
(C) Net primary productivity
(D) Biomass, the total mass of all organisms in the ecosystem

Q55. A food chain has four trophic levels. If the producers contain 10,000 kJ of energy, approximately how much energy is available to the tertiary consumers, according to the 10 percent rule?

(A) 10 kJ, because only about 10 percent of energy transfers at each of three transfers
(B) 1,000 kJ, because 10 percent of the producer energy reaches the top level directly
(C) 100 kJ, because energy is lost only at the first trophic level
(D) 10,000 kJ, because energy is recycled through the food chain

Q56. A population of deer grows following a logistic growth pattern. What happens to the growth rate as the population size approaches the carrying capacity?

(A) The growth rate decreases and approaches zero
(B) The growth rate increases exponentially, because more individuals reproduce
(C) The growth rate stays constant, because birth and death rates do not change
(D) The population immediately crashes to zero once it reaches carrying capacity

Q57. A researcher uses the mark-recapture method to estimate a fish population. She marks 50 fish and releases them. Later she captures 100 fish, of which 10 are marked. What is the estimated population size?

(A) 150, because 50 marked plus 100 captured equals the total population
(B) 1,000, because the recapture rate of 10 percent means the population is ten times the marked number
(C) 60, because only 60 distinct fish were handled in total
(D) 500, because (50 marked x 100 captured) divided by 10 recaptured = 500

Q58. Wolves are reintroduced to an area, and their predation reduces the deer population, which allows vegetation to recover and many other species to increase. Wolves in this scenario are best described as what?

(A) An invasive species, because they were introduced by humans
(B) A pioneer species, because they are the first to colonize the area
(C) A dominant species, because they are the most abundant organism in the area
(D) A keystone species

Q59. A forest is cleared by a wildfire, leaving the soil intact. Over decades, grasses, shrubs, and eventually trees return. This process is best described as what?

(A) Secondary succession
(B) Primary succession, because no life remains after the fire
(C) Climax succession, because the forest never changes after the fire
(D) Ecological extinction, because the original community is permanently lost

Q60. Agricultural runoff adds excess nitrogen and phosphorus to a lake. Algae grow rapidly, then die and decompose, depleting oxygen in the water. This process is called what?

(A) Acidification, because the runoff lowers the pH of the lake
(B) Biomagnification, because toxins accumulate in top predators
(C) Desertification, because the lake becomes too salty for fish
(D) Eutrophication, because nutrient enrichment causes algal blooms and oxygen depletion

Answer Key

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

Worked explanations for all 60 questions: quaidianpoint.com/ap-biology-practice-test-1/