

# PRACTICE EXAM 17: LIFE SCIENCE: BIOLOGY SIMULATION (50 QUESTIONS)

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1. All of the chemical reactions that occur within an organism, including those that build up and break down molecules, are together known as the organism's:

- A. Homeostasis, the maintenance of a stable internal environment
- B. Respiration, the release of energy from glucose inside the cell
- C. Digestion, the breakdown of food into smaller usable molecules
- D. Metabolism, the sum of all chemical reactions in the organism

2. Carbohydrates, lipids, proteins, and nucleic acids are the major organic compounds in living things. Which of these compounds is the body's primary source of quick energy?

- A. Carbohydrates, such as sugars, which the body uses for quick energy
- B. Lipids, such as fats, which are used mainly for long-term energy storage
- C. Proteins, which are used to build tissues and to function as enzymes
- D. Nucleic acids, which store and carry the organism's genetic information

3. An enzyme is a protein that acts on a specific substance, called its substrate. The specific region of the enzyme where the substrate binds is known as the:

- A. Backbone, the chain of sugars and phosphates within the molecule
- B. Active site, the region where the substrate binds to the enzyme
- C. Nucleus, the structure that stores the genetic information of the cell

D. Membrane, the outer layer that controls what enters and leaves a cell

4. In an investigation, the activity of an enzyme is measured at several different pH values. The enzyme works fastest at pH 8 and slows down at higher and lower pH values. This result shows that the enzyme:

- A. Works equally well at every pH value that was tested in the investigation
- B. Requires an extremely acidic environment in order to function at all
- C. Has an optimal pH at which it works best, with activity dropping on either side
- D. Cannot function in any environment that contains water or dissolved salts

5. The cell membrane controls the movement of materials into and out of the cell. The movement of water across the cell membrane from an area of higher water concentration to an area of lower water concentration is called:

- A. Active transport, which moves substances against their concentration gradient
- B. Endocytosis, in which the membrane engulfs material to bring it into the cell
- C. Phagocytosis, in which the cell takes in large solid particles as food
- D. Osmosis, the diffusion of water across a selectively permeable membrane

6. A plant cell is placed in a very salty solution, and water moves out of the cell, causing the cell contents to shrink away from the cell wall. The salty solution, compared to the inside of the cell, is best described as:

- A. Hypotonic, having a lower solute concentration than the inside of the cell
- B. Hypertonic, having a higher solute concentration than the inside of the cell
- C. Isotonic, having a solute concentration that is equal to that of the cell
- D. Neutral, meaning it has no effect at all on the movement of water in cells

7. Cellular respiration releases the energy stored in glucose. In a eukaryotic cell, most of the ATP produced during cellular respiration is generated in the:

- A. Mitochondria, the organelles where most of the cell's ATP is produced
- B. Nucleus, where the genetic information of the cell is stored and protected
- C. Cell wall, the rigid outer layer that surrounds and supports plant cells
- D. Ribosomes, the small structures where proteins are built within the cell

8. Photosynthesis and cellular respiration are linked in the cycling of materials. The oxygen produced during photosynthesis is used by organisms during:

- A. Digestion, the breakdown of food into smaller molecules in the body
- B. Photosynthesis, the production of glucose from carbon dioxide and water
- C. Cellular respiration, the release of energy from glucose using oxygen
- D. Fermentation, the release of energy from glucose without any oxygen

9. Many organs in the human body work together to carry out a major function. The heart, blood vessels, and blood together form a structure that transports materials throughout the body. This is an example of a(n):

- A. Cell, the basic structural and functional unit of every living organism
- B. Tissue, a group of similar cells that work together for one function
- C. Organ, a structure made of several tissues that performs a function
- D. Organ system, a group of organs that work together for a major function

10. In the human body, blood glucose is carefully regulated. When blood glucose falls too low, the pancreas releases the hormone glucagon, which raises the level back up. This regulation of blood glucose is an example of the body maintaining:

- A. Metabolism, the sum of all chemical reactions occurring within the body
- B. Homeostasis, a stable internal environment despite external changes
- C. Reproduction, the process by which organisms produce new offspring
- D. Digestion, the breakdown of food into smaller molecules in the gut

11. The human nervous system allows the body to detect and respond to stimuli. A signal travels through the nervous system in the form of an electrical impulse carried along cells called:

- A. Receptors, the structures that detect changes in the environment
- B. Effectors, the muscles or glands that carry out the body's response
- C. Neurons, the cells that carry electrical impulses through the body
- D. Hormones, the chemical messengers released into the bloodstream

12. The structure of DNA can be compared to a twisted ladder, with the sides made of alternating sugar and phosphate molecules. The "rungs" of this ladder are made of:

- A. Pairs of nitrogen bases bonded together across the two strands
- B. Long chains of amino acids that fold into functional proteins
- C. Molecules of glucose that store energy for the cell to use later
- D. Fatty acids that make up the main structure of the cell membrane

13. During protein synthesis, the information carried in mRNA is used to assemble a chain of amino acids in the correct order. This process, in which the mRNA is read to build a protein, is called:

- A. Replication, in which a complete copy of the DNA molecule is produced
- B. Transcription, in which an mRNA strand is built from a DNA template
- C. Mutation, in which the sequence of bases in the DNA is permanently changed
- D. Translation, in which the mRNA is read to assemble a chain of amino acids

14. In guinea pigs, black coat color (B) is dominant over white coat color (b). A black guinea pig of unknown genotype is crossed with a white guinea pig (bb), and about half of the offspring are white. The genotype of the black parent is most likely:

- A. BB, homozygous dominant, because a cross with white gives all black offspring
- B. Bb, heterozygous, because a cross with white gives about half white offspring

- C. bb, homozygous recessive, even though this parent has a black coat color
- D. Impossible to determine from the results of this particular cross at all

15. A pedigree is a chart that shows how a trait is inherited within a family across several generations. A pedigree is most useful to scientists because it can help them to:

- A. Directly change the genes that are passed from parents to their offspring
- B. Cure a genetic disorder by removing the harmful gene from the family
- C. Track how a genetic trait is inherited and predict its appearance in offspring
- D. Increase the genetic variation found within a family over many generations

16. In humans, certain traits such as red-green color blindness are carried on the X chromosome. Males are more likely than females to express such X-linked recessive traits because a male:

- A. Has only one X chromosome, so a single recessive allele will be expressed
- B. Has two X chromosomes, so both must carry the allele for it to be expressed
- C. Inherits the X-linked trait only from his father and never from his mother
- D. Cannot pass an X-linked trait on to any of his own children in the future

17. A mutation is a change in the DNA sequence of an organism. Which type of mutation can be passed on to an organism's offspring?

- A. A mutation that occurs in a skin cell on the surface of the organism's body
- B. A mutation that occurs in a muscle cell within the leg of the organism
- C. A mutation that occurs in a nerve cell within the brain of the organism
- D. A mutation that occurs in a sex cell, such as a sperm or egg cell

18. Scientists have transferred a gene that produces a useful protein from one organism into the DNA of bacteria, which then produce the protein. The bacteria are able to read and use the transferred gene because:

- A. The bacteria and the source organism are very closely related species
- B. All organisms use essentially the same genetic code to read their genes
- C. The transferred gene physically changes the bacteria into the other organism
- D. Bacteria can produce any protein at all without needing any genes for it

19. Asexual reproduction produces offspring that are genetically identical to the single parent. An advantage of asexual reproduction over sexual reproduction is that it:

- A. Produces offspring with a great deal of genetic variation among them
- B. Requires two parents, which increases the chances of finding a mate
- C. Allows organisms to reproduce quickly without needing to find a mate
- D. Always produces offspring that are better adapted to a new environment

20. Meiosis is a type of cell division that produces gametes. A cell that begins meiosis with 8 chromosomes will produce gametes that each contain how many chromosomes?

- A. 4 chromosomes, because meiosis reduces the chromosome number by half
- B. 8 chromosomes, because the chromosome number stays the same throughout
- C. 16 chromosomes, because the chromosome number is doubled during meiosis
- D. 2 chromosomes, because the chromosome number is reduced to one-quarter

21. The peppered moth exists in light and dark forms. Before the Industrial Revolution, light moths were common because they were camouflaged on light bark. After pollution darkened the bark, dark moths became more common. This change in the population over time is an example of:

- A. An acquired characteristic that each individual moth developed in its lifetime
- B. Natural selection acting on the inherited variation in the moth population
- C. The complete absence of any inherited variation within the moth population
- D. The moths deliberately changing their color to match the darkened tree bark

22. Some whales have tiny, reduced hip and leg bones buried within their bodies that serve no function in swimming. These structures, which are remnants of structures that were functional in the whale's ancestors, are called:

- A. Homologous structures, which indicate a shared common ancestor among species
- B. Analogous structures, which serve the same function but have different origins
- C. Adaptive structures, which give the whale a clear advantage in its environment
- D. Vestigial structures, reduced remnants of structures that were once functional

23. Over time, a single species of finch that arrived on a group of islands gave rise to many different species, each with a beak adapted to a different food source. This diversification of one ancestral species into many new species is called:

- A. Convergent evolution, in which unrelated species develop similar traits
- B. Extinction, in which a species permanently disappears from the Earth
- C. Adaptive radiation, in which one ancestral species gives rise to many species
- D. Genetic drift, the random change in allele frequencies in a small population

24. Scientists comparing the proteins of several species find that the amino acid sequences of two species are nearly identical, while a third species has a very different sequence. This molecular evidence suggests that the two species with nearly identical sequences:

- A. Share a more recent common ancestor with each other than with the third species
- B. Are much more distantly related to each other than to the third species
- C. Evolved their identical sequences completely independently and by pure chance
- D. Must belong to the same species because their proteins are nearly identical

25. In an ecosystem, the flow of energy begins with the Sun. The organisms that capture this solar energy and convert it into chemical energy stored in food are called:

- A. Consumers, which obtain their energy by feeding on other organisms

- B. Producers, which capture solar energy and convert it into chemical energy
- C. Decomposers, which break down dead organisms and recycle their nutrients
- D. Predators, which hunt and capture other animals to obtain their energy

26. In a typical food chain, only about 10% of the energy available at one trophic level is passed on to the next higher level. The remaining energy is mostly:

- A. Stored permanently in the bodies of the organisms at that trophic level
- B. Passed back down to the producers at the bottom of the food chain
- C. Converted into new genetic material within the cells of the organisms
- D. Used for the organisms' life processes and lost from the chain as heat

27. A food web shows the feeding relationships among many organisms in an ecosystem. Compared with a simple food chain, a food web is generally a more realistic model of an ecosystem because it:

- A. Shows that most organisms have more than one food source and predator
- B. Shows that energy increases as it moves up to the higher trophic levels
- C. Includes only the producers and leaves out all of the consumers entirely
- D. Demonstrates that each organism eats only one other type of organism

28. A population of rabbits in a field increases rapidly at first, but as the population grows, food and space become scarce and disease spreads more easily, slowing the population's growth. Factors such as food, space, and disease that limit population growth are called:

- A. Producers, which capture the Sun's energy for the entire ecosystem
- B. Trophic levels, which describe each feeding step in a food chain
- C. Limiting factors, which restrict the growth of a population over time
- D. Keystone species, which support the overall structure of an ecosystem

29. Two species of insects feed on the same type of plant in the same area. As a result, the two species are likely to experience:

- A. Mutualism, in which both of the insect species benefit from the relationship
- B. Competition, in which both species struggle for the same limited resource
- C. Predation, in which one of the insect species hunts and eats the other one
- D. Commensalism, in which one species benefits and the other is unaffected

30. A small bird removes parasites and dead skin from the back of a large grazing animal. The bird gains a source of food, and the grazing animal is relieved of harmful parasites. Both organisms benefit from this relationship, which is an example of:

- A. Parasitism, in which one organism benefits while the other is harmed
- B. Competition, in which both organisms struggle for the same resource
- C. Commensalism, in which one organism benefits and the other is unaffected
- D. Mutualism, in which both of the organisms involved benefit from the relationship

31. Nitrogen is an essential element for living things, but most organisms cannot use nitrogen gas directly from the air. Certain soil bacteria convert nitrogen gas into compounds that plants can absorb through their roots. These bacteria are an important part of the:

- A. Nitrogen cycle, in which nitrogen moves between the air, soil, and organisms
- B. Water cycle, in which water moves between the land, oceans, and atmosphere
- C. Carbon cycle, in which carbon moves between the atmosphere and organisms
- D. Energy pyramid, which shows the energy available at each level of a food chain

32. A factory releases a chemical pollutant into a river. The chemical does not break down and becomes increasingly concentrated in the tissues of organisms at higher trophic levels. This increase in the concentration of a pollutant up a food chain is called:

- A. Eutrophication, the nutrient enrichment of a body of water over time

- B. Succession, the gradual change in the species of a community over time
- C. Biomagnification, the increase in a pollutant's concentration up a food chain
- D. Homeostasis, the maintenance of a stable internal environment in organisms

33. An area of bare rock left behind by a retreating glacier is first colonized by lichens, which help break the rock down and begin forming soil. Over time, mosses, then grasses, and eventually larger plants take over. The lichens in this example are best described as:

- A. Keystone species, whose presence supports the entire ecosystem's structure
- B. Pioneer species, the first organisms to colonize a previously lifeless area
- C. Top predators, which control the populations of organisms below them
- D. Decomposers, which break down the remains of dead organisms in the soil

34. Human activities have led to the extinction of many species and threaten many others. Which of the following human activities poses the greatest threat to biodiversity worldwide?

- A. Establishing national parks where natural habitats are legally protected
- B. Passing laws that limit the hunting of endangered animal species
- C. Replanting native trees in areas where forests had been cut down before
- D. Destroying natural habitats through deforestation and urban development

35. The increasing concentration of greenhouse gases such as carbon dioxide in the atmosphere is associated with a gradual rise in average global temperatures. A major human activity that adds carbon dioxide to the atmosphere is:

- A. The burning of fossil fuels such as coal, oil, and natural gas for energy
- B. The planting of large forests of trees that absorb carbon dioxide from air
- C. The recycling of paper, glass, and metal materials to reduce overall waste
- D. The use of solar panels and wind turbines to generate electrical power

36. The cell theory is a fundamental principle of modern biology. Which of the following is one of the main statements of the cell theory?

- A. Cells can form spontaneously from nonliving matter under the right conditions
- B. Only large plants and animals are made up of cells, while microbes are not
- C. All living things are composed of one or more cells, the basic unit of life
- D. Cells are the largest structures that can be found within any living organism

37. A virus is a particle made of genetic material surrounded by a protein coat. Viruses are not considered to be fully living because they:

- A. Are made of cells that contain a nucleus and other membrane-bound organelles
- B. Cannot carry out life processes or reproduce without a living host cell
- C. Are far larger than the cells of the organisms that they infect and destroy
- D. Are able to reproduce entirely on their own outside of any living cell

38. A doctor explains to a patient that antibiotics will help treat a bacterial infection but will not help with a viral infection such as the flu. This is because antibiotics:

- A. Work by strengthening viruses so that the body can fight them more easily
- B. Are too large to enter the patient's body and reach the site of the infection
- C. Can only destroy pathogens that have first been weakened by a vaccine shot
- D. Target structures and processes found in bacteria but not found in viruses

39. When a pathogen enters the body, certain white blood cells produce proteins that bind to the pathogen and mark it for destruction. These specialized defensive proteins are called:

- A. Antibodies, proteins that bind to a specific pathogen and mark it for destruction
- B. Hormones, chemical messengers that travel through the blood to target organs
- C. Enzymes, proteins that speed up the chemical reactions that occur in cells

D. Platelets, cell fragments that help the blood to form clots at the site of a wound

40. A person who has recovered from chickenpox usually does not catch the same disease again. This long-lasting protection is provided by the immune system through the production of:

- A. Red blood cells, which carry oxygen from the lungs to the body's tissues
- B. Digestive enzymes, which break down the pathogen in the person's stomach
- C. Memory cells, which allow the body to respond quickly to the same pathogen
- D. Platelets, which form clots to seal any wounds where pathogens might enter

41. A scientist designs an experiment to test whether a new plant food increases the growth rate of tomato plants. To make the experiment valid, the scientist compares the treated plants with a group of plants that receive no plant food. This untreated group is called the:

- A. Independent variable, the single factor that the scientist deliberately changes
- B. Dependent variable, the factor that the scientist measures during the experiment
- C. Hypothesis, the testable prediction made by the scientist before the experiment
- D. Control group, which provides a baseline for comparison with the treated plants

42. A student measures the lengths of seven leaves, in centimeters, as follows: 5, 6, 7, 8, 9, 10, and 11. What is the median length of these seven leaves?

- A. 5 centimeters, which is the shortest leaf in the entire set of measurements
- B. 8 centimeters, which is the middle value when the lengths are placed in order
- C. 11 centimeters, which is the longest leaf in the entire set of measurements
- D. 56 centimeters, which is the total of all seven leaf lengths added together

43. A scientist makes an observation, forms a question, and proposes a possible explanation that can be tested through experiments. This proposed, testable explanation is called a(n):

- A. Hypothesis, a proposed and testable explanation for an observation
- B. Conclusion, a statement of what the data showed at the end of the study
- C. Variable, a factor that can change or be changed during an experiment
- D. Theory, a broad explanation supported by a large body of evidence

44. In a well-designed controlled experiment, a scientist tests the effect of one variable while keeping all other conditions the same. The main reason for keeping all other conditions the same is to:

- A. Make the experiment finish more quickly than it otherwise would have
- B. Guarantee in advance that the scientist's hypothesis will be supported
- C. Ensure that any change in the results is due to the one variable being tested
- D. Allow many different variables to be tested at the very same time

45. A scientist wants to display data showing the change in the population of a species over a period of 20 years. The most appropriate type of graph for showing this change over time would be a:

- A. Pie chart, which is best for showing how a single whole is divided into parts
- B. Line graph, which is best for showing how a value changes over time
- C. Bar graph, which is best for comparing values across separate categories
- D. Labeled diagram, which is best for showing the parts of a single structure

46. All of the different populations of organisms living and interacting together in the same area make up a(n):

- A. Population, which consists of the members of a single species in an area
- B. Organism, which is a single complete living thing of one particular species
- C. Biome, which is a large region defined mainly by its climate and plant life
- D. Community, which includes all the interacting populations in an area

47. Mitosis and meiosis are two types of cell division. One important difference between them is that mitosis produces cells that are genetically identical to the parent cell, while meiosis produces cells that are:

- A. Genetically different from one another, which increases variation in offspring
- B. Always exactly identical to the original parent cell in every possible way
- C. Unable to take part in any form of reproduction within the organism
- D. Containing twice as many chromosomes as the original parent cell had

48. Producers, consumers, and decomposers all play roles in an ecosystem. Which statement correctly describes the role of a consumer in an ecosystem?

- A. A consumer captures energy from the Sun to produce its own food supply
- B. A consumer breaks down dead organisms and returns nutrients to the soil
- C. A consumer obtains its energy by feeding on other organisms in the ecosystem
- D. A consumer produces all of the oxygen that the other organisms in the area need

49. Biodiversity refers to the variety of different species living in an ecosystem. A high level of biodiversity is generally beneficial to an ecosystem because it:

- A. Guarantees that the population of each species will never change at all
- B. Ensures that a single species will dominate and control the whole ecosystem
- C. Prevents the ecosystem from responding to any changes in its environment
- D. Increases the ecosystem's stability and its ability to recover from disturbances

50. Human populations depend on natural resources such as clean water, fertile soil, and forests. Practices such as recycling, conserving energy, and protecting habitats are all examples of efforts to promote:

- A. Deforestation, the clearing of large areas of forest for farms and cities
- B. Sustainability, using resources to meet present needs while protecting the future

- C. Biomagnification, the buildup of toxic substances at higher trophic levels
- D. Extinction, the permanent disappearance of a species from the planet Earth

## ANSWER KEY WITH EXPLANATIONS – Practice Exam 17

1. D — Metabolism is the sum of all the chemical reactions in an organism, including both building up (anabolic) and breaking down (catabolic) reactions. It encompasses all the cell's chemical activity. Homeostasis, respiration, and digestion are narrower processes, not the whole of an organism's chemistry.
2. A — Carbohydrates, such as sugars, are the body's primary source of quick energy, readily broken down to fuel cellular activity. Lipids store energy long-term, proteins build and run cells, and nucleic acids carry genetic information. The fast-energy role belongs to carbohydrates.
3. B — The active site is the specific region of an enzyme where the substrate binds, allowing the reaction to be catalyzed. Its shape fits the substrate like a lock and key. This binding region is what gives each enzyme its specificity.
4. C — The pattern of peak activity at pH 8 with slowing on either side shows the enzyme has an optimal pH at which it works best. Moving away from that optimum reduces activity because the enzyme's shape is affected. This is a typical feature of enzyme behavior.
5. D — Osmosis is the diffusion of water across a selectively permeable membrane from higher to lower water concentration. It is a passive process driven by the water concentration difference. Active transport, endocytosis, and phagocytosis involve different mechanisms.
6. B — The salty solution is hypertonic to the cell, meaning it has a higher solute concentration, so water leaves the cell by osmosis and the contents shrink. The direction of water movement is set by the solute difference. A hypertonic environment draws water out of cells.
7. A — Most ATP in a eukaryotic cell is produced in the mitochondria during the later stages of cellular respiration. Their folded inner membranes provide surface area for these energy-releasing reactions. The nucleus, cell wall, and ribosomes have other roles.
8. C — Oxygen released during photosynthesis is used by organisms in cellular respiration, where it helps release energy from glucose. This links the two processes in the cycling of materials. Each process supplies a reactant the other needs.
9. D — The heart, blood vessels, and blood together form an organ system, a group of organs working together for a major function—in this case, transport. An organ is a single structure of several tissues, while an organ system coordinates several organs. This makes the circulatory grouping an organ system.
10. B — Regulating blood glucose by releasing glucagon to raise a low level is part of maintaining homeostasis, a stable internal environment. The body counteracts the change to keep glucose in balance. This regulation illustrates homeostasis rather than metabolism, reproduction, or digestion.
11. C — Neurons are the cells that carry electrical impulses through the nervous system. They transmit signals between receptors, the brain, and effectors. Receptors detect stimuli, effectors respond, and hormones are chemical messengers, but the impulse-carrying cells are neurons.
12. A — The rungs of the DNA "ladder" are formed by pairs of nitrogen bases bonded across the two strands (A with T, G with C). The sugar-phosphate backbones form the sides. The paired bases, not amino acids, sugars, or fatty acids, make up the rungs.

13. D — Translation is the process in which mRNA is read by the ribosome to assemble amino acids into a protein in the correct order. It follows transcription in gene expression. Replication copies DNA and transcription makes mRNA, so building the protein is translation.
14. B — A black parent crossed with white (bb) that produces about half white offspring must be heterozygous (Bb), since this is the only genotype giving a 1:1 ratio. A homozygous dominant (BB) parent would yield all black offspring. The roughly even split of white offspring reveals the Bb genotype.
15. C — A pedigree lets scientists track how a genetic trait is inherited across generations and predict its likelihood in future offspring. It maps the appearance of the trait through a family. It does not change genes, cure disorders, or increase variation.
16. A — Because a male has only one X chromosome, a single recessive allele on it is expressed, with no second X to mask it. Females, with two X chromosomes, would need the allele on both to express the trait. This is why X-linked recessive traits appear more often in males.
17. D — Only a mutation in a sex cell (gamete) can be passed on to offspring, because the gamete contributes to the next generation. Mutations in skin, muscle, or nerve cells affect only the individual. Germ-line mutations are the heritable ones.
18. B — Because all organisms use essentially the same genetic code, bacteria can read and translate a gene transferred from another organism to make its protein. This universality of the code makes genetic engineering across species possible. The bacteria do not need to be related to the source organism.
19. C — An advantage of asexual reproduction is that an organism can reproduce quickly on its own, without needing to find a mate. This allows rapid population growth in favorable conditions. Asexual reproduction produces little variation, so the other options do not apply.
20. A — Meiosis reduces the chromosome number by half, so a cell starting with 8 chromosomes produces gametes with 4 each. This halving ensures the normal number is restored at fertilization. The chromosome number is not kept the same, doubled, or quartered.
21. B — The shift from light to dark moths as bark darkened is natural selection acting on inherited variation: better-camouflaged moths survived and reproduced more. The change reflects selection among existing variants, not acquired traits or deliberate change. This is a classic example of natural selection.
22. D — The whales' tiny, functionless hip and leg bones are vestigial structures, reduced remnants of structures that were functional in their land-dwelling ancestors. Their presence is evidence of evolutionary change. This differs from homologous or analogous structures, which compare features across species.
23. C — Adaptive radiation is the diversification of one ancestral species into many new species, each adapted to a different niche, as with the island finches and their varied beaks. One lineage fills a range of available food sources and habitats. It is distinct from convergence, extinction, or drift.
24. A — Nearly identical amino acid sequences indicate that the two species share a more recent common ancestor with each other than with the more divergent third species. Greater molecular similarity reflects closer evolutionary relatedness. Similar sequences do not mean independent origin or that the species are the same.
25. B — Producers capture solar energy and convert it into chemical energy stored in food through photosynthesis, beginning the flow of energy in an ecosystem. They form the base of food webs. Consumers, decomposers, and predators obtain energy that originally came from producers.

26. D — Most of the energy at each trophic level is used for the organisms' life processes and ultimately lost as heat, which is why only about 10% passes to the next level. This heat loss cannot be reused for growth. The energy is not stored permanently or returned to producers.
27. A — A food web is more realistic than a single food chain because it shows that most organisms have several food sources and several predators. This interconnected model captures the complexity of real ecosystems. Energy still decreases up the levels, and organisms rarely eat just one thing.
28. C — Factors such as food, space, and disease that restrict how large a population can grow are called limiting factors. As the population increases, these factors slow its growth. They set the population's upper limit rather than being producers, trophic levels, or keystone species.
29. B — When two species use the same limited resource, such as the same plant, they experience competition. Each species' use of the resource reduces what is available to the other. This struggle for a shared resource defines competition.
30. D — When both organisms benefit, as the bird gains food and the grazing animal is rid of parasites, the relationship is mutualism. Each partner helps the other. This two-way benefit distinguishes mutualism from parasitism, competition, or commensalism.
31. A — Nitrogen-fixing soil bacteria convert atmospheric nitrogen gas into compounds plants can absorb, a key step in the nitrogen cycle. Most organisms cannot use nitrogen gas directly, so these bacteria make the element available. This role places them in the nitrogen cycle.
32. C — Biomagnification is the increase in a persistent pollutant's concentration at each higher trophic level, so top predators accumulate the most. The chemical is passed and concentrated up the food chain. This differs from eutrophication, succession, and homeostasis.
33. B — Pioneer species are the first organisms to colonize a previously lifeless area, such as lichens on bare rock that begin forming soil. They make the area habitable for later species. This is the defining role of pioneer species in primary succession.
34. D — Destroying natural habitats through deforestation and urban development is the greatest worldwide threat to biodiversity, because it removes the living space species depend on. Habitat loss drives many extinctions. The other options—parks, hunting laws, and replanting—help protect biodiversity.
35. A — Burning fossil fuels such as coal, oil, and natural gas releases large amounts of carbon dioxide, a greenhouse gas linked to global warming. This is a major human source of atmospheric carbon dioxide. Planting forests, recycling, and using renewables reduce rather than add emissions.
36. C — A central statement of the cell theory is that all living things are composed of one or more cells, the basic unit of life. The theory also holds that cells come from preexisting cells. The idea that cells form spontaneously from nonliving matter is not part of cell theory.
37. B — Viruses are not considered fully living because they cannot carry out life processes or reproduce without a living host cell. They lack the cellular machinery to function independently. This dependence on a host is why their status as living things is debated.
38. D — Antibiotics target structures and processes found in bacteria, such as cell walls and bacterial protein synthesis, which viruses do not have. Because viruses lack these features, antibiotics cannot affect them. This is why antibiotics treat bacterial but not viral infections.
39. A — Antibodies are proteins produced by white blood cells that bind to a specific pathogen and mark it for destruction. Their specificity lets the immune system target particular invaders. Hormones, enzymes, and platelets serve other functions.

40. C — Long-lasting immunity after recovering from chickenpox comes from memory cells, which let the immune system respond quickly if the same pathogen returns. These cells "remember" the pathogen. Red blood cells, digestive enzymes, and platelets do not provide this specific protection.
41. D — The untreated group used for comparison is the control group, which provides a baseline against which the treated plants are measured. Without it, differences could not be attributed to the plant food. The control makes the experiment's conclusion valid.
42. B — When the seven values are placed in order (5, 6, 7, 8, 9, 10, 11), the median is the middle value, which is 8 centimeters. The median is the central data point, not the smallest, largest, or total. With seven values, the fourth one is the median.
43. A — A hypothesis is a proposed, testable explanation for an observation, formed before experimentation. It can be supported or refuted by data. This distinguishes it from a conclusion, a variable, or a theory.
44. C — Keeping all other conditions the same ensures that any change in the results is due to the single variable being tested. If multiple factors varied, the cause of the outcome would be unclear. Controlling variables is what makes an experiment's conclusion valid.
45. B — A line graph is best for showing how a value, such as population size, changes over time, with the connected points revealing the trend across the years. Pie charts show parts of a whole, bar graphs compare categories, and diagrams show structures. Change over time calls for a line graph.
46. D — A community includes all the interacting populations of different species living together in the same area. A population is just one species, and a biome is a large climatic region. The grouping of all interacting populations is the community.
47. A — Unlike mitosis, meiosis produces gametes that are genetically different from one another, which increases variation among offspring. This variation comes from processes like crossing over and independent assortment. Meiotic cells are not identical to the parent or doubled in chromosome number.
48. C — A consumer obtains its energy by feeding on other organisms, rather than making its own food. This distinguishes consumers from producers, which photosynthesize, and decomposers, which break down dead matter. Consuming other organisms for energy defines a consumer.
49. D — High biodiversity increases an ecosystem's stability and its ability to recover from disturbances, because many species can fill different roles and respond to change. This resilience helps the ecosystem withstand events like disease or fire. Greater diversity supports stability rather than guaranteeing unchanging populations.
50. B — Practices such as recycling, conserving energy, and protecting habitats promote sustainability, using resources to meet present needs while protecting the ability of future generations to meet theirs. These efforts support long-term resource balance. They are the opposite of deforestation, biomagnification, and extinction.