# PRACTICE EXAM 11: LIFE SCIENCE: BIOLOGY SIMULATION (50 QUESTIONS)

1. A biologist observes a cell that contains a large central vacuole, a rigid outer wall, and many chloroplasts. Which type of cell is the biologist most likely examining?

A. An animal cell specialized for rapid movement through tissues

B. A bacterial cell that lacks any membrane-bound organelles

C. A plant cell adapted for photosynthesis and structural support

D. A fungal cell that absorbs nutrients from its surroundings

2. The cell membrane allows certain substances to enter and exit the cell while blocking others. This characteristic of the cell membrane is best described as:

A. Selective permeability that regulates which substances cross the membrane

B. Active transport that moves every molecule against its concentration gradient

C. Complete impermeability to both water and dissolved substances

D. Random diffusion that allows any molecule to pass through freely

3. Which structure within a eukaryotic cell contains the genetic information that directs the cell's activities?

A. The ribosome, where proteins are assembled from amino acids

B. The mitochondrion, where energy is released from glucose molecules

C. The vacuole, where water and dissolved materials are stored

D. The nucleus, where DNA is housed and protected from damage

4. Enzymes speed up chemical reactions in living cells. Which factor would most likely cause an enzyme to lose its function permanently?

A. A slight increase in the concentration of the substrate molecules

B. Exposure to high temperatures that change the enzyme's shape

C. A small decrease in the temperature of the surrounding solution

D. The presence of additional water molecules in the reaction mixture

5. A scientist studies a single-celled organism living in pond water. The organism maintains stable internal conditions despite changes in the surrounding water. This ability to maintain a stable internal environment is called:

A. Metabolism that builds and breaks down molecules for energy

B. Differentiation that produces specialized cell types over time

C. Reproduction that passes genetic material to the next generation

D. Homeostasis that keeps internal conditions within a stable range

6. During strenuous exercise, human muscle cells may run low on oxygen. Under these low-oxygen conditions, muscle cells produce ATP through a process that also generates:

A. Lactic acid, which can build up and contribute to muscle fatigue

B. Ethyl alcohol, which is released from the muscle cells as waste

C. Pure oxygen gas, which is then reused by the cell's mitochondria

D. Glucose molecules, which are stored for use during later activity

7. In protein synthesis, one molecule carries the genetic message from the DNA in the nucleus out to the ribosomes in the cytoplasm. This molecule is:

A. A transfer RNA that delivers amino acids to the ribosome

B. A DNA polymerase that copies the genetic code during division

C. A messenger RNA that carries instructions out of the nucleus

D. A ribosomal protein that assembles into a functional ribosome

8. Chloroplasts and mitochondria are both organelles involved in energy transformations. Which statement correctly compares the roles of these two organelles?

A. Both organelles release oxygen gas as a product of their reactions

B. Chloroplasts capture light energy while mitochondria release energy from food

C. Both organelles break down glucose to release stored chemical energy

D. Mitochondria capture light energy while chloroplasts store it as starch

9. Antibodies are produced by the human immune system in response to foreign substances. The foreign substance that triggers this immune response is called:

A. An antigen that the immune system recognizes as foreign

B. A vaccine that provides immunity without causing the disease

C. A pathogen that always consists of a single living virus particle

D. A platelet that helps the blood form clots at the site of a wound

10. A person is infected with a particular virus for the first time. After recovering, the person is later exposed to the same virus but does not become sick. Which part of the immune system is most responsible for this protection?

A. Red blood cells that carry oxygen throughout the body's tissues

B. Digestive enzymes that break down the virus inside the stomach

C. Platelets that form clots to seal the entry point of the virus

D. Memory cells that respond quickly to a previously encountered virus

11. The human body uses negative feedback to regulate many internal conditions. Which of the following is an example of negative feedback maintaining homeostasis?

A. The release of milk increasing as a baby continues to nurse longer

B. The intensity of labor contractions increasing during childbirth

C. The release of insulin lowering blood sugar after a person eats a meal

D. The growth of a blood clot increasing until a wound is fully sealed

12. Which sequence correctly traces the path of blood as it returns from the body and is then pumped toward the lungs?

A. Left atrium, left ventricle, aorta, then out to the body tissues

B. Right atrium, right ventricle, pulmonary artery, then to the lungs

C. Left ventricle, right atrium, vena cava, then out to the body tissues

D. Pulmonary vein, left ventricle, right atrium, then back to the lungs

13. The human respiratory and circulatory systems work together to supply body cells with oxygen. Where in the body does oxygen move from the air into the blood?

A. In the bronchi, where air is warmed before it reaches the lungs

B. In the trachea, where air passes on its way down toward the lungs

C. In the diaphragm, which contracts to draw air into the chest cavity

D. In the alveoli, where gases are exchanged with surrounding capillaries

14. A nerve impulse travels along a neuron and must cross a small gap to reach the next neuron. The chemical messengers that carry the signal across this gap are called:

A. Neurotransmitters that are released into the synapse between neurons

B. Hormones that are secreted by glands directly into the bloodstream

C. Enzymes that catalyze reactions inside the neuron's cell body

D. Antibodies that defend the neuron against invading pathogens

15. The endocrine system regulates body activities by releasing chemical signals that travel through the bloodstream to distant organs. These chemical signals are known as:

A. Neurotransmitters that act across the gaps between adjacent neurons

B. Antigens that stimulate the immune system to produce antibodies

C. Hormones that travel in the blood to target organs and tissues

D. Enzymes that lower the activation energy of cellular reactions

16. In humans, the liver helps maintain a stable level of glucose in the blood. After a meal high in sugar, the liver helps restore balance by:

A. Releasing stored glucose into the blood to raise the blood sugar level

B. Storing the excess glucose as glycogen to lower the blood sugar level

C. Converting the glucose into proteins used to build new body tissue

D. Breaking the glucose down into oxygen and water through respiration

17. A scientist examines a sample of human tissue and finds cells that are tightly packed together, forming a protective layer that covers an organ's surface. This tissue is best classified as:

A. Epithelial tissue, which covers surfaces and lines body cavities

B. Muscle tissue, which contracts to produce movement in the body

C. Nervous tissue, which carries electrical impulses through the body

D. Connective tissue, which supports and binds other tissues together

18. During human development, a single fertilized egg gives rise to many different specialized cells, such as nerve cells and muscle cells. The process by which cells become specialized for particular functions is called:

A. Fertilization, in which the sperm and egg nuclei combine into one

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

C. Replication, in which the DNA is copied before a cell divides

D. Differentiation, in which cells develop specialized structures and roles

19. In sexually reproducing organisms, gametes are produced through a special type of cell division. Compared to a normal body cell, each gamete contains:

A. Twice the number of chromosomes found in a normal body cell

B. The exact same number of chromosomes as a normal body cell

C. Half the number of chromosomes found in a normal body cell

D. A random number of chromosomes that varies with each gamete

20. A zygote is formed when an egg cell and a sperm cell join during fertilization, and the zygote then begins to divide. What process produces the many cells of the developing embryo from this single zygote?

A. Meiosis, which reduces the chromosome number by half with each division

B. Mitosis, which produces genetically identical cells from the zygote

C. Differentiation, which immediately produces every specialized tissue

D. Fertilization, which repeats many times to build up the new embryo

21. In a DNA molecule, the order of the nitrogenous bases along a strand helps determine an organism's traits, and the bases pair according to specific rules. In DNA, adenine always pairs with:

A. Cytosine, forming one of the rungs of the DNA ladder structure

B. Guanine, which is held in place by exactly three hydrogen bonds

C. Another adenine located on the opposite strand of the molecule

D. Thymine, forming a complementary base pair across the strands

22. A geneticist finds that a particular trait is controlled by a single gene with two alleles. An organism that has two identical alleles for this gene is described as:

A. Homozygous for that gene, carrying two copies of the same allele

B. Heterozygous for that gene, carrying two different alleles

C. Recessive for that gene, masking the dominant phenotype shown

D. Codominant for that gene, expressing both alleles at the same time

23. In pea plants, round seeds (R) are dominant over wrinkled seeds (r). Two heterozygous plants (Rr) are crossed with each other. What fraction of the offspring would be expected to have wrinkled seeds?

A. None of the offspring, because wrinkled is a recessive hidden trait

B. One-half of the offspring, because both parents are heterozygous

C. One-quarter of the offspring, which inherit two recessive alleles

D. Three-quarters of the offspring, which show the recessive phenotype

24. In four-o'clock flowers, a cross between a red-flowered plant and a white-flowered plant produces offspring that all have pink flowers. This pattern, in which the heterozygous phenotype is a blend of the two parent phenotypes, is best described as:

A. Complete dominance, in which one allele fully masks the other allele

B. Incomplete dominance, in which the heterozygous phenotype is intermediate

C. Codominance, in which both alleles are fully and separately expressed

D. Sex linkage, in which the gene is located on the X or Y chromosome

25. A mutation occurs in a body (somatic) cell of an adult human. Which statement correctly describes the most likely effect of this mutation?

A. It will not be passed on to the person's offspring through reproduction

B. It will always be passed to every one of the person's future children

C. It will immediately change the traits of all cells throughout the body

D. It will be repaired automatically and have no effect on the cell at all

26. A change in the sequence of bases in a gene is known as a mutation. Which of the following is most likely to increase the rate of mutations in an organism's cells?

A. Eating a diet that is rich in proteins and complex carbohydrates

B. Drinking large amounts of clean water over a long period of time

C. Performing regular physical exercise that strengthens the muscles

D. Exposure to ultraviolet radiation or certain chemicals in the environment

27. Bacteria have been engineered to produce human insulin by inserting the human insulin gene into the bacterial DNA. The bacteria are then able to make human insulin because:

A. The bacteria naturally produce insulin once they are grown in a lab

B. All organisms use the same genetic code to read DNA into proteins

C. The human gene transforms the bacteria into human cells over time

D. The bacteria copy the insulin by closely observing nearby human cells

28. Genetic engineering can be used to produce crops that resist insect pests. One possible long-term concern about widely planting such genetically modified crops is that:

A. The crops will be unable to reproduce or pass on their genes at all

B. The crops will immediately convert into a completely new species

C. Insects could evolve resistance, reducing the crops' long-term effectiveness

D. The crops will lose all of their genes within a single growing season

29. Selective breeding has been used for thousands of years to produce dogs, crops, and livestock that have desirable traits. Selective breeding works because:

A. Organisms with desired traits are chosen to reproduce and pass on genes

B. Breeders directly edit the DNA of the organisms to insert new genes

C. The environment forces all organisms to develop the same useful traits

D. Offspring always show traits that are completely different from parents

30. According to the theory of evolution by natural selection, which individuals in a population are most likely to pass their genes on to the next generation?

A. The largest individuals, because body size always determines survival

B. The youngest individuals, because they have the most time to reproduce

C. Individuals chosen at random, since survival is entirely a matter of luck

D. Individuals whose inherited traits are best suited to the local environment

31. Within a population of insects, there is variation in body color among the individuals. This genetic variation is important for the population because it:

A. Guarantees that every individual in the population will survive equally

B. Provides the raw material on which natural selection can act over time

C. Ensures that all of the offspring will be identical to their parents

D. Prevents the population from changing in response to its environment

32. Two populations of the same species become separated by a mountain range. Over many generations, they accumulate so many differences that they can no longer interbreed. This formation of new species is called:

A. Extinction, in which an entire species permanently disappears from Earth

B. Mutation, in which the DNA sequence of an organism changes at random

C. Speciation, in which one species gives rise to one or more new species

D. Migration, in which organisms move from one location to another one

33. The fossil record provides important evidence for evolution. Which statement best explains how fossils support the idea that species have changed over time?

A. Fossils found in older rock layers often differ from those in newer layers

B. Fossils show that all species appeared on Earth at the very same moment

C. Fossils prove that living species have never changed since they first formed

D. Fossils are found only in the most recently deposited layers of rock

34. Whales and fish both have a streamlined body shape that helps them move through water, even though whales are mammals and fish are not. The independent evolution of similar traits in unrelated organisms is best explained by:

A. Common ancestry, because whales and fish share a very recent ancestor

B. Genetic drift, because random changes produced the same traits by chance

C. Selective breeding, because humans bred both groups for streamlined shapes

D. Similar environmental pressures favoring streamlined body shapes in water

35. Antibiotic-resistant bacteria have become a serious problem in hospitals. The development of antibiotic resistance within a bacterial population is an example of:

A. Bacteria deciding to change their own genes in response to the antibiotic

B. Natural selection favoring resistant bacteria that survive and reproduce

C. Bacteria passing resistance to humans, who then become resistant too

D. The antibiotic teaching the bacteria how to survive future treatments

36. All living things on Earth use DNA as their genetic material and share many of the same basic biochemical processes. This similarity among all organisms provides evidence that:

A. All species were created independently with no relationship to each other

B. Living things can freely change their genetic material whenever they need to

C. All living things on Earth share a common ancestor in the distant past

D. DNA evolved separately many times in completely unrelated organisms

37. An ecosystem includes both living and nonliving components. Which of the following lists contains only abiotic (nonliving) factors of an ecosystem?

A. Bacteria, sunlight, temperature, and the amount of available water

B. Producers, consumers, decomposers, and oxygen in the atmosphere

C. Soil, plants, rainfall, and the populations of animals living there

D. Sunlight, temperature, soil composition, and the amount of rainfall

38. In an ecosystem, energy enters mainly as sunlight and then flows through living things. Which group of organisms captures this energy and makes it available to the rest of the ecosystem?

A. Producers, which convert sunlight into chemical energy through photosynthesis

B. Herbivores, which eat plants and pass energy on to the predators above them

C. Decomposers, which break down dead material and return nutrients to the soil

D. Carnivores, which obtain their energy by consuming other animals for food

39. In a food chain, only about 10% of the energy stored at one trophic level is passed on to the next level. Which statement best explains why so little energy is transferred between levels?

A. Most of the energy is converted into new genetic material at each level

B. Most of the energy is permanently stored in the bodies of the producers

C. Most of the energy is used for life processes and lost as heat at each level

D. Most of the energy is transferred back down to the producers in the chain

40. A pond ecosystem contains algae, small fish that eat the algae, and larger fish that eat the small fish. If a disease suddenly kills most of the small fish, what is the most likely short-term effect on the algae?

A. The algae population will rapidly decrease as the disease spreads to it

B. The algae population will increase because fewer small fish are eating it

C. The algae population will stay exactly the same as it was before the event

D. The algae population will immediately be replaced by larger fish in the pond

41. Carbon is constantly cycled through ecosystems. Which two processes are most directly responsible for moving carbon between the atmosphere and living organisms?

A. Photosynthesis removes carbon from the air, and respiration returns it

B. Evaporation removes carbon from the air, and condensation returns it

C. Digestion removes carbon from the air, and excretion returns it to the air

D. Decomposition removes carbon from the air, and combustion returns it

42. A new species of plant is introduced into an ecosystem where it has no natural predators or competitors. Which outcome is most likely if the introduced plant reproduces rapidly?

A. The new plant will quickly die out because the ecosystem will reject it

B. The new plant will have no measurable effect on the other organisms there

C. The native plants will immediately grow faster to outcompete the newcomer

D. The new plant may outcompete native species and disrupt the ecosystem

43. Ecologists describe the role an organism plays in its ecosystem — including what it eats, what eats it, and how it interacts with its surroundings — using a specific term. This role is called the organism's:

A. Habitat, which is the specific physical place where the organism lives

B. Population, which is all the members of one species in a given area

C. Niche, which is the organism's role and interactions in its ecosystem

D. Biome, which is a large region defined by its climate and organisms

44. A lake becomes polluted with fertilizer runoff, causing algae to grow rapidly across the surface. When the algae die, bacteria decompose them and use up the oxygen in the water. Which outcome is the most likely result of this chain of events?

A. Fish populations will rise sharply because of the abundant algae as food

B. Fish and other organisms may die because of the reduced oxygen levels

C. The water will become clearer as the algae remove pollutants from it

D. The bacteria will die first, leaving the algae to dominate the lake forever

45. Human activities such as the burning of fossil fuels have increased the amount of carbon dioxide in Earth's atmosphere. Many scientists link this increase to:

A. A steady decrease in the average global temperature over the last century

B. A rapid increase in the amount of oxygen available in the atmosphere

C. The complete removal of the ozone layer high in the upper atmosphere

D. A rise in average global temperatures associated with climate change

46. A wetland filters pollutants from water, provides habitat for wildlife, and reduces flooding in the surrounding area. When a wetland is drained and paved over for development, which outcome is most likely?

A. The loss of these natural services that the wetland once provided

B. An immediate increase in the number of species living in the area

C. An improvement in the water quality of nearby rivers and streams

D. A complete reversal of the development within a few short months

47. Conservation biologists often work to protect biodiversity within ecosystems. Maintaining high biodiversity is considered important because it:

A. Guarantees that no species in the ecosystem will ever become extinct

B. Ensures that one single species will always dominate the entire ecosystem

C. Tends to make ecosystems more stable and better able to recover from change

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

48. A scientist wants to test whether a certain fertilizer increases the growth of tomato plants. Which of the following describes the best experimental design for testing this hypothesis?

A. Grow one tomato plant with the fertilizer and draw a conclusion from it

B. Grow two groups of plants, giving fertilizer to one group but not the other

C. Give the fertilizer to every plant in the study to ensure they all grow well

D. Grow several different plant species, each with a different fertilizer added

49. In the experiment described above, the group of tomato plants that does NOT receive any fertilizer serves as the:

A. Control group, which is used for comparison with the experimental group

B. Independent variable, which is the single factor changed by the scientist

C. Dependent variable, which is the factor that is measured in the experiment

D. Hypothesis, which is the proposed explanation being tested in the study

50. A student measures the height of bean plants every day for two weeks and records the data. Organizing this data into a line graph would be most useful because it:

A. Proves that the student's original hypothesis must be completely correct

B. Removes the need to repeat the experiment to check for reliable results

C. Changes the actual measurements into more favorable values for the report

D. Shows how the height of the plants changed over the two-week period

# PRACTICE EXAM 11—ANSWERS KEYS AND EXPLANATIONS

1. C — A large central vacuole, a rigid cell wall, and chloroplasts are all hallmarks of a plant cell. The chloroplasts carry out photosynthesis while the cell wall and turgid vacuole provide structural support. Animal cells lack walls and chloroplasts, and bacterial cells lack membrane-bound organelles like the nucleus and chloroplast.
2. A — Selective permeability means the membrane lets some substances pass while restricting others. This control is essential for maintaining homeostasis, since the cell must admit nutrients and expel wastes while keeping its internal environment stable. The membrane is not fully impermeable, nor does it allow unrestricted passage of every molecule.
3. D — The nucleus contains the cell's DNA, which stores the genetic instructions that direct all cell activities. Its membrane protects the genetic material and regulates what enters and leaves. Ribosomes build proteins and mitochondria release energy, but neither stores the genetic blueprint.
4. B — High temperatures change the three-dimensional shape of an enzyme, a process called denaturation, which is usually permanent. Because an enzyme's function depends on its shape fitting a specific substrate, a denatured enzyme can no longer catalyze its reaction. Minor changes in substrate amount or modest temperature drops slow reactions but do not permanently destroy enzyme function.
5. D — Homeostasis is the maintenance of a stable internal environment despite external change. Single-celled and multicellular organisms alike must regulate factors such as water balance and pH to survive. Metabolism, differentiation, and reproduction are separate life processes that do not describe internal stability itself.
6. A — When oxygen is limited, human muscle cells switch to anaerobic respiration (lactic acid fermentation), producing ATP plus lactic acid. The accumulation of lactic acid is associated with muscle fatigue during intense exercise. Alcohol fermentation occurs in yeast, not human muscle, and the process does not regenerate oxygen or glucose.
7. C — Messenger RNA (mRNA) is transcribed from DNA in the nucleus and carries the genetic message to ribosomes in the cytoplasm. This transfer of information is the link between the gene and the protein it codes for. Transfer RNA brings amino acids during translation, but it does not carry the original message out of the nucleus.
8. B — Chloroplasts capture light energy to build glucose during photosynthesis, while mitochondria release the chemical energy stored in food during respiration. The two organelles carry out complementary, opposite energy transformations. Only chloroplasts release oxygen, and only mitochondria break glucose down for energy.
9. A — An antigen is any foreign substance that triggers an immune response and the production of antibodies. The immune system recognizes antigens as "non-self" and responds specifically to them. A vaccine introduces antigens safely, and a pathogen carries antigens, but the triggering substance itself is the antigen.
10. D — After a first infection, memory cells remain in the body and "remember" the specific pathogen. On a second exposure, these cells trigger a faster, stronger immune response that prevents illness, which is the basis of immunity. Red blood cells, digestive enzymes, and platelets do not provide this specific long-term protection.
11. C — Negative feedback reverses a change to restore balance, as when rising blood sugar triggers insulin release that lowers it back toward normal. The response opposes the original stimulus. Milk

release, labor contractions, and clotting are examples of positive feedback, in which the response amplifies the original stimulus.

12. B — Oxygen-poor blood returning from the body enters the right atrium, passes to the right ventricle, and is pumped through the pulmonary artery to the lungs. There the blood picks up oxygen before returning to the left side of the heart. The aorta and left-side chambers handle oxygen-rich blood bound for the body, not the lungs.
13. D — Gas exchange occurs in the alveoli, tiny air sacs surrounded by capillaries where oxygen diffuses into the blood and carbon dioxide diffuses out. Their thin walls and enormous combined surface area make this exchange efficient. The bronchi, trachea, and diaphragm move air but are not where gases cross into the blood.
14. A — Neurotransmitters are chemical messengers released into the synapse, the small gap between neurons, to relay a signal to the next cell. They bind to receptors on the neighboring neuron, allowing the impulse to continue. Hormones travel in blood rather than across synapses, and enzymes and antibodies serve unrelated functions.
15. C — Hormones are the chemical signals of the endocrine system, secreted into the bloodstream and carried to target organs and tissues. This bloodborne delivery allows slower, longer-lasting regulation than nerve signaling. Neurotransmitters act locally at synapses, while antigens and enzymes are not endocrine messengers.
16. B — When blood sugar rises after a meal, insulin signals the liver to store excess glucose as glycogen, lowering blood glucose toward normal. This storage is a key part of glucose homeostasis. Releasing stored glucose would raise blood sugar, which is the opposite of what is needed after eating.
17. A — Epithelial tissue is made of tightly packed cells that cover body surfaces and line cavities and organs, forming protective layers. This close packing creates an effective barrier. Muscle tissue contracts, nervous tissue transmits impulses, and connective tissue binds and supports — none of which fits the described covering function.
18. D — Differentiation is the process by which unspecialized cells develop into specialized cell types such as nerve or muscle cells. Although all the cells share the same DNA, different genes are expressed to produce distinct structures and functions. Fertilization, mitosis, and replication are involved in development but do not themselves create specialization.
19. C — Gametes are produced by meiosis, which halves the chromosome number so each gamete carries half the chromosomes of a body cell. This reduction ensures that fertilization restores the normal full number in the offspring. Gametes do not contain the same, double, or a random number of chromosomes.
20. B — A zygote develops into a multicellular embryo through mitosis, which produces genetically identical body cells. Each division copies the full set of chromosomes so every new cell carries the same genetic information. Meiosis would reduce the chromosome number, and differentiation only specializes cells after they are produced.
21. D — In DNA, the rules of complementary base pairing dictate that adenine always pairs with thymine (and guanine with cytosine). These specific pairings maintain a uniform width of the double helix and allow accurate copying of the genetic code. Adenine does not pair with cytosine, guanine, or another adenine.
22. A — An organism with two identical alleles for a gene is homozygous for that gene. Heterozygous describes two different alleles. The terms recessive and codominant describe how alleles are expressed, not whether the two copies are the same.

23. C — In a cross of two heterozygotes (Rr × Rr), the Punnett square gives a 3:1 ratio of dominant to recessive, so one-quarter of the offspring are homozygous recessive (rr) and show wrinkled seeds. Only the rr genotype produces the recessive phenotype. The remaining three-quarters carry at least one dominant R allele and have round seeds.
24. B — Incomplete dominance occurs when the heterozygous phenotype is an intermediate blend of the two homozygous phenotypes, as with pink offspring from red and white parents. Neither allele fully masks the other. Codominance differs because both alleles are expressed fully and separately rather than blended.
25. A — A somatic (body cell) mutation occurs in non-reproductive cells, so it cannot be passed to offspring. Only mutations in sperm or egg cells can be inherited by the next generation. Somatic mutations affect only the individual and the descendants of that single cell, not all the body's cells or future children.
26. D — Mutagens such as ultraviolet radiation and certain chemicals damage DNA and increase the rate of mutation. These agents alter the base sequence or interfere with accurate DNA replication. Diet, water intake, and exercise are not mutagens and do not raise the mutation rate.
27. B — Genetic engineering works across species because all organisms share the same genetic code, so a human gene inserted into bacteria is read and translated the same way. This universality allows bacteria to produce functional human insulin. The bacteria do not become human cells or learn to copy insulin from observation.
28. C — Because pest populations contain genetic variation, repeated exposure to a pest-resistant crop selects for insects that can survive it, allowing resistance to evolve over time. This natural selection can reduce the crop's long-term effectiveness, much like antibiotic resistance in bacteria. The modified crops still reproduce normally and do not become a new species.
29. A — Selective breeding works by choosing organisms with desirable traits to reproduce, so those traits become more common in later generations. It relies on existing inherited variation rather than directly editing DNA. The environment does not force uniform traits, and offspring generally resemble their selected parents.
30. D — Natural selection favors individuals whose inherited traits make them best suited to their environment, increasing their survival and reproduction. Over generations, these advantageous traits become more common in the population. Survival is not random, nor is it determined solely by size or age.
31. B — Genetic variation provides the raw material on which natural selection acts, because differences among individuals allow some to be better suited to the environment. Without variation, a population cannot adapt to changing conditions. Variation does not guarantee equal survival or produce identical offspring.
32. C — Speciation is the formation of one or more new species from an existing one, often when populations are geographically isolated and accumulate differences until they can no longer interbreed. Reproductive isolation is the key marker of a new species. Extinction, mutation, and migration describe different processes.
33. A — Fossils in deeper, older rock layers tend to differ from those in newer, shallower layers, showing that life forms have changed over geologic time. This sequence of change is direct evidence for evolution. Fossils do not show all species appearing at once or species remaining unchanged.
34. D — Similar streamlined body shapes in unrelated whales and fish result from convergent evolution, in which comparable environmental pressures favor similar adaptations. Living in water

selects for shapes that reduce drag in both groups independently. The resemblance is not due to recent common ancestry, chance drift, or human breeding.

35. B — Antibiotic resistance arises through natural selection: bacteria that happen to carry resistance genes survive treatment and reproduce, passing resistance to offspring. Over time the resistant trait dominates the population. Bacteria do not consciously change their genes, and the antibiotic does not "teach" survival.
36. C — The shared use of DNA and common biochemical processes across all organisms is strong evidence that life descends from a single common ancestor. These deep similarities would not be expected if species arose entirely independently. The pattern reflects shared ancestry, not separate or repeated origins of DNA.
37. D — Abiotic factors are the nonliving components of an ecosystem, such as sunlight, temperature, soil composition, and rainfall. The other lists all include living (biotic) factors like bacteria, plants, producers, or animal populations. Only option D contains exclusively nonliving factors.
38. A — Producers, mainly plants and algae, capture sunlight and convert it into chemical energy through photosynthesis, making energy available to the rest of the ecosystem. They form the base of food chains and food webs. Herbivores, decomposers, and carnivores obtain energy that originally came from producers.
39. C — Only about 10% of energy passes to the next trophic level because most energy at each level is used for the organisms' own life processes and ultimately lost as heat. This loss limits the number of trophic levels a food chain can support. The energy is not converted into genetic material or returned to producers.
40. B — Removing most of the small fish reduces grazing pressure on the algae, so the algae population is likely to increase in the short term. Fewer herbivores means the producers are eaten less. The disease targets the fish, not the algae, so the algae would not decrease or be replaced by larger fish.
41. A — Photosynthesis removes carbon dioxide from the atmosphere and incorporates the carbon into organic molecules, while cellular respiration releases that carbon back as carbon dioxide. Together these two processes are the main biological link in the carbon cycle. Evaporation, condensation, digestion, and excretion are not the primary atmosphere–organism carbon pathways.
42. D — An introduced species with no natural predators or competitors can reproduce unchecked, potentially outcompeting native species and disrupting the ecosystem. Such invasive species often reduce biodiversity. It is unlikely to simply die out, have no effect, or be outcompeted by the natives it displaces.
43. C — An organism's niche is its full role in the ecosystem, including what it eats, what eats it, and how it interacts with its environment. This is distinct from its habitat, which is simply where it lives. Population and biome describe a group of organisms and a large climatic region, respectively.
44. B — When decomposing bacteria consume the oxygen in the water after an algal bloom dies, dissolved oxygen levels drop sharply, and fish and other organisms may suffocate and die. This sequence is the basis of oxygen depletion from nutrient pollution. The bloom does not benefit fish or clarify the water in this process.
45. D — Burning fossil fuels increases atmospheric carbon dioxide, a greenhouse gas linked to rising average global temperatures and climate change. More carbon dioxide traps additional heat in the atmosphere. This does not lower global temperatures, increase atmospheric oxygen, or remove the ozone layer.

46. A — Draining and paving a wetland destroys the ecosystem services it provided, such as filtering water, supporting wildlife, and reducing flooding. Losing these functions can harm water quality and increase flood risk. Development does not increase local biodiversity or improve nearby water quality, and it is not quickly reversed.
47. C — High biodiversity tends to make ecosystems more stable and more able to recover from disturbances, because varied species can fill different roles and respond to change. This resilience is a key reason conservation efforts protect biodiversity. Diversity does not guarantee that no species goes extinct or prevent all change.
48. B — A sound experiment compares an experimental group that receives the fertilizer with a control group that does not, keeping other conditions the same. This design isolates the effect of the fertilizer and provides a basis for comparison. Using a single plant, treating all plants alike, or mixing species would not yield valid conclusions.
49. A — The plants that receive no fertilizer form the control group, which provides a baseline for comparison with the treated experimental group. Without it, any change could not be attributed to the fertilizer. The independent variable is the fertilizer itself, and the dependent variable is the measured growth.
50. D — A line graph displays how a variable changes over time, making it ideal for showing plant height measured daily over two weeks. It reveals trends and patterns in the data at a glance. A graph does not prove a hypothesis, replace repeated trials, or alter the recorded measurements.