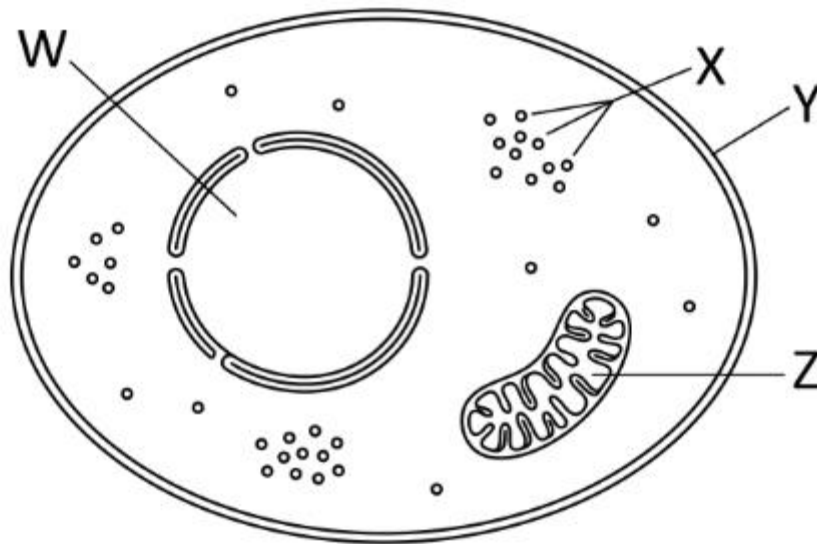


PRACTICE EXAM 12: LIFE SCIENCE: BIOLOGY SIMULATION (50 QUESTIONS)

1. Which type of organic compound serves as a major long-term energy storage molecule in many animals and is built from glycerol and fatty acids?

- A. Carbohydrate, the body's quickest available source of usable energy
- B. Lipid, which stores more energy per gram than the other compounds
- C. Protein, which is built from amino acids joined by peptide bonds
- D. Nucleic acid, which stores and transmits an organism's genetic information

2. The diagram below shows a typical animal cell with four structures labeled W, X, Y, and Z. Which labeled structure is the site where most ATP is produced during aerobic respiration?



- A. W, the structure that contains the cell's genetic material

- B. X, the structures that assemble amino acids into proteins
- C. Y, the boundary that controls what enters and leaves the cell
- D. Z, the organelle where aerobic respiration produces most ATP

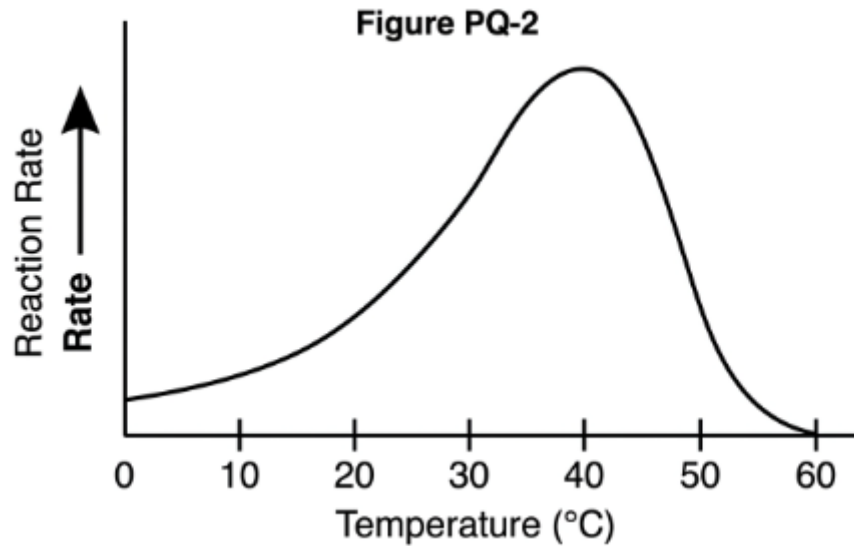
3. In an experiment, a student places one strip of potato in distilled water and an identical strip in a concentrated salt solution. After 30 minutes, the strip in the salt solution is limp and has lost mass. Which process best explains this change?

- A. Osmosis moved water out of the cells into the surrounding salt solution
- B. Active transport pumped salt ions out of the potato cells very rapidly
- C. The cells carried out respiration and used up all their stored starch
- D. The cell walls dissolved in the salt and released their water as waste

4. A molecule of glucose has the formula $C_6H_{12}O_6$, and plants build glucose from carbon dioxide and water during photosynthesis. Which statement best describes the role of light in this process?

- A. Light is incorporated directly into the glucose molecule as stored matter
- B. Light breaks glucose down into carbon dioxide and water during the day
- C. Light provides the energy used to build glucose from simpler molecules
- D. Light supplies the carbon atoms needed to assemble the glucose molecule

5. The graph below shows how the rate of an enzyme-controlled reaction changes as the temperature increases. Based on the graph, which statement best describes what happens to the reaction rate above $40^{\circ}C$?



- A. The reaction rate continues to increase steadily as the temperature rises
 - B. The reaction rate decreases as the enzyme loses its functional shape
 - C. The reaction rate stays constant because enzymes are not affected by heat
 - D. The reaction rate doubles for every additional ten degrees above this point
6. Which sequence correctly lists the levels of organization in a complex multicellular organism, from smallest to largest?
- A. Cell → tissue → organ → organ system → organism
 - B. Tissue → cell → organism → organ → organ system
 - C. Organ → organ system → tissue → cell → organism
 - D. Organism → organ system → organ → cell → tissue
7. A virus is sometimes described as being on the borderline between living and nonliving things. Which characteristic of viruses supports the idea that they are NOT fully living?
- A. Viruses contain genetic material such as DNA or RNA inside their coats
 - B. Viruses can cause diseases in plants, animals, and bacteria alike
 - C. Viruses are much smaller than the cells of the organisms they infect

D. Viruses cannot reproduce on their own without using a living host cell

8. Cellular respiration and photosynthesis are often described as opposite processes. Which statement correctly identifies the reactants of cellular respiration?

A. Carbon dioxide and water are used to produce glucose and oxygen

B. Glucose and water are used to produce oxygen and carbon dioxide

C. Glucose and oxygen are used to produce carbon dioxide and water

D. Oxygen and carbon dioxide are used to produce glucose and water

9. A student observes onion root tip cells under a microscope and notices that, in some cells, thickened chromosomes are lined up across the middle of the cell. These cells are most likely undergoing:

A. Fertilization, in which two gametes are combining their nuclei together

B. Mitosis, the cell division that produces two identical body cells

C. Digestion, in which enzymes break down nutrients within the cell

D. Diffusion, the movement of molecules from high to low concentration

10. In a healthy person, the pancreas releases two hormones, insulin and glucagon, that act in opposition to regulate blood sugar. This type of opposing hormonal control is an example of:

A. Negative feedback that keeps the blood sugar within a stable range

B. Positive feedback that amplifies the original change in blood sugar

C. Active transport that moves glucose against its concentration gradient

D. Differentiation that produces the specialized cells of the pancreas

11. The human digestive system breaks large food molecules into smaller ones that can be absorbed. Which statement correctly pairs a nutrient with the smaller molecules it is broken into?

A. Proteins are broken down into simple sugars such as glucose units

- B. Carbohydrates are broken down into amino acids used to build tissue
- C. Lipids are broken down into nucleotides used to construct new DNA
- D. Proteins are broken down into amino acids that the body can absorb

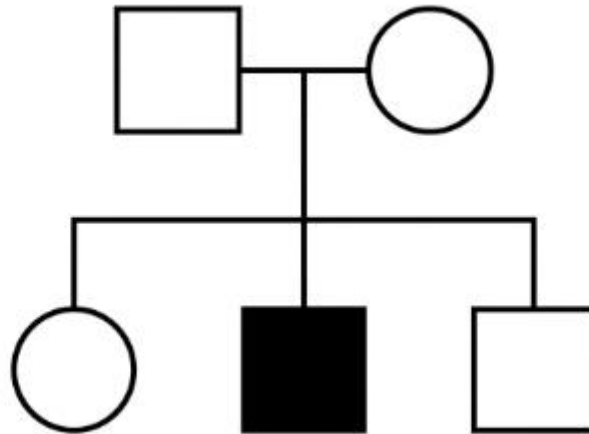
12. A scientist grows bacteria in a flask with abundant nutrients. At first the population doubles rapidly, but later growth slows and levels off. The leveling off of the population is most likely caused by:

- A. A sudden genetic mutation that stops all the bacteria from dividing
- B. The bacteria becoming too large to fit within the space of the flask
- C. Limited resources and waste buildup as the population nears carrying capacity
- D. The bacteria evolving into a completely new and much larger species

13. Which level of ecological organization includes all the populations of different species that live and interact in the same area?

- A. A community, made up of all the interacting populations in an area
- B. A population, made up of one species in a single particular location
- C. An ecosystem, made up of living things together with nonliving factors
- D. A biome, made up of large regions that share a similar overall climate

14. The pedigree chart below traces a single genetic trait through a family. Squares represent males, circles represent females, and shaded shapes represent individuals who express the trait. Based on the chart, two unaffected parents have a child who is affected. This pattern indicates that the trait is most likely:



- A. A dominant trait, because every affected child must have an affected parent
- B. A recessive trait, because two unaffected parents produced an affected child
- C. A trait that appears only in males in every generation of the family
- D. A trait caused entirely by the environment rather than by inheritance

15. In humans, ABO blood type is determined by multiple alleles, and in a person with type AB blood, both the A and B alleles are fully expressed. This inheritance pattern, in which two different alleles are both fully expressed in the heterozygote, is called:

- A. Incomplete dominance, in which the phenotype is a blend of two alleles
- B. Sex linkage, in which the controlling gene is located on the X chromosome
- C. Complete dominance, in which one allele fully masks the other allele
- D. Codominance, in which both alleles are fully expressed in the phenotype

16. One strand of a DNA molecule has the base sequence A–T–G–C–A. What is the complementary base sequence found on the opposite strand of this DNA molecule?

- A. A–T–G–C–A, the identical sequence repeated on the other strand
- B. G–C–A–T–G, formed by shifting each base one position over
- C. T–A–C–G–T, formed by pairing A with T and G with C

D. U–A–C–G–U, with uracil substituted in place of every thymine

17. During meiosis, homologous chromosomes may exchange segments of genetic material in a process called crossing over. This process is important to evolution because it:

- A. Produces two genetically identical daughter cells used for body growth
- B. Increases the genetic variation among the gametes that are produced
- C. Reduces the chromosome number from diploid down to haploid in cells
- D. Repairs damaged sections of DNA before the cell begins to divide

18. A farmer notices that repeated use of the same pesticide has become less effective at controlling an insect pest over several years. Which explanation best accounts for this loss of effectiveness?

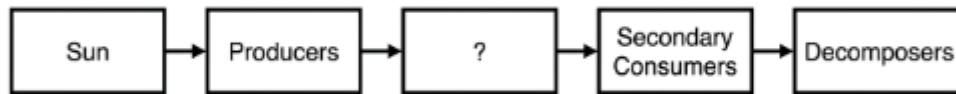
- A. Insects with resistance survived and passed the trait on to their offspring
- B. The pesticide became chemically weaker each time it was applied to the field
- C. Each insect individually adapted its own body to tolerate the pesticide
- D. The crops produced their own chemicals that ended up protecting the pests

19. Two species of birds on the same island both feed on insects, but they feed at different times of day and in different parts of the trees. This division of resources allows both species to coexist. This situation best illustrates:

- A. Predation, in which one organism captures and then consumes another
- B. Mutualism, in which both of the species benefit from their interaction
- C. Reduced competition through occupying different ecological niches
- D. Parasitism, in which one organism benefits while the other is harmed

20. The diagram below shows the flow of energy through an ecosystem. Based on the diagram, which group of organisms belongs in the box marked with a question mark, directly after the producers?

Figure PQ-4:



- A. Decomposers, which break down dead organisms and recycle their nutrients
- B. Producers, which capture sunlight to manufacture their own food supply
- C. Top predators, which sit at the very highest level of the food web
- D. Herbivores, the primary consumers that feed directly on the producers

21. A scientist measures dissolved oxygen in a river at several points downstream from a sewage outflow. Just below the outflow, oxygen levels drop sharply, then gradually recover farther downstream. The sharp drop just below the outflow is best explained by:

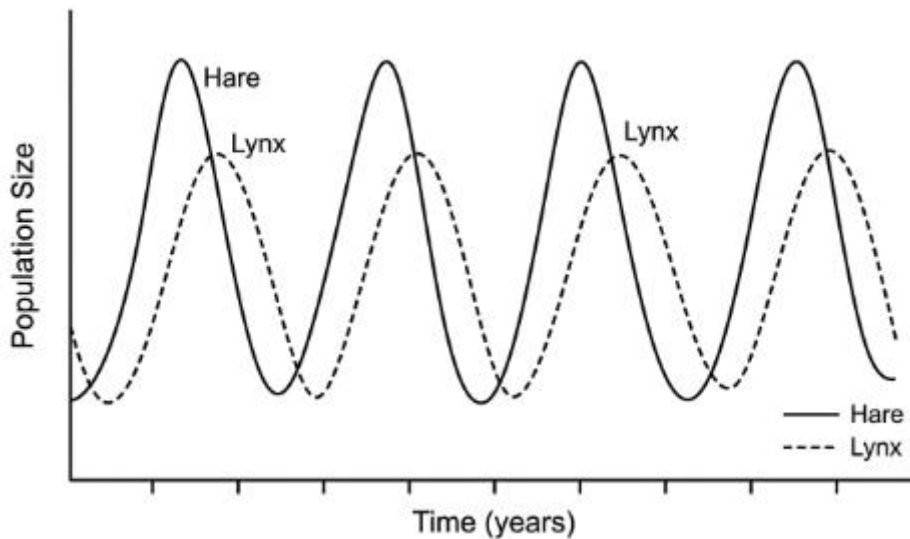
- A. Algae using up all of the oxygen during photosynthesis in the daytime
- B. Bacteria consuming oxygen as they decompose the organic sewage waste
- C. Fish migrating into the area and breathing out the dissolved oxygen
- D. Cold temperatures causing the oxygen to escape from the river water

22. Nitrogen is an essential element for living things primarily because it is a key building component of:

- A. Proteins and nucleic acids, which organisms need to build their cells
- B. Simple sugars, which organisms use as their main source of quick energy
- C. Lipids, which organisms store as a long-term reserve of chemical energy

D. Water molecules, which make up the largest part of the mass of cells

23. The graph below shows the populations of a predator (lynx) and its prey (hare) over many years. Based on the graph, which statement best describes the relationship between the two population curves?



- A. The two populations rise and fall completely independently of one another
- B. Both populations increase steadily together and never decline at any point
- C. The predator population always remains far larger than the prey population
- D. Predator peaks follow prey peaks, showing the two populations are linked

24. A keystone species is one whose removal causes dramatic changes throughout an ecosystem. Which statement best describes why protecting a keystone species is important for an ecosystem?

- A. Keystone species are always the largest organisms living in the ecosystem
- B. Keystone species produce all of the oxygen used by the other organisms
- C. Their presence helps maintain the structure and balance of the ecosystem
- D. Keystone species are the only organisms able to break down dead matter

25. Which human activity is most directly responsible for the increased rate of species extinctions around the world?

- A. Destruction of natural habitats through deforestation and development
- B. Planting native trees in areas where forests had previously been cleared
- C. Establishing protected nature reserves to conserve wild populations
- D. Reducing the use of chemical pesticides on large commercial farms

26. Ecological succession describes the gradual change in the community of species in an area over time. Which of the following correctly describes primary succession?

- A. It begins in an area where a community already existed and was disturbed
- B. It begins in a lifeless area with no soil, such as on bare volcanic rock
- C. It occurs only in aquatic ecosystems such as ponds and shallow lakes
- D. It happens only when a mature forest is suddenly destroyed by a wildfire

27. A scientist wants to estimate the size of a fish population in a lake. She captures, tags, and releases 50 fish. Later she captures 100 fish and finds that 10 of them are tagged. Which method of studying populations is the scientist using?

- A. A direct count of every single fish living in the entire lake at once
- B. A controlled laboratory experiment with a treatment and a control group
- C. A study of the energy flow between the different trophic levels present
- D. A mark-and-recapture sampling method used to estimate population size

28. Bioaccumulation can cause harmful substances such as mercury to become more concentrated in organisms at higher trophic levels. Which organism in a food chain would be expected to have the highest concentration of such a toxin?

- A. The producer, such as algae, located at the very base of the food chain
- B. The primary consumer that feeds directly on the producers in the chain
- C. The top predator that feeds at the highest level of the food chain
- D. The decomposer that breaks down the remains of dead organisms

29. The Galápagos finches studied by Charles Darwin have beaks of different shapes and sizes suited to different food sources. Darwin proposed that these varied beaks arose because:

- A. Finches with beaks better suited to available food survived and reproduced
- B. Each individual finch changed the shape of its own beak to match its food
- C. The finches all inherited identical beaks that never varied between islands
- D. An unknown force deliberately designed each beak for one chosen purpose

30. Homologous structures, such as the forelimbs of a human, a bat, and a whale, share a similar internal bone arrangement but serve very different functions. These structures provide evidence of:

- A. Convergent evolution from completely unrelated ancestral species
- B. Common ancestry shared among the organisms that possess the structures
- C. Structures that developed purely by chance with no evolutionary meaning
- D. Organisms acquiring identical traits during their own individual lifetimes

31. A small group of birds is blown by a storm onto a remote island and establishes a new population there. By chance, this founding group does not contain the full genetic variety of the original population. This situation is an example of:

- A. Natural selection favoring the best-adapted individuals in the group
- B. Gene flow as individuals move freely between two large populations
- C. The founder effect, a form of genetic drift in a small population
- D. Convergent evolution producing similar traits in different species

32. Which of the following provides the most direct evidence that two organisms are closely related in their evolutionary history?

- A. The two organisms happen to live in the same geographic region today
- B. The two organisms are similar in their overall body size and coloration

- C. The two organisms occupy a similar role within their separate food chains
- D. The two organisms have highly similar DNA and protein sequences

33. In a population at genetic equilibrium, allele frequencies remain constant from generation to generation. Which of the following would most likely cause the allele frequencies in the population to change over time?

- A. The introduction of a new selective pressure such as a disease outbreak
- B. A very large population whose members mate completely at random
- C. The complete absence of any new mutations arising in the population
- D. No movement of individuals into or out of the population at all

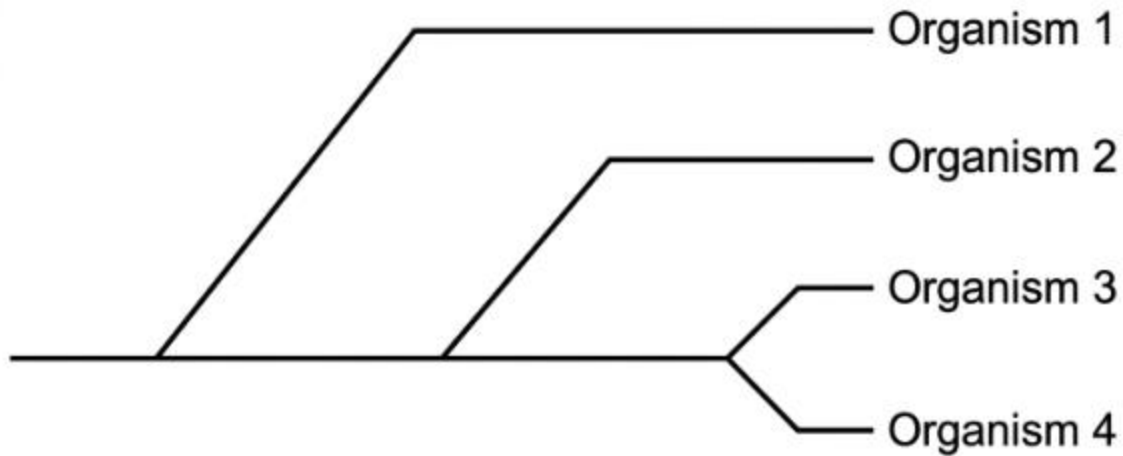
34. Antibiotic resistance and pesticide resistance are both examples of evolution occurring over a relatively short period of time. Both of these arise because:

- A. The organisms consciously decide to change in order to survive the threat
- B. The chemical itself directly inserts resistance genes into the organisms
- C. Pre-existing variation allows resistant individuals to survive and reproduce
- D. Every organism in the population becomes resistant at the very same time

35. Scientists classify living things into groups based on shared characteristics. Two organisms placed in the same genus are more closely related than two organisms that share only the same:

- A. Species, which is the most specific and narrowest level of classification
- B. Kingdom, which is one of the broadest and most general classification levels
- C. Subspecies, a level even more specific than the species classification level
- D. Population, all the members of one species in one particular location

36. The cladogram below shows the evolutionary relationships among four organisms based on their shared characteristics. Based on the cladogram, which two organisms are most closely related?



- A. Organisms 1 and 2, because they appear at the top of the diagram
- B. Organisms 1 and 4, because they are at opposite ends of the diagram
- C. Organisms 2 and 3, because they branch from the oldest shared ancestor
- D. Organisms 3 and 4, because they share the most recent common ancestor

37. A reflex, such as quickly pulling your hand away from a hot surface, allows an extremely rapid response. This speed is possible because the signal:

- A. Travels through the spinal cord without first being processed by the brain
- B. Is carried by hormones moving quickly through the bloodstream to muscles
- C. Bypasses the nervous system entirely and goes straight to the muscle cells
- D. Is slowed by the brain so the body can make a careful decision beforehand

38. The kidneys help maintain homeostasis in the human body primarily by:

- A. Producing hormones that directly increase the heart rate during exercise
- B. Breaking down large food molecules into smaller absorbable nutrients
- C. Filtering wastes from the blood and regulating the body's water and salt balance

D. Exchanging oxygen and carbon dioxide between the air and the blood

39. White blood cells are an important part of the body's defense against disease. One way that certain white blood cells protect the body is by:

- A. Carrying oxygen from the lungs to the tissues throughout the body
- B. Engulfing and destroying bacteria and other invading pathogens
- C. Forming clots that seal cuts and prevent the excessive loss of blood
- D. Transporting dissolved nutrients from the intestines to the body's cells

40. During strenuous exercise, a person's breathing rate and heart rate both increase. The increased breathing rate most directly helps the body by:

- A. Lowering the body's temperature to keep it from overheating too quickly
- B. Removing excess salt and water from the blood through faster breathing
- C. Digesting food more quickly to release extra energy for the working muscles
- D. Supplying more oxygen and removing more carbon dioxide from the body

41. A person eats a meal and the glucose level in their blood rises, prompting the pancreas to release insulin. The release of insulin in response to rising glucose is part of a control system that works to:

- A. Increase blood glucose even further to provide extra energy for the cells
- B. Permanently remove all glucose so that none ever remains in the bloodstream
- C. Return the blood glucose level back toward its normal stable set point
- D. Convert the glucose directly into proteins used for building new muscle

42. Stem cells are unspecialized cells that can develop into many different cell types. This property makes stem cells especially valuable in medicine because they could potentially be used to:

- A. Replace damaged or diseased specialized cells in tissues and organs

- B. Destroy all bacteria in the body without the use of any antibiotics
- C. Supply a permanent source of oxygen to cells that lack a blood supply
- D. Replace the genetic code of an adult so that aging is fully reversed

43. Vaccines help protect people from certain infectious diseases. A vaccine works mainly by:

- A. Killing pathogens that are already present and causing an active infection
- B. Exposing the immune system to a harmless form of a pathogen's antigens
- C. Providing antibiotics that destroy bacteria before they are able to multiply
- D. Supplying the body with extra red blood cells to fight off the infection

44. A scientist hypothesizes that plants exposed to blue light will grow taller than plants exposed to red light. In this investigation, the height of the plants is the:

- A. Control group, which receives no light treatment for the sake of comparison
- B. Hypothesis, the proposed explanation that the scientist is testing here
- C. Independent variable, the factor that the scientist deliberately changes
- D. Dependent variable, the factor that is measured as a result of the test

45. In a plant, the rate of photosynthesis increases as carbon dioxide concentration increases, then levels off and stays constant even when still more carbon dioxide is added. This leveling off most likely means that:

- A. The plant has permanently stopped carrying out photosynthesis entirely
- B. Carbon dioxide is now the only factor controlling the rate of the process
- C. Another factor, such as light or temperature, has become the limiting factor
- D. The plant has begun to carry out respiration instead of photosynthesis

46. Producers are essential to nearly all ecosystems because they:

- A. Capture energy from sunlight and make it available to other organisms
- B. Break down the bodies of dead organisms and recycle their nutrients
- C. Control the population sizes of herbivores by directly preying upon them
- D. Move energy from the highest trophic level back down to the producers

47. Two organisms of different species live in close association, and one benefits while the other is neither helped nor harmed. For example, a barnacle attaches to a whale and gains transportation without affecting the whale. This relationship is best described as:

- A. Mutualism, in which both of the organisms involved gain a clear benefit
- B. Parasitism, in which one organism benefits while the other one is harmed
- C. Predation, in which one organism captures and then consumes the other
- D. Commensalism, in which one organism benefits and the other is unaffected

48. Coral reefs support an enormous variety of marine life and are among the most biologically diverse ecosystems on Earth. A major threat to coral reefs caused by rising ocean temperatures is:

- A. An increase in the number of fish species competing for the same food
- B. Coral bleaching, in which the corals expel the algae that live within them
- C. A rapid increase in the growth rate of the corals across the entire reef
- D. The complete replacement of saltwater with freshwater on the reef itself

49. A dichotomous key is a tool used to identify organisms. It works by:

- A. Listing every known organism in alphabetical order by its common name
- B. Showing the complete evolutionary history of a group of related species
- C. Offering a series of paired choices that narrow down the organism's identity
- D. Measuring the exact genetic similarity between two unknown organisms

50. Using renewable energy sources such as solar and wind power instead of fossil fuels can benefit the environment by:

- A. Reducing the amount of carbon dioxide released into the atmosphere
- B. Eliminating the need for any electricity in homes and businesses entirely
- C. Increasing the rate at which fossil fuels form deep underground over time
- D. Removing all of the carbon dioxide that is already in the atmosphere now

PRACTICE EXAM 12—ANSWERS KEYS AND EXPLANATIONS

1. B — Lipids (fats) store more chemical energy per gram than carbohydrates or proteins, which is why animals use them for long-term energy reserves. A lipid molecule is built from a glycerol backbone joined to fatty acid chains. This high energy density makes fat an efficient way to store surplus energy in body tissue.
2. D — The mitochondrion (labeled Z) is the organelle where most ATP is produced during aerobic cellular respiration. Its folded inner membranes provide a large surface area for the reactions that capture energy from glucose. The nucleus, ribosomes, and cell membrane have other roles and are not the main site of ATP production.
3. A — Osmosis is the diffusion of water across a membrane from a region of higher water concentration to lower. The salt solution has a lower water concentration than the potato cells, so water moves out of the cells, leaving the strip limp and lighter. This loss of water by osmosis explains the change in mass and firmness.
4. C — During photosynthesis, light energy is captured and used to power the chemical reactions that build glucose from carbon dioxide and water. The light itself is not a building material; it provides the energy stored in the bonds of glucose. This conversion of light energy into chemical energy is the core of photosynthesis.
5. B — Above its optimal temperature (about 40°C), an enzyme begins to denature, losing the specific three-dimensional shape its function depends on. As the active site changes shape, the enzyme can no longer bind its substrate, so the reaction rate falls sharply. This is why the curve drops steeply past the peak rather than continuing to rise.
6. A — The correct order of organization from smallest to largest is cell → tissue → organ → organ system → organism. Cells group into tissues, tissues form organs, organs work together as systems, and systems make up the whole organism. Each level builds on the one below it in increasing complexity.
7. D — Viruses lack the cellular machinery to reproduce on their own and must hijack a living host cell to make copies of themselves. Because independent reproduction is a basic characteristic of living things, this dependence is a key reason viruses are not considered fully alive. Their

possession of genetic material is one trait that blurs the line, but the inability to self-reproduce sets them apart.

8. C — In aerobic cellular respiration, glucose and oxygen are the reactants, and they are broken down to release energy, producing carbon dioxide and water as products. This is essentially the reverse of photosynthesis. Identifying glucose and oxygen as the inputs is central to understanding how cells obtain usable energy.
9. B — Cells with thickened chromosomes lined up across the cell's middle (the metaphase plate) are undergoing mitosis, the division that produces two genetically identical body cells. Root tips are regions of active cell division and growth, making them ideal for observing mitosis. The alignment of chromosomes at the center is a recognizable mitotic stage.
10. A — Insulin and glucagon work in opposition to keep blood sugar within a stable range, which is the essence of negative feedback: a change in one direction triggers a response that reverses it. When glucose rises, insulin lowers it; when glucose falls, glucagon raises it. This opposing control maintains homeostasis around a set point.
11. D — Proteins are broken down by digestion into amino acids, which are small enough to be absorbed and used to build the body's own proteins. Each nutrient breaks into characteristic building blocks: carbohydrates into simple sugars and lipids into fatty acids and glycerol. Matching proteins to amino acids is the only correct pairing.
12. C — Bacterial population growth levels off as resources such as nutrients and space become limited and metabolic wastes accumulate, bringing the population to its carrying capacity. These density-dependent factors slow reproduction and increase death rates. The plateau reflects the environment's limited ability to support more individuals, not a mutation or a change in species.
13. A — A community consists of all the interacting populations of different species living in the same area. A population is a single species, while an ecosystem also includes nonliving factors and a biome is a large climatic region. The community is specifically the living, interacting portion at that level.
14. B — When two unaffected parents produce an affected child, the trait must be recessive, because the parents each carried a hidden recessive allele that combined in the child. A dominant trait would have to appear in at least one parent. The pattern of "skipping" unaffected carriers to reappear in offspring is the classic signature of recessive inheritance.
15. D — Codominance occurs when two different alleles are both fully and separately expressed in the heterozygote, as in type AB blood where both A and B antigens appear. This differs from incomplete dominance, where the phenotype is a blend. The simultaneous full expression of both alleles is what defines codominance.
16. C — DNA base pairing follows strict rules: adenine pairs with thymine and guanine pairs with cytosine. The complement of A–T–G–C–A is therefore T–A–C–G–T. Because thymine, not uracil, is used in DNA, the sequence with uracil is incorrect for a DNA strand.
17. B — Crossing over exchanges segments between homologous chromosomes during meiosis, producing new combinations of alleles in the gametes. This shuffling increases genetic variation, which is the raw material on which natural selection acts. Greater variation among offspring is what makes crossing over important to evolution.
18. A — Pesticide resistance evolves through natural selection: a few insects carry resistance alleles, survive the pesticide, and pass that trait to their offspring. Over generations the resistant trait becomes common, reducing the pesticide's effectiveness. The pesticide selects for pre-existing resistant individuals rather than teaching or weakening anything.

19. C — When similar species use resources at different times or in different parts of the habitat, they occupy different ecological niches, which reduces direct competition and lets them coexist. This resource partitioning is a common way that competing species share an environment. It is not predation, mutualism, or parasitism, which describe other interactions.
20. D — Herbivores are the primary consumers that feed directly on producers, so they occupy the level immediately after producers in the flow of energy. Energy moves from the Sun to producers, then to primary consumers, and on to higher consumers. Decomposers and top predators occupy other positions, not the step right after producers.
21. B — Sewage adds organic matter that decomposer bacteria break down, and these bacteria consume large amounts of dissolved oxygen as they do so. This sharp increase in bacterial respiration causes the oxygen drop just below the outflow. As the waste is used up downstream, bacterial activity falls and oxygen levels recover.
22. A — Nitrogen is an essential component of proteins (in amino acids) and of nucleic acids such as DNA and RNA, which all organisms need to build and run their cells. This is why nitrogen availability often limits growth in ecosystems. Sugars, lipids, and water do not require nitrogen as a core building element.
23. D — In predator–prey cycles, the predator population rises and falls in response to the prey population, with predator peaks lagging slightly behind prey peaks. This linked, offset pattern shows that each population influences the other. The curves are not independent, and the predator does not stay constantly larger than the prey.
24. C — A keystone species has an effect on its ecosystem out of proportion to its abundance, helping maintain the ecosystem's structure and balance. Removing it can trigger large changes, such as the collapse or overgrowth of other populations. Protecting it preserves the stability of the whole community, regardless of the species' size.
25. A — Habitat destruction through deforestation and development is the leading cause of rising extinction rates worldwide, because it removes the living space and resources species depend on. When habitat disappears, populations decline and can be lost entirely. Planting native trees and protecting reserves are conservation measures, not causes of extinction.
26. B — Primary succession begins in a lifeless area with no soil, such as bare volcanic rock, where pioneer species like lichens slowly create soil over time. This distinguishes it from secondary succession, which begins where soil and a previous community already existed. The absence of preexisting soil is the defining feature of primary succession.
27. D — The mark-and-recapture method tags a sample of individuals, releases them, and then uses the proportion of tagged individuals in a later capture to estimate total population size. It is used when counting every individual directly is impractical, as with mobile fish in a lake. This sampling technique is a standard ecological estimation tool.
28. C — Toxins like mercury that are not easily broken down become more concentrated at each higher trophic level through biomagnification, so the top predator accumulates the highest concentration. Each consumer takes in the stored toxin from all the prey it eats over time. This is why apex predators are most at risk from such pollutants.
29. A — Darwin proposed that finches whose inherited beak shapes were better suited to the available food survived and reproduced more successfully, passing those traits on. Over generations this natural selection produced the variety of beaks adapted to different food sources. Individual finches did not change their own beaks during their lifetimes.
30. B — Homologous structures share the same underlying bone arrangement because the organisms inherited it from a common ancestor, even though the limbs now perform different functions. This

shared internal structure despite different uses is strong evidence of common descent. It contrasts with convergent evolution, where similar function arises in unrelated organisms.

31. C — When a small group founds a new population and happens not to carry the full genetic variety of the original population, the result is the founder effect, a type of genetic drift. The new population's allele frequencies differ from the source population simply by chance of who was in the founding group. This is a random change, not selection or gene flow.
32. D — Highly similar DNA and protein sequences are the most direct evidence of a close evolutionary relationship, because shared genetic material reflects shared ancestry. Living in the same place, looking alike, or filling similar roles can occur without close relatedness. Molecular similarity provides the strongest line of evidence for common descent.
33. A — A new selective pressure, such as a disease outbreak, changes which individuals survive and reproduce, shifting allele frequencies and disrupting genetic equilibrium. Random mating, no mutation, and no migration are conditions that help maintain equilibrium, not change it. Selection is the factor here that drives the population to evolve.
34. C — Both antibiotic resistance and pesticide resistance arise because pre-existing variation means a few individuals already carry resistance, and these survive and reproduce when the chemical is applied. The chemical selects for those resistant individuals rather than creating resistance in everyone at once. This is natural selection acting over a short time span.
35. B — Genus is a more specific classification level than kingdom, so two organisms in the same genus are more closely related than two that share only the same kingdom. Classification moves from broad categories like kingdom down to narrow ones like genus and species. Sharing only a broad level like kingdom indicates a more distant relationship.
36. D — On a cladogram, the two organisms that share the most recent common branch point are the most closely related, which here are Organisms 3 and 4. The earlier an organism branches off, the more distantly it is related to the rest. Position at the top, bottom, or ends of the diagram does not by itself indicate relatedness.
37. A — A reflex is rapid because the sensory signal triggers a response through the spinal cord without waiting for the brain to process it. This reflex arc shortens the pathway, allowing protective actions like pulling away from heat to happen almost instantly. The signal does involve the nervous system, but it bypasses conscious brain processing.
38. C — The kidneys maintain homeostasis chiefly by filtering metabolic wastes from the blood and regulating the balance of water and dissolved salts. By adjusting what is excreted in urine, they help keep the internal fluid environment stable. Gas exchange and food digestion are the jobs of other body systems.
39. B — Certain white blood cells, such as phagocytes, defend the body by engulfing and destroying bacteria and other invading pathogens. This is a key part of the immune response. Oxygen transport, clotting, and nutrient transport are carried out by red blood cells, platelets, and plasma, not by these defensive white blood cells.
40. D — A faster breathing rate during exercise supplies the body with more oxygen for cellular respiration and removes the additional carbon dioxide produced by hard-working muscles. This gas exchange supports the higher energy demand of activity. The primary purpose is respiratory, not cooling, salt removal, or digestion.
41. C — Insulin release in response to rising blood glucose is part of a negative feedback system that returns blood sugar toward its normal set point. Insulin signals cells to take up glucose and the liver to store it, lowering the level back to balance. It does not eliminate glucose entirely or raise it further.

42. A — Because stem cells are unspecialized and can develop into many cell types, they hold promise for replacing damaged or diseased specialized cells in tissues and organs. This regenerative potential is the basis of much stem cell research in medicine. Their value lies in becoming functional replacement cells, not in fighting bacteria or reversing aging.
43. B — A vaccine works by exposing the immune system to a harmless form of a pathogen's antigens, prompting the body to build antibodies and memory cells without causing the disease. If the real pathogen is later encountered, the immune system can respond quickly. This preparation, not the use of antibiotics, is how immunity is established.
44. D — The factor that is measured as the outcome of an experiment is the dependent variable, which here is the height of the plants. The light color the scientist changes is the independent variable. Identifying plant height as the measured result correctly classifies it as the dependent variable.
45. C — When the photosynthesis rate stops increasing despite more carbon dioxide, it means a different factor — such as light intensity or temperature — has become the limiting factor controlling the rate. Once carbon dioxide is no longer in short supply, something else caps the process. This illustrates the concept of limiting factors in photosynthesis.
46. A — Producers capture energy from sunlight through photosynthesis and convert it into chemical energy in food, making that energy available to consumers throughout the ecosystem. They form the base of food chains and food webs. Decomposing dead matter and preying on herbivores are roles of other organisms, not producers.
47. D — Commensalism is a relationship in which one organism benefits while the other is neither helped nor harmed, as when a barnacle gains transport from a whale that is unaffected. This contrasts with mutualism, where both benefit, and parasitism, where one is harmed. The neutral effect on the whale identifies the relationship as commensalism.
48. B — Rising ocean temperatures cause coral bleaching, in which stressed corals expel the symbiotic algae that provide them with food and color. Without these algae, corals weaken and can die, threatening the entire reef ecosystem. This loss of the coral–algae partnership is a major temperature-driven threat to reefs.
49. C — A dichotomous key identifies an organism through a series of paired choices, each step narrowing the possibilities based on observable characteristics until a single identification remains. The user follows the branching choices that match the specimen. It is an identification tool, not an alphabetical list or a measure of genetic similarity.
50. A — Replacing fossil fuels with renewable sources such as solar and wind reduces the amount of carbon dioxide released into the atmosphere, since these sources generate energy without burning carbon-based fuels. Lower carbon dioxide emissions help limit the greenhouse effect and climate change. Renewables reduce new emissions rather than removing carbon dioxide already present.