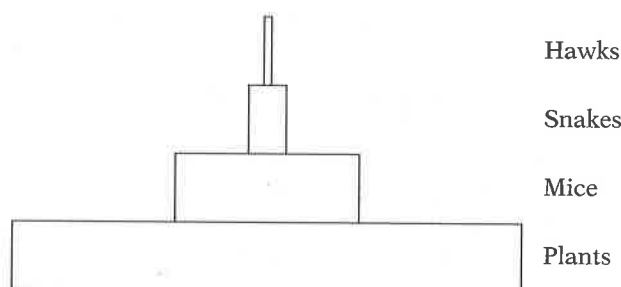


DIAGNOSTIC TEST**Time: 30 Minutes****Part A (Core Questions 1–30—for both Biology-E and Biology-M)****Directions:** Determine the BEST answer for each question. Then fill in the corresponding oval on the answer sheet.

- Which of the following methods of reproduction leads to populations with the greatest genetic diversity?
(A) binary fission
(B) sexual reproduction
(C) asexual reproduction
(D) alternation of generations
(E) binary fission and conjugation
- Which of the following organ systems maintains homeostasis in the human body by removing nitrogenous wastes from the blood?
(A) urinary system
(B) lymphatic system
(C) circulatory system
(D) respiratory system
(E) integumentary system
- Use the following diagram to answer Question 3.
- In plant cells, where is sunlight's energy used to build organic chemicals?
(A) chlorophyll
(B) leaves
(C) stomata
(D) cuticle
(E) chloroplasts
- Tay–Sachs disease is a genetic disorder that affects the central nervous system. The condition is lethal at an early age in homozygous recessive individuals (tt). Which statement best explains why a fatal disease can be carried in a population?
(A) If one parent is heterozygous, the offspring have a 25% chance of being heterozygous.
(B) If one parent is heterozygous, the offspring have a 75% chance of being heterozygous.
(C) If one parent is heterozygous, the offspring have a 100% chance of being heterozygous.
(D) If one parent is heterozygous, all offspring will be carriers.
(E) If one parent is heterozygous, the offspring have a 50% chance of being heterozygous.



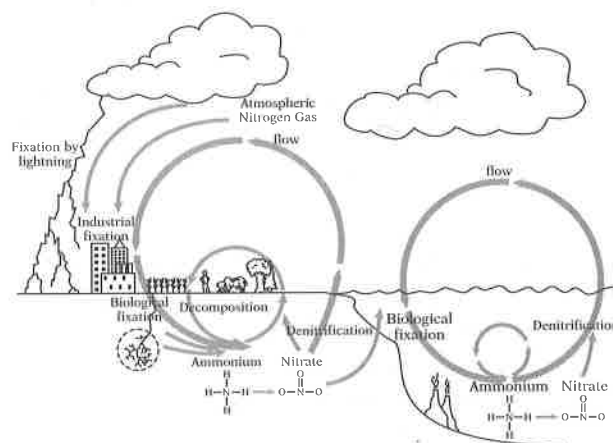
- The ecological pyramid shows the amount of energy available at each trophic level. Which of the following statements best describes energy flow in this diagram?
(A) Energy is passed up the pyramid with the least energy at the top.
(B) Energy is passed up the pyramid with the most energy at the top.
(C) Energy is passed down the pyramid with the most energy at the top.
(D) Energy is passed down the pyramid with the most energy at the bottom.
(E) Energy is a constant in the pyramid.
- Many scientists believe that an asteroid impact on Earth at the end of the Cretaceous Period was responsible for dinosaurs becoming extinct. Which of the following best explains why there are still organisms on Earth?
(A) The dinosaurs quickly evolved into new organisms when faced with a changed environment.
(B) The ancestors of organisms living today were able to adapt to the changed environment.
(C) The ancestors of organisms living today evolved to fill the niches left by the dinosaurs.
(D) The asteroid brought new organisms that started new lines of organisms leading to those of today.
(E) The evolutionary process started over and has resulted in the organisms present now.

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7. Which of the following best describes a biological community?
- a group of individuals of the same species that live together in the same area at the same time
 - all populations of different species that live and interact in the same area
 - all populations of different species that live and interact in the same area and the abiotic environment
 - the part of Earth where life exists
 - a group of organisms that share similar ecological niches in different areas
8. Which biome is defined as having dry, hot summers and cold winters?
- taiga
 - tropical rainforest
 - savannas
 - temperate grasslands
 - temperate deciduous forests
9. Although mutations in DNA are very common, they are seldom expressed when passed to offspring. Which of the following explanations is correct?
- Many mutations are recessive, and it is unlikely that both parents will have the same recessive mutation.
 - Mutations are not passed to offspring because they are lethal to the organism.
 - Mutations only occur in body cells and not in the gametes.
 - Most mutations are fatal and not passed to offspring.
 - Most mutations only occur in body cells and are usually repaired before the cells divide.
10. Which of the following actions causes water to move from the soil into the roots of a plant?
- evaporation of water from the leaves
 - capillary action
 - hydrophillic compounds
 - osmosis
 - active transport
11. The movement of specific materials across a plasma membrane through a transport protein is called
- concentration gradient
 - active transport
 - osmosis
 - facilitated transport
 - phagocytosis

12. After meiosis, the number of chromosomes in a gamete is _____ the number of chromosomes than the parent cell.
- twice
 - three times
 - the same as
 - one-half
 - one-quarter

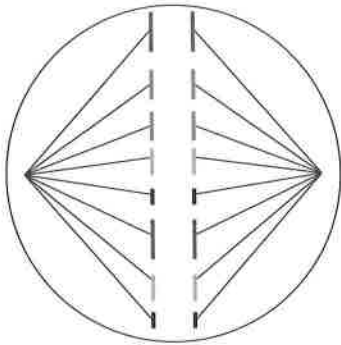
Use the diagram below to answer Question 13.



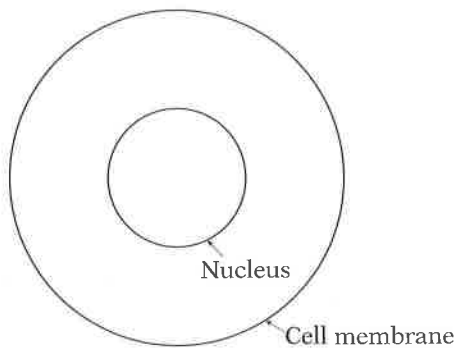
13. The atmosphere is made up of about 78% nitrogen. Nitrogen is very important to plant growth. Nitrogen in soil is often a limiting factor for plants, even though it is common in air. Which statement best describes why it is often limited in soil?
- The nitrogen is quickly removed from the soil and tied up in plants.
 - The nitrogen is not being returned to the atmosphere quickly enough.
 - The nitrogen compounds are water soluble and quickly washed away.
 - The nitrogen-fixing bacteria fix nitrogen in the soil and water at a slow rate.
 - The denitrifying bacteria remove nitrogen from the soil too fast.
14. Which plant adaptation would best suit a plant growing on a forest floor?
- has shallow roots
 - requires low light
 - has a deep tap root
 - requires strong light
 - requires moist soil

15. Place the following stages of mitosis in animal cells in the order in which they occur.

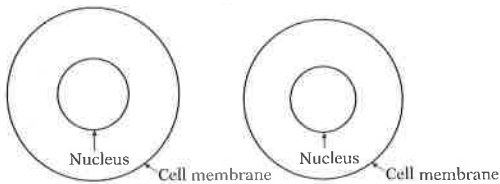
I.



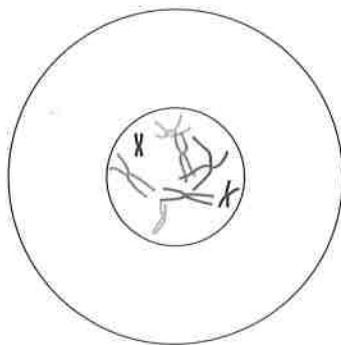
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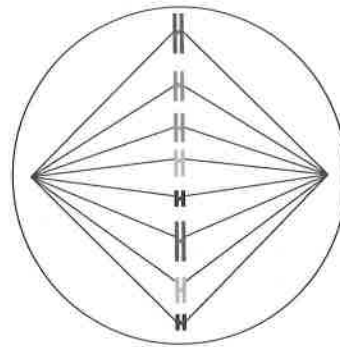
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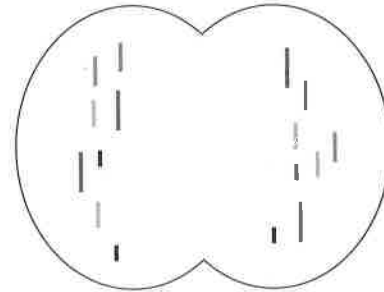
IV.



V.



VI.



- (A) II, IV, VI, I, V, III
- (B) II, IV, V, I, VI, III
- (C) II, V, IV, VI, I, III
- (D) III, VI, V, I, IV, II
- (E) III, IV, V, VI, I, II

16. When a human egg is fertilized, the sex of the child is determined by the presence or absence of a Y chromosome. A male child will have an X and a Y chromosome. A female child will have two X chromosomes. Which statement describes the inheritance of sex chromosomes?

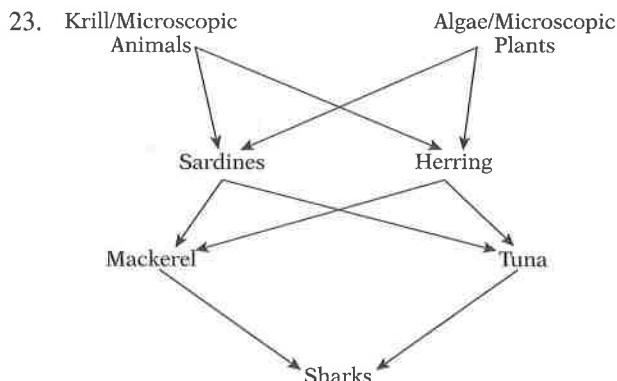
- (A) The gametes from each parent have either an X or a Y chromosome.
- (B) The gamete from the mother has either an X or a Y chromosome.
- (C) The gamete from the father has either an X or a Y chromosome.
- (D) The gamete from the father only has an X chromosome.
- (E) The gamete from the mother only has a Y chromosome.

17. According to Charles Darwin's theory of evolution by natural selection, "survival of the fittest" is an important part of natural selection. What is meant by the phrase, "survival of the fittest?"
- The strongest members of a population are those who breed and leave offspring.
 - The members of a population that are strongest are the ones that survive the longest.
 - The members of a population that are best suited for their environment breed and have offspring.
 - The weakest members of a population do not reproduce so their traits are not passed on.
 - The members of a population that are least suited die off immediately.
18. Skin protects the body from harmful ultraviolet radiation by producing a dark-colored pigment called melanin. In which layer of skin is melanin produced?
- dead epidermis
 - living epidermis
 - dermis
 - subcutaneous layer
 - epithelial
19. How many net ATP molecules are produced during aerobic cellular respiration?
- 2
 - 4
 - 36
 - 38
 - 44
20. A plasmid is a small, circular ring of DNA. Plasmids are useful for inserting DNA fragments into cells to produce transgenic organisms. Plasmids are usually found in
- viruses
 - bacteria
 - fungi
 - plant cells
 - animal cells
21. Mosses are able to reproduce asexually. Asexual reproduction in mosses is called
- alternation of generations
 - sporophyte generation
 - vegetative reproduction
 - gametophyte reproduction
 - binary fission

22. For this segment of DNA, which is the proper sequence in messenger RNA (mRNA)?

AGTTCG

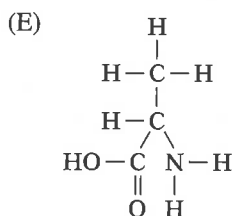
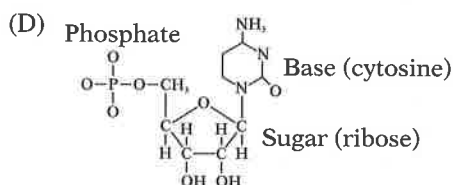
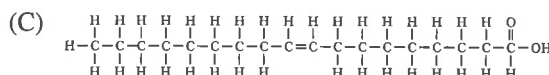
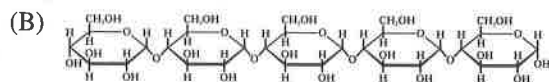
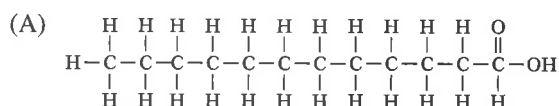
- TCUUGC
- UCAACG
- AGTTCG
- TCAACG
- UCAAGC



In this food web, which would likely happen if an oil spill killed all the herring?

- The krill population would decrease.
- The sardine population would increase.
- The mackerel and tuna populations would decrease.
- The shark population would increase.
- The algae population would decrease.

24. Which of the following represents an unsaturated fat?



25. When your body temperature begins to drop, one thing that happens is that you shiver. How does shivering help raise your body temperature?

- (A) Shivering dilates blood vessels.
- (B) Shivering constricts blood vessels.
- (C) Shivering increases the heart rate.
- (D) Shivering stimulates rapid muscle action.
- (E) Shivering tightens skin to cause goose bumps.

26. The process where an ancestral species evolves into an array of species that occupy different niches is called

- (A) convergent evolution
- (B) divergent evolution
- (C) adaptive radiation
- (D) gradualism
- (E) directional selection

27. Which equation best represents photosynthesis in plants?

- (A) carbon dioxide + water $\rightarrow$ starch + oxygen
- (B) carbon dioxide + water $\rightarrow$ glucose + oxygen
- (C) glucose + oxygen $\rightarrow$ carbon dioxide + water
- (D) carbon dioxide + glucose $\rightarrow$ starch + oxygen
- (E) light + carbon dioxide $\rightarrow$ glucose + oxygen

28. Pea plants may be tall or short. The genetic material received by the offspring from the parent determines this characteristic. This Punnett square shows the possible outcomes of the cross between parents. Which best describes the number of short offspring?

	T	T
T	TT	Tt
t	Tt	tt

T—tall plant

t—short plant

- (A) None are short.
- (B) 25% are short.
- (C) 50% are short.
- (D) 75% are short.
- (E) All are short.

29. ATP is the energy storage molecule found in both plants and animals. The energy in ATP is released when it

- (A) passes electrons to NADH
- (B) is split into a phosphate ion and ADP
- (C) loses electrons and becomes ADP
- (D) breaks its bonds and loses all its phosphate ions
- (E) breaks the bonds within one of its phosphate groups

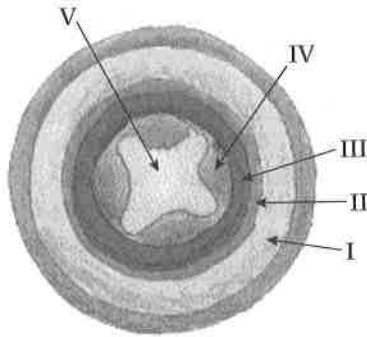
30. Which system in the human body regulates long-term processes, such as fluid balance, growth, and sexual development?

- (A) endocrine system
- (B) reproductive system
- (C) integumentary system
- (D) circulatory system
- (E) lymphatic system

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Part B (Biology-E Questions 31–40)

31.



In this diagram, which part of the root carries water up to the rest of the plant?

- (A) I
- (B) II
- (C) III
- (D) IV
- (E) V

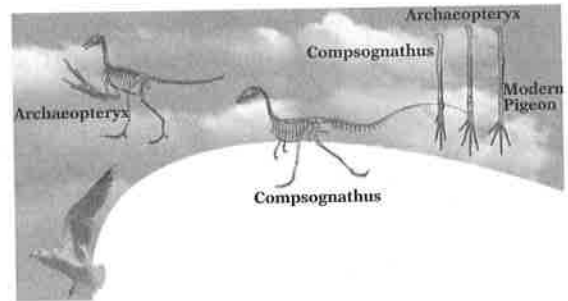
32. In the carbon cycle, where do the producers get their carbon?

- (A) the soil
- (B) carbohydrates in plants
- (C) fossil fuels
- (D) the atmosphere
- (E) animal remains

33. Mammals who bear young that have a short development period in the mother and then continue their development inside a pouch on the outside of the mother's body are called

- (A) marsupials
- (B) amniotes
- (C) placentals
- (D) monotremes
- (E) prokaryotes

34.



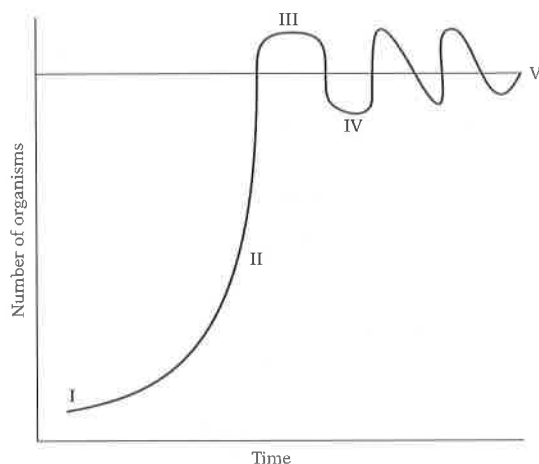
Similarities in structure are often used as evidence of evolution. In this example, the arm of the *Compsognathus* is very similar to the wing of the *Archaeopteryx* and modern bird. These similarities are called

- (A) analogous structures
- (B) homologous structures
- (C) vestigial structures
- (D) homogenous structures
- (E) embryological structures

35. Endotherms are animals that maintain a constant body temperature. Which of the following animals is an endotherm?

- (A) fish
- (B) lizard
- (C) snake
- (D) bird
- (E) insect

36.



This graph shows population growth over a period of time. Which represents the carrying capacity of an environment on this growth chart?

- (A) I
 - (B) II
 - (C) III
 - (D) IV
 - (E) V
37. The process of speciation can proceed in many different ways. Which describes the process of speciation where rapid speciation takes place followed by long periods of stability?
- (A) gradualism
 - (B) punctuated equilibrium
 - (C) adaptive radiation
 - (D) convergent evolution
 - (E) divergent evolution
38. Which of the following statements about ecological succession is true?
- (A) It is a natural progression of plant types that cannot be reversed.
 - (B) It always occurs over a short period of time.
 - (C) The rate can be changed by factors such as fire, clear cutting, and lava flows.
 - (D) It only takes place on freshly cleared or new land such as islands.
 - (E) The rate is very slow and constant.

39. Vestigial structures often provide clues to the evolutionary past of an organism. Which of the following would be considered a vestigial structure?

- (A) gill slits in an embryo
- (B) wing of a bat
- (C) pelvis in a whale
- (D) flippers on a dolphin
- (E) fins on a fish

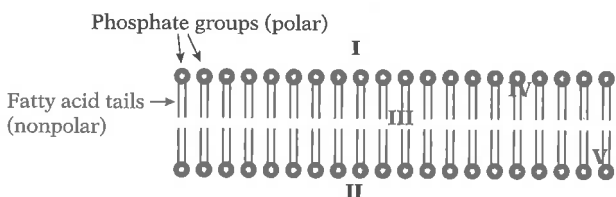
40. Which of the following best describes the niche of an earthworm?

- (A) Earthworms are decomposers who live in the soil.
- (B) Earthworms eat decaying organic matter.
- (C) Earthworms are usually found living in the soil.
- (D) Earthworms are used as food by some birds.
- (E) Earthworms help the soil by aerating it.

Part C (Biology-M Questions 41–50)

41. A plant with a genotype of PP produces purple flowers. A plant with a genotype of pp produces white flowers. If the plants are crossed, which describes the possible genotypes of the offspring?
- (A) 100% are pp
 - (B) 100% are Pp
 - (C) 100% are PP
 - (D) 50% are PP and 50% are pp
 - (E) 25% are PP, 50% are Pp, and 25% are pp
42. Muscle cells are a specialized type of cell that must perform great amounts of work. The work requires large amounts of energy. Which of these organelles would be found in large numbers in muscle cells?
- (A) chloroplasts
 - (B) ribosomes
 - (C) mitochondria
 - (D) lysosomes
 - (E) vacuoles
43. One method for identifying reaction pathways is by adding reactants that contain radioactive isotopes. The products of the reaction can be checked for the presence of the radioisotope. If the oxygen atoms in water were a radioisotope, where would the oxygen radioisotopes be found in the photosynthesis reaction?
- (A) in glucose molecules
 - (B) in water
 - (C) in oxygen gas
 - (D) in ATP
 - (E) in carbon dioxide
44. Genetic drift is the changes in allele frequency by chance processes. On which type of population would genetic drift have the most effect?
- (A) a small, isolated population
 - (B) a large, isolated population
 - (C) two widespread, interbreeding populations
 - (D) two geographically isolated, large populations
 - (E) two isolated, interbreeding populations
45. Enzymes act as catalysts to speed up chemical reactions in cells. Enzymes are a kind of
- (A) protein
 - (B) nucleic acid
 - (C) carbohydrate
 - (D) lipid
 - (E) steroid
46. DNA is a long, double-stranded molecule made up of nucleotide bases. What kind of chemical bond holds the two strands of DNA together?
- (A) hydrogen bonds
 - (B) covalent bonds
 - (C) metallic bonds
 - (D) ionic bonds
 - (E) polar covalent bonds
47. The invertebrates that have spines or bumps on their endoskeletons, radial symmetry, and a water vascular system, belong to the phylum
- (A) Porifera (sponges)
 - (B) Annelida (earthworms)
 - (C) Arthropoda (insects, crabs, and scorpions)
 - (D) Echinodermata (starfishes and sea urchins)
 - (E) Mollusca (snails and slugs)
48. The vascular tissue composed of living tubular cells that carry sugars from the leaves to other parts of the plant is called
- (A) phloem
 - (B) xylem
 - (C) parenchyma
 - (D) cambium
 - (E) pericycle

49. The framework of a membrane consists of two rows of phospholipid molecules. The molecules are arranged with their polar heads to the outside and their nonpolar tails to the inside. With this arrangement in a membrane, where would you expect to find water molecules?



- (A) I and II
(B) IV and V
(C) I, II, and III
(D) III, IV, and V
(E) I, II, IV, and V

50. The beak of a bird is adapted to the type of food the bird eats. If a bird has a short, stout beak, it probably uses its beak to
- (A) drink nectar from flowers
(B) catch fish
(C) pick up small insects
(D) tear flesh from animals
(E) crack seeds

S T O P

IF YOU FINISH BEFORE TIME RUNS OUT, GO BACK AND CHECK YOUR WORK.