PRACTICE EXAM 15: LIFE SCIENCE: BIOLOGY SIMULATION (50 QUESTIONS)

1. The element carbon is the basis of all organic compounds in living things. Carbon is especially suited to forming the large, complex molecules of life because each carbon atom can:

A. Dissolve readily in water in order to carry out reactions inside the cell

B. Form four stable bonds, allowing long chains and rings of atoms to form

C. Release large amounts of energy whenever its single bond is broken apart

D. Replace nitrogen in the structure of every protein found in the body

2. Enzymes are biological catalysts that speed up chemical reactions in cells. An enzyme speeds up a reaction by:

A. Adding extra energy to the reactants so the reaction is able to begin

B. Permanently joining with the product so the reaction can never reverse

C. Lowering the activation energy needed for the reaction to occur

D. Raising the temperature of the entire cell to speed up all reactions

3. A particular enzyme works best at a pH of 7 and a temperature of 37°C. If the temperature is raised to 70°C, the enzyme stops working. The most likely reason is that the high temperature:

A. Changed the shape of the enzyme so its active site no longer fits the substrate

B. Increased the concentration of substrate beyond what the enzyme could handle

C. Caused the enzyme to bond permanently and correctly with all of its products

D. Lowered the pH of the solution far below the level that the enzyme requires

4. A red blood cell is placed in a beaker of pure distilled water, and water moves into the cell by osmosis until the cell swells and bursts. This happens because the distilled water, compared to the inside of the cell, is:

A. Hypertonic, having a higher solute concentration than the cell's interior

B. Isotonic, having a solute concentration equal to that of the cell's interior

C. Saturated with solutes that pull water out of the cell into the beaker

D. Hypotonic, having a lower solute concentration than the cell's interior

5. In cells, large molecules such as proteins are sometimes taken into the cell by being surrounded and enclosed by the cell membrane, forming a vesicle. This energy-requiring process is called:

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

B. Endocytosis, in which the membrane engulfs material into a vesicle

C. Osmosis, the movement of water across a selectively permeable membrane

D. Exocytosis, in which a vesicle fuses with the membrane to expel material

6. During cellular respiration, glucose is broken down in a series of steps. The first stage, called glycolysis, takes place in the:

A. Nucleus, where the cell's genetic information is stored and protected

B. Mitochondrion, the organelle where most of the cell's ATP is produced

C. Cytoplasm, the fluid region of the cell outside the membrane-bound organelles

D. Cell membrane, the outer boundary that controls what enters and exits

7. Photosynthesis can be summarized as: carbon dioxide + water + light energy → glucose + oxygen. In this process, the carbon atoms that end up in the glucose molecule come from the:

A. Carbon dioxide that the plant takes in from the surrounding air

B. Water that the plant absorbs through its roots from the soil below

C. Light energy that the plant captures through its green pigments

D. Oxygen that the plant releases as a waste product of the process

8. A dehydrated person produces a small volume of very concentrated urine, while a person who has consumed a large amount of water produces a large volume of dilute urine. This adjustment in urine output helps the body to:

A. Increase the rate at which food is digested in the small intestine

B. Speed up the breakdown of glucose during cellular respiration

C. Raise the body's internal temperature when the weather is cold

D. Maintain a stable balance of water within the body, a form of homeostasis

9. The human nervous system detects and responds to changes in the environment. A structure that detects a change, such as light, sound, or temperature, and sends a signal to the nervous system is called a:

A. Effector, a muscle or gland that carries out the body's response

B. Synapse, the small gap between two neurons across which signals pass

C. Receptor, a structure that detects a stimulus and sends a signal

D. Neuron, the cell that carries electrical impulses through the body

10. Hormones are chemical messengers released by glands that travel through the bloodstream to affect target organs. Compared with nerve impulses, the effects of hormones usually:

A. Act much faster and wear off much more quickly than nerve impulses do

B. Take longer to begin but last longer than the effects of nerve impulses

C. Travel along neurons rather than being carried within the bloodstream

D. Affect only the gland that released them and no other body organs

11. The two strands of a DNA molecule are held together by bonds between pairs of nitrogen bases. The two strands are described as complementary because:

A. The base sequence of one strand determines the base sequence of the other

B. The two strands carry exactly the same base sequence in the same direction

C. Both strands are made entirely of sugar and phosphate, without any bases

D. The strands repel each other and are held apart by the bases between them

12. During DNA replication, the two strands of the original DNA molecule separate, and each serves as a template for building a new strand. As a result, each of the two new DNA molecules contains:

A. Two completely new strands, with no part of the original molecule remaining

B. Only the two original strands, with no new strands being built at all

C. A random mixture of pieces from several different DNA molecules combined

D. One original strand and one newly built strand paired together

13. In a plant, the allele for purple flowers (P) is dominant over the allele for white flowers (p). A cross is made between a heterozygous purple plant (Pp) and a white plant (pp). What percentage of the offspring are expected to have white flowers?

A. 0%, because the dominant purple allele will mask the white in every offspring

B. 25%, because only one in four offspring will inherit two recessive alleles

C. 50%, because half the offspring inherit two recessive alleles and are white

D. 75%, because three out of four offspring inherit at least one recessive allele

14. A karyotype is a picture of an individual's chromosomes arranged in pairs. A karyotype can be used to detect certain genetic disorders that are caused by:

A. A single change in one base of one gene located on a chromosome

B. An abnormal number of chromosomes, such as an extra chromosome

C. The environment a person was exposed to during their early childhood

D. A diet lacking in certain vitamins and minerals during development

15. A scientist inserts the gene for a glowing protein from a jellyfish into the DNA of a bacterium, and the bacterium begins to glow. This is possible because:

A. The genetic code is essentially universal, so different organisms can read the same gene

B. The bacterium and the jellyfish are very closely related in evolutionary history

C. The glowing protein gene physically transforms the bacterium into a jellyfish cell

D. Bacteria naturally produce glowing proteins whenever they are grown in a laboratory

16. Sexual reproduction produces offspring with greater genetic variation than asexual reproduction. One major source of this variation is the random separation of chromosomes into gametes during meiosis, a process known as:

A. Replication, in which the DNA of the cell is copied before division

B. Fertilization, in which a sperm cell and an egg cell join together

C. Mitosis, in which one cell divides to form two identical body cells

D. Independent assortment, the random distribution of chromosomes to gametes

17. In humans, a child who inherits two X chromosomes will typically be female, while a child who inherits an X and a Y chromosome will typically be male. The chromosome that determines a male is normally inherited from the:

A. Mother, who contributes either an X or a Y chromosome to each child

B. Father, who contributes either an X or a Y chromosome to each child

C. Mother, who always contributes a Y chromosome to her male children

D. Father, who always contributes two X chromosomes to each of his children

18. A mutation in a gene changes the sequence of bases, which can change the protein the gene codes for. A mutation will have the greatest effect on an organism's offspring if it occurs in:

A. A skin cell that is later shed from the surface of the organism's body

B. A muscle cell located deep within the leg of the adult organism over time

C. A sex cell (gamete) that takes part in the reproduction of the organism

D. A red blood cell circulating through the bloodstream of the organism

19. According to the theory of evolution, the variety of species alive today arose from earlier species over long periods of time. The main mechanism Darwin proposed to explain how populations change over time is:

A. Natural selection, in which better-suited individuals survive and reproduce more

B. The inheritance of traits that an organism acquires during its own lifetime

C. A deliberate effort by organisms to change themselves to fit their surroundings

D. Sudden large changes that instantly create entirely new species in one step

20. A population of insects is sprayed with an insecticide, and a small number survive because they happen to carry a gene for resistance. These survivors reproduce, and over time the whole population becomes resistant. This change is an example of:

A. An acquired trait that each individual insect developed during its own lifetime

B. A change caused directly by the insecticide rewriting the insects' genes

C. The complete absence of any variation within the insect population

D. Evolution by natural selection acting on inherited variation in the population

21. The wing of a bird and the wing of an insect both allow flight, but they have completely different internal structures and evolved independently in unrelated groups. Structures that serve a similar function but do not share a common ancestral origin are called:

A. Homologous structures, which indicate descent from a shared ancestor

B. Vestigial structures, which have lost most of their original function

C. Analogous structures, which evolved separately to perform a similar function

D. Inherited structures, which every related organism receives from its parents

22. Scientists studying the relationships among organisms use many kinds of evidence. Which of the following would provide the strongest evidence that two species share a recent common ancestor?

A. The two species happen to live in the same type of habitat today

B. The two species have very similar DNA and amino acid sequences

C. The two species are about the same size and the same body color

D. The two species both occupy the same trophic level in a food chain

23. Over millions of years, a single ancestral species of bird that reached an island group gave rise to many different species, each adapted to a different food source and habitat. This process, in which one ancestral species rapidly gives rise to many new species, is called:

A. Adaptive radiation, the diversification of one lineage into many forms

B. Extinction, the permanent disappearance of a species from the Earth

C. Convergent evolution, in which unrelated species come to resemble one another

D. Genetic drift, the random change in allele frequencies in a small population

24. A geographic barrier, such as the formation of a new river, separates a single population of animals into two groups that can no longer interbreed. Over many generations, the two groups become so different that they form two separate species. This process is best described as:

A. Artificial selection, in which humans choose which organisms reproduce

B. Convergent evolution, in which unrelated species develop similar traits

C. Succession, the gradual change in a community of species over time

D. Geographic isolation leading to the formation of two new species

25. In an ecosystem, energy flows in one direction while matter is recycled. Which statement correctly describes the flow of energy through an ecosystem?

A. Energy is recycled endlessly among the organisms of the ecosystem

B. Energy flows from the consumers down to the producers at the base of the web

C. Energy flows from the Sun to producers and then to consumers, decreasing at each level

D. Energy increases at each higher level because predators are larger than their prey

26. Decomposers, such as bacteria and fungi, are a vital part of every ecosystem. Their primary role in the cycling of matter is to:

A. Capture energy from sunlight and store it in the chemical bonds of food

B. Break down dead organisms and wastes, releasing nutrients back into the environment

C. Hunt and consume the largest animals to keep their populations in check

D. Produce the oxygen that all of the other organisms in the ecosystem need

27. A pyramid of energy shows the amount of energy available at each trophic level of a food chain. The level with the greatest amount of available energy is always the level of the:

A. Top predators, which sit at the very highest level of the food chain

B. Decomposers, which break down all of the dead material in the ecosystem

C. Secondary consumers, which feed on the primary consumers below them

D. Producers, which form the base of the pyramid and capture the original energy

28. In a food web, removing one species can affect many others. If all the producers were removed from an ecosystem, the most likely immediate effect would be that:

A. The consumers would lose their energy source and their populations would decline

B. The decomposers would multiply rapidly and replace the missing producers

C. The top predators would increase in number because of reduced competition

D. The ecosystem would be unaffected because consumers do not need producers

29. In a study of an island, ecologists notice that the population of a certain bird grows rapidly at first, then slows and levels off near a stable number. The leveling off of the population is most likely caused by:

A. The complete absence of any predators that hunt the bird on the island

B. A sudden increase in the food supply available to the birds on the island

C. Limiting factors such as food, space, and nesting sites becoming scarce

D. A mutation that causes all of the birds to stop reproducing at the same time

30. Two species of barnacle live on the same rocky shoreline. One species lives only on the upper rocks and the other only on the lower rocks, even though each could survive in both areas. The most likely reason they occupy separate zones is to:

A. Increase the amount of direct competition between the two barnacle species

B. Reduce competition by occupying different portions of the available habitat

C. Allow the two species to interbreed more easily across the whole shoreline

D. Ensure that both species are eaten at the same rate by the same predators

31. A farmer notices that a field treated heavily with chemical fertilizer has runoff that flows into a nearby pond. Soon the pond is covered with a thick layer of algae, and later many fish die. The death of the fish is most directly caused by:

A. The algae physically trapping and crushing the fish near the surface

B. The fertilizer being directly poisonous to the fish that live in the pond

C. The algae producing so much oxygen that the fish are unable to breathe

D. Bacteria using up the oxygen in the water while decomposing the dead algae

32. Some species, called keystone species, have an unusually large effect on their ecosystems. The sea otter is a keystone species in kelp forests because it eats sea urchins, which graze on kelp. If sea otters were removed, the most likely result would be that:

A. Sea urchin numbers would rise and the kelp forest would be heavily damaged

B. The kelp forest would expand rapidly because more sunlight would reach it

C. The sea urchins would quickly die out without the otters there to control them

D. There would be no change at all, since the otters have little effect overall

33. Carbon dioxide is removed from the atmosphere and added back to it through natural processes. Which of the following processes removes carbon dioxide from the atmosphere?

A. Cellular respiration carried out by animals, plants, and decomposers

B. The burning of fossil fuels such as coal, oil, and natural gas in engines

C. Photosynthesis carried out by green plants, algae, and other producers

D. The decay of dead organisms by bacteria and fungi in the soil over time

34. Human population growth and activity have increased the demand for resources. Which of the following human activities is most likely to help conserve biodiversity rather than reduce it?

A. Draining wetlands to create new land for housing developments

B. Establishing protected areas where natural habitats are preserved

C. Introducing a non-native predator to control a native prey species

D. Clearing large areas of forest to plant a single crop for farming

35. The release of certain gases from human activities has been linked to the thinning of the ozone layer in the upper atmosphere. The ozone layer is important to living things because it:

A. Provides the oxygen that animals need to carry out cellular respiration

B. Traps heat near the surface, keeping the planet warm enough for life

C. Supplies the carbon dioxide that plants use during photosynthesis daily

D. Absorbs much of the Sun's harmful ultraviolet radiation before it reaches Earth

36. All living things are made of one or more cells, and all cells come from preexisting cells. These statements are part of a fundamental scientific idea known as:

A. The cell theory, a foundational concept in the study of biology

B. The theory of evolution, which explains how species change over time

C. The law of independent assortment, which describes the inheritance of traits

D. The principle of homeostasis, which describes a stable internal environment

37. Prokaryotic cells, such as bacteria, differ from eukaryotic cells, such as those of plants and animals, mainly because prokaryotic cells:

A. Are always much larger than the eukaryotic cells found in plants and animals

B. Lack a true nucleus and the membrane-bound organelles found in eukaryotic cells

C. Contain many more membrane-bound organelles than typical eukaryotic cells

D. Are the only type of cell that contains genetic material in the form of DNA

38. A doctor prescribes an antibiotic for a patient's bacterial infection and advises the patient to finish the entire course even after feeling better. Completing the full course is important mainly because it helps to:

A. Make the antibiotic taste better and easier for the patient to swallow

B. Provide the patient with extra vitamins that speed up the healing process

C. Kill the remaining bacteria and reduce the chance of resistant bacteria surviving

D. Strengthen the patient's bones and muscles during the recovery period

39. When a pathogen such as a virus enters the body, the immune system responds by producing proteins that recognize and help destroy that specific pathogen. These protective proteins are called:

A. Hormones, the chemical messengers released by glands into the bloodstream

B. Enzymes, the catalysts that speed up chemical reactions inside the cell

C. Platelets, the cell fragments that help the blood to form clots at wounds

D. Antibodies, proteins that recognize and help destroy a specific pathogen

40. A person recovering from an illness is advised to eat a balanced diet that includes proteins. Proteins are an important part of the diet because the body uses the amino acids from proteins to:

A. Build and repair tissues and to make enzymes and other important molecules

B. Store the body's main long-term supply of energy in the form of body fat

C. Provide the genetic instructions that are passed on to the person's offspring

D. Carry oxygen from the lungs to the body tissues through the bloodstream

41. In an investigation, a scientist wants to find out whether adding a certain mineral to water increases the growth of algae. To make the results reliable, the scientist tests many containers rather than just one. Testing many containers is important because it:

A. Guarantees that the scientist's original hypothesis will be proven correct

B. Provides more data and reduces the effect of chance on the final results

C. Removes the need to include a control group in the experimental design

D. Makes the experiment finish much more quickly than testing one container

42. A student studying the effect of fertilizer on plant height grows all the plants in identical pots, with the same soil, water, and light, changing only the amount of fertilizer. Keeping all of these other conditions the same is important because it:

A. Guarantees that the fertilizer will cause the plants to grow much taller

B. Allows the student to test several different variables at the same time

C. Ensures that any difference in plant height is due to the fertilizer alone

D. Makes the experiment more interesting for other students to observe

43. A scientist measures the height of a population of plants and records the following values, in centimeters: 10, 12, 14, 16, and 18. What is the mean (average) height of these five plants?

A. 10 centimeters, which is the smallest value in the set of measurements

B. 16 centimeters, found by adding the largest and smallest values together

C. 18 centimeters, which is the largest value in the set of measurements

D. 14 centimeters, found by adding all the values and dividing by five

44. A scientist forms a hypothesis, designs an experiment, collects data, and finds that the data do not support the hypothesis. The best next step for the scientist to take is to:

A. Revise the hypothesis or form a new one and test it with further experiments

B. Change the collected data so that it matches the original hypothesis better

C. Ignore the results entirely and publish the original hypothesis as a proven fact

D. Conclude that science cannot be used to study the question being investigated

45. A graph can be a useful way to present scientific data. If a scientist wants to compare the average heights of plants grown under four completely different fertilizer brands, the most appropriate type of graph to use would be a:

A. Line graph, which is best for showing how one value changes over time

B. Pie chart, which is best for showing the parts that make up a single whole

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 members of a single species that live in the same area at the same time and are able to interbreed make up a:

A. Community, which includes all the different species living within an area

B. Population, which is one species living in an area at a given time

C. Ecosystem, which includes both the living and the nonliving parts of an area

D. Biome, which is a large region defined mainly by its climate and plant life

47. Mitosis and meiosis are both forms of cell division, but they produce different results. A key difference is that mitosis produces cells used for growth and repair, while meiosis produces cells used for:

A. Digestion, breaking down food into smaller absorbable nutrient molecules

B. Respiration, releasing the energy stored in glucose for the cell to use

C. Photosynthesis, capturing light energy to build food in plant leaf cells

D. Reproduction, forming the gametes that combine during fertilization

48. A virus is much smaller than a bacterium and cannot carry out life processes such as reproduction on its own. To make copies of itself, a virus must:

A. Enter a living host cell and use the cell's machinery to reproduce

B. Absorb nutrients directly from its surroundings like a free-living cell

C. Divide in half by itself the way that a bacterial cell normally divides

D. Build its own ribosomes and produce its own energy independently

49. Plants and other producers are essential to almost all ecosystems on Earth because they are able to:

A. Break down the dead remains of organisms and recycle their nutrients

B. Capture energy from sunlight and convert it into chemical energy in food

C. Feed on other organisms to obtain the energy stored in their tissues

D. Move quickly from place to place in search of food and fresh water

50. Maintaining biodiversity in an ecosystem is widely considered beneficial. One important reason that high biodiversity is valuable to an ecosystem is that it:

A. Guarantees that the populations of every species will remain exactly constant

B. Ensures that a single dominant species will control the entire ecosystem alone

C. Increases the stability of the ecosystem and its ability to recover from disturbance

D. Prevents the ecosystem from ever changing in response to its environment over time

ANSWER KEY WITH EXPLANATIONS – Practice Exam 15

1. B — Carbon atoms each form four stable covalent bonds, which lets them link into long chains, branches, and rings that make up the large, complex molecules of life. This bonding versatility is why carbon is the backbone of carbohydrates, lipids, proteins, and nucleic acids. No other common element builds such diverse organic structures.
2. C — Enzymes speed up reactions by lowering the activation energy, the energy barrier that must be overcome for the reaction to proceed. By reducing this barrier, the enzyme allows the reaction to happen faster and at body temperature. Enzymes are not used up and do not add energy or permanently bind to products.
3. A — High temperatures denature an enzyme, altering its three-dimensional shape so the active site no longer fits its substrate. Once the shape is disrupted, the enzyme cannot catalyze its reaction. This is why each enzyme works only within a limited temperature range around its optimum.
4. D — Distilled water has a lower solute concentration than the cell's interior, making it hypotonic to the cell. Water therefore moves into the cell by osmosis, causing it to swell and, in a red blood cell, burst. The direction of water movement is set by the difference in solute concentration.
5. B — Endocytosis is the process in which the cell membrane surrounds and engulfs large materials, enclosing them in a vesicle that is brought into the cell. Because it moves material into the cell and requires energy, it differs from passive diffusion and osmosis. Exocytosis is the reverse process, expelling material from the cell.
6. C — Glycolysis, the first stage of cellular respiration, takes place in the cytoplasm, the fluid outside the membrane-bound organelles. There glucose is partially broken down before the later stages occur in the mitochondria. Locating glycolysis in the cytoplasm is a key detail of respiration.
7. A — During photosynthesis, plants take in carbon dioxide from the air, and the carbon atoms in that carbon dioxide become part of the glucose produced. Water supplies hydrogen and oxygen, and light supplies energy, but the carbon comes from carbon dioxide. Tracing the carbon shows how atmospheric carbon enters living matter.
8. D — Adjusting urine concentration and volume lets the body conserve water when dehydrated and remove excess water when overhydrated, keeping internal water balance stable. This maintenance of a steady internal environment is homeostasis. The kidneys carry out this regulation through the urine they produce.
9. C — A receptor is a structure that detects a stimulus such as light, sound, or temperature and sends a signal into the nervous system. Effectors carry out responses, neurons transmit impulses, and the synapse is a gap between neurons. The detecting structure specifically is the receptor.
10. B — Hormones travel through the bloodstream, so their effects generally begin more slowly but last longer than the rapid, brief effects of nerve impulses. This makes the endocrine system suited to sustained regulation. Nerve signals, by contrast, are fast and short-lived.

11. A — The strands are complementary because each base pairs with a specific partner (A with T, G with C), so the sequence of one strand determines the sequence of the other. This complementary pairing allows DNA to be copied accurately. The strands are not identical; they are matching opposites running in opposite directions.
12. D — DNA replication is semiconservative: each new molecule keeps one original strand and pairs it with one newly synthesized strand. This ensures each daughter molecule is an accurate copy of the original. The retained original strand serves as the template for building its new partner.
13. C — Crossing Pp with pp produces half Pp (purple) and half pp (white) offspring, so 50% are expected to be white. Only the homozygous recessive pp plants show the white phenotype. This is the characteristic 1:1 ratio of a test cross with a heterozygote.
14. B — A karyotype displays the chromosomes in pairs, so it can reveal disorders caused by an abnormal chromosome number, such as an extra chromosome (as in trisomy). It shows large-scale chromosomal changes rather than single-base mutations. Counting and arranging chromosomes is how such conditions are detected.
15. A — Because the genetic code is essentially universal, different organisms read the same DNA sequence to make the same protein, so a jellyfish gene placed in bacteria produces the glowing protein. This shared code is what makes genetic engineering across species possible. It does not require the organisms to be closely related.
16. D — Independent assortment is the random distribution of homologous chromosomes into gametes during meiosis, producing many different chromosome combinations. This randomness is a major source of genetic variation in sexually reproducing organisms. It is distinct from replication, fertilization, and mitosis.
17. B — The father contributes either an X or a Y chromosome to each child, so it is the father's chromosome that determines whether a child is male (XY) or female (XX). The mother always contributes an X. Thus a male child receives his Y chromosome from his father.
18. C — A mutation has the greatest effect on offspring when it occurs in a sex cell (gamete), because that change can be passed on during reproduction. Mutations in body cells like skin, muscle, or blood cells affect only the individual. Only germ-line mutations are inherited by the next generation.
19. A — Darwin proposed natural selection, in which individuals with traits better suited to the environment survive and reproduce more, gradually changing the population over time. This mechanism relies on inherited variation, not on acquired traits or deliberate change. It is the central explanation for how species evolve.
20. D — The rise of resistance illustrates evolution by natural selection: pre-existing resistant insects survived the insecticide and reproduced, increasing the resistant proportion over generations. The insecticide selects for, rather than creates, resistance. The trait is inherited, not acquired during an insect's lifetime.
21. C — Analogous structures, such as bird and insect wings, perform a similar function but arose independently in unrelated lineages, so they do not share a common ancestral origin. This contrasts with homologous structures, which reflect shared ancestry. Similar function without shared origin defines analogous structures.
22. B — Highly similar DNA and amino acid sequences provide the strongest evidence that two species share a recent common ancestor, because closely related species inherit similar molecular sequences. Shared habitat, size, color, or trophic level can occur without close relatedness. Molecular similarity is the most reliable indicator.

23. A — Adaptive radiation is the rapid diversification of a single ancestral species into many new species, each adapted to a different niche, as seen in island birds. It explains how one lineage fills a variety of available habitats and food sources. This differs from extinction, convergence, or genetic drift.
24. D — When a geographic barrier separates a population so the groups can no longer interbreed, they may accumulate enough differences to become separate species, a process called geographic isolation (allopatric speciation). The barrier prevents gene flow between the groups. Over generations this isolation drives the formation of new species.
25. C — Energy enters an ecosystem from the Sun, is captured by producers, and passes to consumers, decreasing at each trophic level as it is lost as heat. Unlike matter, energy is not recycled and flows in one direction. This one-way decreasing flow is a fundamental feature of ecosystems.
26. B — Decomposers break down dead organisms and wastes, releasing the nutrients they contain back into the environment for reuse by producers. This recycling of matter is essential to keeping nutrient cycles running. Without decomposers, nutrients would remain locked in dead material.
27. D — Producers form the base of an energy pyramid and capture the original energy from the Sun, so they always have the greatest amount of available energy. Energy decreases at each level above them as it is used and lost as heat. This is why the producer level is the largest in the pyramid.
28. A — Producers are the energy source for the entire food web, so removing them would leave consumers without food, and their populations would decline. Decomposers cannot replace producers, and predators would not benefit. The loss of producers cuts off the ecosystem's energy supply.
29. C — A population levels off near carrying capacity when limiting factors such as food, space, and nesting sites become scarce, slowing further growth. These density-dependent factors restrict how many individuals the environment can support. The plateau reflects the balance between population size and available resources.
30. B — By occupying different zones of the same shoreline, the two barnacle species reduce competition for space, allowing them to coexist. This resource partitioning lets similar species share a habitat. It lowers, rather than increases, direct competition between them.
31. D — After the algae die, decomposing bacteria consume large amounts of dissolved oxygen, lowering oxygen levels until the fish suffocate. This oxygen depletion, not direct poisoning or physical trapping, causes the fish deaths. It is a typical consequence of fertilizer runoff and algal blooms.
32. A — As a keystone species, the sea otter controls sea urchins; removing the otters lets urchin numbers rise, and the urchins overgraze and destroy the kelp forest. The otter's influence on the ecosystem is far greater than its abundance suggests. Its loss triggers major ecological damage.
33. C — Photosynthesis removes carbon dioxide from the atmosphere as producers convert it into glucose. Respiration, fossil fuel burning, and decay all release carbon dioxide rather than remove it. Photosynthesis is the key process that draws atmospheric carbon into living matter.
34. B — Establishing protected areas preserves natural habitats and the species that depend on them, helping to conserve biodiversity. Draining wetlands, introducing non-native predators, and clearing forests for single crops all tend to reduce biodiversity. Habitat protection supports a diverse range of species.
35. D — The ozone layer absorbs much of the Sun's harmful ultraviolet radiation, shielding living things from damage to their cells and DNA. Its thinning allows more UV radiation to reach Earth's surface. This protective role, not heat trapping or gas supply, is why the ozone layer matters.

36. A — The statements that all living things are made of cells and that all cells come from preexisting cells are central parts of the cell theory, a foundational concept in biology. This theory unifies the study of all living organisms. It is distinct from evolution, inheritance laws, and homeostasis.
37. B — Prokaryotic cells lack a true nucleus and the membrane-bound organelles found in eukaryotic cells, which is their defining difference. Their genetic material is not enclosed in a nuclear membrane. Both cell types contain DNA, but only eukaryotes have membrane-bound organelles.
38. C — Finishing the full course of antibiotics helps kill all the bacteria, including the hardier ones, reducing the chance that resistant bacteria survive and multiply. Stopping early can leave resistant survivors that lead to a tougher infection. Completing treatment is a key practice in slowing antibiotic resistance.
39. D — Antibodies are proteins produced by the immune system that recognize and help destroy a specific pathogen. Their specificity allows the body to target particular invaders. Hormones, enzymes, and platelets serve other functions and do not provide this specific immune defense.
40. A — The body uses amino acids from dietary protein to build and repair tissues and to make enzymes, antibodies, and other essential molecules. This is why adequate protein supports recovery and growth. Proteins are primarily structural and functional, not the body's main energy store or oxygen carrier.
41. B — Testing many containers provides more data and reduces the influence of chance or error on the results, making the conclusion more reliable. A larger sample gives a more trustworthy picture than a single trial. Repetition strengthens the validity of an experiment rather than replacing the control.
42. C — Holding all other conditions constant ensures that any difference in plant height can be attributed to the fertilizer alone, the one variable being tested. If other factors varied, the cause of the results would be unclear. Controlling variables is what makes the experiment's conclusion valid.
43. D — The mean is found by adding all values ($10 + 12 + 14 + 16 + 18 = 70$) and dividing by the number of values (5), giving $70 \div 5 = 14$ centimeters. The mean represents the average of the data set. It is not simply the largest or smallest value.
44. A — When data do not support a hypothesis, the proper scientific response is to revise the hypothesis or form a new one and test it further. Science advances by adjusting ideas to fit evidence. Altering data or ignoring results would violate the integrity of the scientific process.
45. C — A bar graph is best for comparing values across separate, distinct categories, such as plant height under four different fertilizer brands. Line graphs show change over time, pie charts show parts of a whole, and diagrams show structures. Comparing categories calls for a bar graph.
46. B — A population consists of all members of a single species living in the same area at the same time that can interbreed. A community includes multiple species, and an ecosystem also includes nonliving factors. The defining feature here is one interbreeding species in one place.
47. D — Meiosis produces gametes, the reproductive cells that combine during fertilization, whereas mitosis produces cells for growth and repair. This difference in purpose is fundamental: meiosis halves the chromosome number to make sex cells. Reproduction is the function tied specifically to meiosis.
48. A — A virus cannot reproduce on its own and must enter a living host cell and use that cell's machinery to make copies of itself. This dependence on a host distinguishes viruses from cells that reproduce independently. It is also why viruses are considered to be on the borderline of living things.

49. B — Producers such as plants capture energy from sunlight and convert it into chemical energy stored in food, making that energy available to the rest of the ecosystem. This ability to make food places them at the base of food webs. Consumers and decomposers ultimately depend on the energy producers capture.
50. C — 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.