AP Biology Practice Test 2

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. Ice floats on liquid water. Which property of water best explains this observation?

(A) Ice contains air bubbles that make it buoyant regardless of its density
(B) Water molecules in ice move faster than in liquid water, pushing the ice upward
(C) Ice is warmer than liquid water, so it rises by convection
(D) In ice, hydrogen bonds hold water molecules in an open lattice

Q2. A student compares two fatty acids: one is saturated and the other is unsaturated. Which statement correctly distinguishes them?

(A) The saturated fatty acid has double bonds, while the unsaturated fatty acid has only single bonds
(B) The unsaturated fatty acid has one or more double bonds that create kinks
(C) Saturated fatty acids are found only in plants, while unsaturated fatty acids are found only in animals
(D) Unsaturated fatty acids are solid at room temperature, while saturated fatty acids are liquid

Q3. Which statement best describes the role of a buffer in blood plasma?

(A) A buffer minimizes changes in pH by donating or accepting hydrogen ions when acids or bases are added
(B) A buffer raises blood pH to exactly 7.0 at all times, regardless of conditions
(C) A buffer converts all acids in the blood into strong bases
(D) A buffer prevents carbon dioxide from dissolving in the blood

Q4. Two amino acids are joined to form a dipeptide. Which type of reaction occurs, and what is released?

(A) Dehydration synthesis
(B) Hydrolysis, releasing one water molecule as the bond breaks
(C) Dehydration synthesis, releasing one carbon dioxide molecule
(D) Oxidation, releasing one oxygen molecule

Q5. Starch and glycogen both store glucose, but glycogen is more highly branched than starch. What is the functional advantage of this branching?

(A) More branch points provide more free ends where enzymes can release glucose quickly
(B) Branching makes glycogen insoluble, so it can be stored in larger amounts
(C) Branching prevents enzymes from reaching the glucose, slowing its release
(D) Branching changes glycogen into a lipid that stores more energy

Q6. A protein loses its function after heating, although its amino acid sequence is unchanged. Which level of protein structure has been disrupted?

(A) Tertiary structure, the three-dimensional folding of the polypeptide
(B) Primary structure, the sequence of amino acids
(C) The peptide bonds linking amino acids together
(D) The genetic code in the DNA that encodes the protein

Q7. A mutation substitutes a hydrophilic amino acid for a hydrophobic amino acid in the interior of a folded protein. What is the most likely effect on the protein?

(A) The protein will become more stable because hydrophilic side chains strengthen the core
(B) The primary structure of the protein will be unchanged, so there will be no effect at all
(C) The protein may misfold
(D) The protein will be converted into a nucleic acid

Cell Structure and Function

Q8. The sodium-potassium pump moves three sodium ions out of a cell and two potassium ions into the cell. Which statement about this transport is correct?

(A) It is facilitated diffusion, because the ions move through a channel protein without energy
(B) It is active transport that uses ATP to move ions against their concentration gradients
(C) It is osmosis, because water follows the ions across the membrane
(D) It is passive transport, because sodium and potassium move down their gradients

Q9. A plant cell is placed in a concentrated salt solution. The cell membrane pulls away from the cell wall. This phenomenon is called what, and what causes it?

(A) Plasmolysis, caused by water leaving the central vacuole and cytoplasm by osmosis
(B) Lysis, caused by water rushing into the cell and bursting the membrane
(C) Turgor, caused by water entering the cell and pressing against the wall
(D) Cytolysis, caused by salt entering the cell through aquaporins

Q10. A solution has a solute potential of -0.9 MPa and a pressure potential of 0.3 MPa. What is the water potential of the solution?

(A) -1.2 MPa, because the two potentials are multiplied together
(B) 0.6 MPa, because pressure potential cancels the negative solute potential
(C) -0.6 MPa, because water potential equals solute potential plus pressure potential
(D) -0.3 MPa, because only the pressure potential matters in a solution

Q11. Glucose enters a red blood cell through a transport protein without using ATP, moving from higher to lower concentration. This is an example of what?

(A) Active transport, because a protein is involved in the movement
(B) Facilitated diffusion
(C) Osmosis, because glucose is dissolved in water
(D) Endocytosis, because the membrane engulfs the glucose

Q12. Which organelle is most directly responsible for modifying, sorting, and shipping proteins to their destinations?

(A) The lysosome, which digests proteins that are no longer needed
(B) The mitochondrion, which provides energy for protein synthesis
(C) The nucleolus, which assembles ribosomes for protein synthesis
(D) The Golgi apparatus

Q13. A white blood cell engulfs a bacterium and encloses it in a vesicle. The vesicle then fuses with an organelle containing digestive enzymes. Which organelle is this?

(A) The lysosome, which contains hydrolytic enzymes that digest the bacterium
(B) The vacuole, which stores water for the cell
(C) The peroxisome, which breaks down fatty acids
(D) The ribosome, which synthesizes proteins to fight infection

Q14. Plasmodesmata in plant cells serve a function most similar to which structure in animal cells?

(A) Tight junctions, because both prevent all substances from passing between cells
(B) Desmosomes, because both fuse the plasma membranes of adjacent cells permanently
(C) Anchoring junctions, because both connect cells to the extracellular matrix
(D) Gap junctions, because both allow direct cytoplasmic communication between neighboring cells

Q15. A cube-shaped cell has a side length of 2 micrometers. What is its surface-area-to-volume ratio?

(A) 6 per micrometer, because surface area is 6 times the volume
(B) 1.5 per micrometer, because the ratio is half the side length
(C) 3 per micrometer
(D) 12 per micrometer, because surface area is 24 and volume is 2

Cellular Energetics

Q16. An enzyme has an optimum pH of 7. At pH 3, its activity drops to near zero. Which explanation is most likely?

(A) The substrate is destroyed by the acid before it can reach the enzyme
(B) The change in pH disrupts hydrogen bonds and ionic interactions
(C) The enzyme is converted into its substrate at low pH
(D) Low pH increases the activation energy of the reaction to infinity

Q17. In a metabolic pathway, the end product binds to the first enzyme in the pathway and reduces its activity. This is an example of what?

(A) Feedback inhibition, which prevents overproduction of the end product
(B) Competitive inhibition, because the end product competes with the substrate
(C) Positive feedback, because the product increases pathway activity
(D) Allosteric activation, because the product increases the enzyme activity

Q18. Which statement about the free energy change (ΔG) of a reaction is correct?

(A) A reaction with a positive ΔG is exergonic and releases energy
(B) A reaction with a negative ΔG requires a constant input of energy to proceed
(C) A reaction with a negative ΔG is exergonic and can proceed spontaneously
(D) The value of ΔG tells how fast a reaction will occur

Q19. During photosynthesis, ATP is produced in the thylakoid membrane by which mechanism?

(A) Substrate-level phosphorylation in the Calvin cycle
(B) Fermentation of glucose in the stroma
(C) Direct absorption of light energy by ATP synthase
(D) Chemiosmosis, as protons that accumulate in the thylakoid lumen flow through ATP synthase into the stroma

Q20. The Calvin cycle fixes carbon dioxide into organic molecules. In which part of the chloroplast does this cycle occur, and what is its first stable product?

(A) In the thylakoid lumen, producing glucose directly from CO_2 and water
(B) In the stroma, producing oxygen as the first product of carbon fixation
(C) On the outer membrane, producing ATP from ADP and phosphate
(D) In the stroma, producing 3-phosphoglycerate (3-PGA) after CO_2 joins ribulose bisphosphate

Q21. CAM plants open their stomata at night and close them during the day. What is the adaptive advantage of this pattern?

(A) It increases the rate of photosynthesis by keeping stomata open in bright light
(B) It prevents the plant from absorbing any carbon dioxide at all
(C) It allows the plant to carry out the light reactions at night
(D) It reduces water loss during the hot day while still allowing CO_2 uptake at night

Q22. Glycolysis produces a net gain of how many ATP molecules per glucose molecule, and where does it occur?

(A) 4 ATP, in the mitochondrial matrix
(B) 36 ATP, in the inner mitochondrial membrane
(C) 2 ATP, in the cytoplasm
(D) 0 ATP, because glycolysis consumes more ATP than it produces

Q23. Cyanide binds to a protein complex in the electron transport chain and blocks the transfer of electrons to oxygen. What is the most likely immediate effect on the cell?

(A) Glycolysis stops immediately because cyanide destroys all glucose in the cell
(B) ATP synthesis by oxidative phosphorylation stops
(C) The citric acid cycle speeds up to compensate for the loss of the electron transport chain
(D) Fermentation begins in the mitochondria to replace the blocked chain

Cell Communication and Cell Cycle

Q24. A ligand binds to a ligand-gated ion channel in a neuron membrane. What happens next in the signaling pathway?

(A) The ligand enters the nucleus and directly activates gene transcription
(B) The channel opens and ions flow across the membrane
(C) The channel is destroyed and the cell stops responding to all signals
(D) A second messenger is produced in the cytoplasm before the channel opens

Q25. Receptor tyrosine kinases are activated by which mechanism?

(A) A single receptor binds a G protein, which activates adenylyl cyclase
(B) Two receptor proteins dimerize after ligand binding
(C) The receptor is cleaved by a protease, releasing a fragment that enters the nucleus
(D) The ligand passes through the membrane and binds the receptor inside the cell

Q26. Calcium ions act as a second messenger in many signaling pathways. Which statement about their role is correct?

(A) Calcium ions always inhibit signaling by blocking all protein kinases
(B) A rise in cytosolic calcium concentration triggers responses such as muscle contraction and vesicle release
(C) Calcium is a hormone that travels through the bloodstream to target cells
(D) Calcium ions are stored in the nucleus and released only during mitosis

Q27. How is a cell signaling pathway most commonly terminated after the signal has been removed?

(A) The receptor is permanently destroyed and the cell can never respond again
(B) The ligand is converted into a new signaling molecule that continues the response
(C) All proteins in the pathway are synthesized again to reset the cell
(D) Second messengers are degraded or removed

Q28. Oxytocin release during childbirth increases uterine contractions, which cause more oxytocin release. This is an example of what?

(A) Negative feedback, because the response returns the system to its set point
(B) Feedforward inhibition, because the response prevents further contractions
(C) Positive feedback, because the response amplifies the original stimulus
(D) Homeostatic equilibrium, because the system remains unchanged

Q29. The M checkpoint of the cell cycle checks which condition before the cell proceeds to anaphase?

(A) That DNA has been fully replicated without errors
(B) That the cell has grown to twice its original size
(C) That the cytoplasm has completely divided
(D) That all chromosomes are properly attached to spindle fibers at the metaphase plate

Q30. Cyclins are proteins whose concentrations rise and fall during the cell cycle. What is their role?

(A) They directly replicate DNA during S phase
(B) They bind to cyclin-dependent kinases and activate them to drive the cell through specific phases
(C) They form the spindle fibers that separate chromosomes
(D) They break down the nuclear envelope during prophase

Q31. A proto-oncogene mutates into an oncogene that produces a permanently active growth-promoting protein. What is the most likely consequence for the cell?

(A) The cell will immediately undergo apoptosis
(B) The cell will stop dividing permanently and enter senescence
(C) The cell will lose its plasma membrane and die
(D) The cell may divide uncontrollably

Heredity

Q32. During anaphase I of meiosis, homologous chromosomes separate. How does this differ from anaphase of mitosis?

(A) In meiosis I, sister chromatids separate; in mitosis, homologous chromosomes separate
(B) There is no difference; both separate sister chromatids
(C) In meiosis I, chromosomes do not separate at all
(D) In meiosis I, homologous chromosomes separate; in mitosis, sister chromatids separate

Q33. Two genes are located on the same chromosome, 20 map units apart. What percentage of gametes is expected to be recombinant for these genes?

(A) 50 percent, because genes on the same chromosome always assort independently
(B) 20 percent, because one map unit corresponds to a 1 percent recombination frequency
(C) 0 percent, because linked genes never recombine
(D) 100 percent, because crossing over always occurs between them

Q34. A pedigree shows a trait that appears in every generation, and every affected individual has at least one affected parent. The trait is most likely which of the following?

(A) Autosomal recessive, because the trait skips generations
(B) Autosomal dominant
(C) X-linked recessive, because only males are affected
(D) Mitochondrial, because only females pass the trait on

Q35. In snapdragons, crossing a red-flowered plant (RR) with a white-flowered plant (WW) produces pink-flowered offspring (RW). This pattern is best described as what?

(A) Incomplete dominance
(B) Codominance, because both alleles are fully expressed at the same time
(C) Complete dominance, because red is dominant over white
(D) Epistasis, because one gene masks the expression of another

Q36. A chi-square test compares observed offspring counts of 90, 30, 30, and 10 with expected counts of 90, 30, 30, and 10. What is the chi-square value, and what does it indicate?

(A) 160, indicating a large deviation from the expected results
(B) 3.84, indicating the results are significant at $p = 0.05$
(C) 1, indicating one degree of freedom
(D) 0, indicating the observed results match the expected results exactly

Q37. In a cross between two heterozygous individuals (Aa x Aa), what is the probability that an offspring will be homozygous recessive (aa)?

(A) 1/2, because half the offspring receive the recessive allele
(B) 3/4, because the dominant allele appears in three quarters of the offspring
(C) 1/4, because each parent has a 1/2 chance of contributing the a allele
(D) 1/16, because the alleles must combine twice

Q38. The ABO blood group system shows that a person with blood type AB has both A and B antigens on red blood cells. This is an example of what?

(A) Incomplete dominance, because the phenotype is a blend of A and B
(B) Polygenic inheritance, because many genes determine blood type
(C) Codominance, because both alleles are expressed fully in the heterozygote
(D) Pleiotropy, because one allele affects many traits

Q39. A couple has a child with Down syndrome, caused by trisomy 21. Which event most likely produced the extra chromosome 21?

(A) Nondisjunction during meiosis in one parent
(B) A point mutation in the gene for chromosome 21 during mitosis
(C) Crossing over between chromosome 21 and another chromosome
(D) Deletion of a segment of chromosome 21 in the zygote

Gene Expression and Regulation

Q40. During DNA replication, which enzyme unwinds the double helix by breaking hydrogen bonds between base pairs?

(A) DNA polymerase, which adds nucleotides to the new strand
(B) Primase, which synthesizes short RNA primers
(C) Ligase, which joins Okazaki fragments
(D) Helicase, which separates the two strands ahead of the replication fork

Q41. A tRNA molecule has the anticodon 3′-UAC-5′. Which mRNA codon will it pair with, and which amino acid does that codon specify?

(A) 5′-AUG-3′, which is the start codon specifying methionine
(B) 5′-UAC-3′, which specifies tyrosine
(C) 3′-AUG-5′, which specifies methionine in the reverse direction
(D) 5′-TAC-3′, which specifies tyrosine

Q42. A gene contains introns and exons. During processing of the primary RNA transcript, what happens to the introns?

(A) They are translated into protein along with the exons
(B) They are copied into DNA and inserted back into the genome
(C) They are exported to the cytoplasm unchanged
(D) They are removed by splicing

Q43. In the trp operon of E. coli, high levels of tryptophan in the environment lead to what outcome?

(A) Tryptophan inactivates the repressor, so the operon is transcribed continuously
(B) Tryptophan binds the repressor
(C) The operon is activated by tryptophan, increasing tryptophan synthesis
(D) Tryptophan has no effect because the trp operon is always on

Q44. A frameshift mutation is caused by the insertion of a single nucleotide into a coding sequence. What is the most likely effect on the protein?

(A) The reading frame shifts
(B) Only one amino acid changes, and the rest of the protein is unaffected
(C) The protein becomes longer by exactly one amino acid with no other changes
(D) The mutation is always silent because the genetic code is degenerate

Q45. Small interfering RNAs (siRNAs) regulate gene expression by which mechanism?

(A) They bind to DNA and change its nucleotide sequence
(B) They act as transcription factors that activate gene expression
(C) They bind to complementary mRNA and target it for degradation
(D) They replace ribosomes in the cytoplasm during translation

Q46. A researcher uses PCR to amplify a specific DNA segment. Which component is essential for the reaction to work?

(A) Ribosomes and transfer RNA to translate the DNA
(B) DNA primers that flank the target sequence and a heat-stable DNA polymerase
(C) Restriction enzymes to cut the DNA into fragments
(D) RNA polymerase to transcribe the DNA into mRNA

Natural Selection

Q47. In a population of snails, shell color varies from light to dark. Birds prey most heavily on snails with intermediate shell color, so both light and dark snails survive better. This is an example of which type of selection?

(A) Directional selection, because it favors one extreme over the other
(B) Stabilizing selection, because it favors the intermediate phenotype
(C) Sexual selection, because it involves mate choice
(D) Disruptive selection

Q48. Which condition must be met for a population to remain in Hardy-Weinberg equilibrium?

(A) There is no mutation, migration, genetic drift, or natural selection
(B) The population is small, so genetic drift is strong
(C) Natural selection favors one allele over the other
(D) The population is divided into isolated subpopulations

Q49. A population of cheetahs went through a severe reduction in numbers, and today all cheetahs are genetically very similar. This loss of diversity is best explained by what?

(A) The founder effect, because a few cheetahs colonized a new habitat
(B) Gene flow, because cheetahs migrated between populations
(C) The bottleneck effect
(D) Directional selection, because only the fastest cheetahs survived

Q50. Prezygotic reproductive barriers prevent the formation of a hybrid zygote. Which of the following is a prezygotic barrier?

(A) A hybrid offspring is sterile and cannot reproduce
(B) A hybrid embryo dies before birth
(C) Two species breed at different times of year
(D) Hybrid offspring have lower survival than either parent species

Q51. A researcher builds a phylogenetic tree using the principle of parsimony. Which tree will she choose?

(A) The tree with the largest number of branches
(B) The tree that places the oldest species at the top
(C) The tree that requires the fewest evolutionary changes to explain the observed data
(D) The tree that groups species by overall similarity alone

Q52. Fossils of a species are found in rock layers that are 300 million years old, but the species is absent from older layers. What does this best suggest?

(A) The species existed before 300 million years ago but left no fossils anywhere
(B) The rock layers are incorrectly dated and the species is much younger
(C) The species went extinct exactly 300 million years ago
(D) The species evolved around 300 million years ago

Q53. Which statement best summarizes the evidence from the Miller-Urey experiment for the origin of life?

(A) The experiment created the first living cells from inorganic chemicals
(B) The experiment proved that life arrived on Earth from space
(C) Simple organic molecules such as amino acids can form from inorganic compounds under conditions resembling early Earth
(D) The experiment showed that oxygen was abundant in the early atmosphere

Ecology

Q54. A plant shoot bends toward a light source. This response is controlled by the hormone auxin. How does auxin produce the bending?

(A) Auxin accumulates on the lighted side, causing those cells to grow faster and bend the shoot away from light
(B) Auxin accumulates on the shaded side
(C) Auxin stops all cell elongation, so the shoot bends randomly
(D) Auxin causes cells on the shaded side to shrink, pulling the shoot toward the light

Q55. Which of the following best describes an r-selected species?

(A) It produces many offspring, provides little parental care, and lives in unstable environments
(B) It produces few offspring, provides extensive parental care, and lives near carrying capacity
(C) It reproduces only once in its lifetime and then dies immediately after mating
(D) It has a long lifespan and a low reproductive rate

Q56. A survivorship curve shows high survival through most of life, with most deaths occurring in old age. Which type of survivorship curve is this, and which organisms typically show it?

(A) Type I, typical of humans and other large mammals with extensive parental care
(B) Type II, typical of birds with constant mortality throughout life
(C) Type III, typical of fish that produce many offspring with little care
(D) Type I, typical of insects that lay thousands of eggs

Q57. Two species of barnacles compete for space on a rocky shore. One species is excluded from the lower shore by the other. This is an example of what?

(A) Competitive exclusion
(B) Mutualism, because both species benefit from sharing the shore
(C) Predation, because one barnacle eats the other
(D) Commensalism, because one species benefits and the other is unaffected

Q58. Which factor is density-dependent, meaning its effect increases as population density increases?

(A) A severe drought that kills individuals regardless of population size
(B) Disease transmission
(C) A volcanic eruption that destroys a habitat
(D) A sudden freeze that kills a fixed proportion of the population

Q59. An introduced species spreads rapidly in a new habitat, outcompeting native species and reducing biodiversity. Which term best describes this species?

(A) A keystone species, because it maintains the structure of the community
(B) An endemic species, because it is found only in that habitat
(C) An invasive species
(D) A pioneer species, because it is the first to colonize disturbed land

Q60. The carbon cycle includes the movement of carbon between the atmosphere, living organisms, and the Earth. Which process removes carbon dioxide from the atmosphere?

(A) Cellular respiration, which releases CO2 into the atmosphere
(B) Combustion, which releases CO2 from fossil fuels
(C) Photosynthesis, which fixes CO2 into organic molecules in producers
(D) Decomposition, which releases CO2 from dead organisms

Answer Key

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

Worked explanations for all 60 questions: quaidianpoint.com/ap-biology-practice-test-2/