Blizzard Bag #1
AP Biology

BIOLOGY
SECTION I
Time—1 hour and 20 minutes

Directions: Each of the questions or incomplete statements below is followed by five suggested answers or completions. Select the one that is best in each case and place the letter of your choice in the corresponding box on the student answer sheet.

1. Which of the following is true of both mitochondria and chloroplasts?

   (A) They are found in the cells of eukaryotic autotrophs and heterotrophs.
   (B) They include stacks of membranes that absorb light.
   (C) They include compartments where hydrogen ions are concentrated.
   (D) They produce sugars using energy harvested in the cytoplasm.
   (E) They break down sugar to produce ATP.

2. The tertiary structure and function of a polypeptide is principally determined by the

   (A) length of the polypeptide
   (B) number of nucleotides present in the polypeptide
   (C) repeated units of glycerol making up the polypeptide
   (D) interactions between amino acids present in the polypeptide
   (E) number of introns within the polypeptide

3. In a species that has five different alleles for a gene at a particular locus, how many different alleles may be present in the somatic cells of one diploid individual?

   (A) One
   (B) Two
   (C) Three
   (D) Four
   (E) Five

4. If red blood cells cultured in an isotonic medium are placed in distilled water, they will most likely

   (A) remain unchanged
   (B) shrivel
   (C) swell and lyse
   (D) divide
   (E) become dormant

5. The best evidence that the giant panda is more closely related to bears than is the raccoonlike lesser panda involves

   (A) comparative anatomy
   (B) comparative embryology
   (C) DNA sequence comparisons
   (D) behavioral similarities
   (E) fossil records

6. Which of the following structures contains highly oxygenated blood?

   (A) Vena cava
   (B) Right ventricle
   (C) Pulmonary artery
   (D) Pulmonary vein
   (E) Jugular vein

7. Metabolism of which of the following molecules results in the greatest net usable energy per gram?

   (A) A triglyceride
   (B) A tripeptide
   (C) An alpha-linked disaccharide
   (D) A beta-linked disaccharide
   (E) An anabolic steroid

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8. Cells that make up salivary glands would be expected to contain a relatively large amount of

   (A) smooth endoplasmic reticulum
   (B) rough endoplasmic reticulum
   (C) genetic material
   (D) lipids
   (E) peroxisomes

9. Which of the following characteristics distinguishes prokaryotic organisms from eukaryotic organisms?

   (A) Prokaryotes are unicellular, while all eukaryotes are multicellular.
   (B) Prokaryotes are aquatic, while eukaryotes are terrestrial.
   (C) Prokaryotes are structurally less complex than eukaryotes are.
   (D) Prokaryotes require a host to replicate, while eukaryotes do not.
   (E) Prokaryotes lack a cell membrane, while eukaryotes do not.

10. An important role of soil microbes in biological systems is the

    (A) recycling of matter
    (B) creation of biomass
    (C) causing of disease
    (D) production of energy
    (E) degradation of energy

11. Which of the following diseases is caused by the lack of a functional gene responsible for a specific enzyme?

    (A) Down Syndrome
    (B) Tay-Sachs disease
    (C) Ricketts
    (D) Malaria
    (E) Influenza

$AaBb \times AaBb$

12. How many different genotypes are possible from the cross shown above?

    (A) 2
    (B) 4
    (C) 7
    (D) 9
    (E) 16

13. All of the following statements concerning the theory of evolution by natural selection are true EXCEPT:

    (A) Organisms produce far more offspring than are required for replacement.
    (B) The individuals in a population show variation in survivability and in their ability to cope with environmental stress.
    (C) The number of offspring that survive to reproduce varies among individuals.
    (D) The bodies of organisms in a population change by use and disuse, and the changes are inherited by the next generation.
    (E) Some of the variation in adaptation is the result of genetic differences that may be passed on to the next generation.

14. Which of the following sequences best represents the life cycle of a typical angiosperm?

    (A) Gametophyte → meiosis → gametes → fertilization → sporophyte → spores → zygote → gametophyte
    (B) Gametophyte → gametes → meiosis → fertilization → sporophyte → spores → zygote → gametophyte
    (C) Sporophyte → meiosis → gametophyte → spores → fertilization → zygote → sporophyte
    (D) Sporophyte → meiosis → gametophyte → gametes → fertilization → zygote → sporophyte
    (E) Sporophyte → spores → gametophyte → meiosis → gametes → fertilization→ zygote → sporophyte

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15. Birds associating the bright colors of certain butterflies with an unpleasant taste is an example of

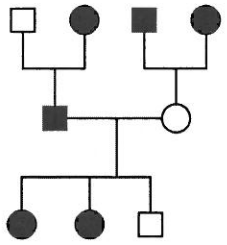
(A) instinct
(B) habituation
(C) imprinting
(D) insight learning
(E) trial-and-error learning

16. Which of the following best describes allosteric inhibition of an enzyme?

(A) The inhibitor binds to the mRNA to prevent translation of the enzyme.
(B) The inhibitor binds to the enzyme substrate.
(C) The inhibitor binds to the enzyme but not at its active site.
(D) The inhibitor binds to the enzyme at its active site.
(E) The inhibitor binds to the gene that encodes for the enzyme.

17. Which of the following organelles is correctly matched with its function?

(A) Lysosome . . lipid hydrolysis
(B) Nucleolus . . protein synthesis
(C) Ribosome . . carbohydrate synthesis
(D) Mitochondrion . . Calvin cycle
(E) Endoplasmic reticulum . . transcription



18. The occurrence of a particular genetic condition in a family is shown in the pedigree above. Which of the following is the most likely inheritance pattern for the individuals with the condition? Squares represent males, circles represent females, and shaded symbols represent individuals who exhibit the condition.

(A) Autosomal dominant
(B) Sex-linked dominant
(C) Y linked
(D) Autosomal recessive
(E) Sex-linked recessive

19. Rates of adaptive radiation typically are at their highest in which of the following situations?

(A) When Earth is exposed to increased electromagnetic waves caused by Sun flares
(B) In very large, randomly mating populations
(C) When new niches become available
(D) When many species are competing for the same limited resource
(E) When food is abundant

20. Which of the following led to the increased function of the invertebrate nervous system?

(A) Development of an advanced cerebellum
(B) Evolution of a ventral nerve cord, thus increasing the ability to move
(C) Cephalization of the major sensory organs and the cerebrum
(D) Specialization of the sympathetic and parasympathetic systems within the nervous system
(E) Occurrence of highly developed olfactory lobes in the invertebrate brain

21. Which of the following is the most direct result of the heating up of pond water during the summer?

(A) The water's ability to hold oxygen decreases.
(B) The water's ability to act as a buffer changes.
(C) The viscosity of the water increases.
(D) Hydrogen bonding at the surface of the water increases.
(E) Less light penetrates the surface of the water.

22. A protein is synthesized in the cytoplasm and transported to the plasma membrane. Which of the following summarizes the protein's pathway in the cell?

(A) Smooth endoplasmic reticulum → nucleus → vesicle → plasma membrane
(B) Plastid → rough endoplasmic reticulum→ plasma membrane
(C) Nucleus → vesicle → rough endoplasmic reticulum → plasma membrane
(D) Smooth endoplasmic reticulum→ microfilament →vesicle → plasma membrane
(E) Rough endoplasmic reticulum → Golgi complex → vesicle → plasma membrane

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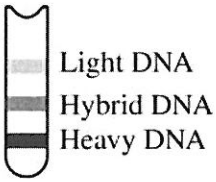
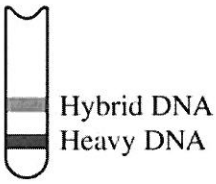
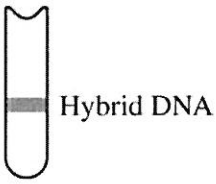
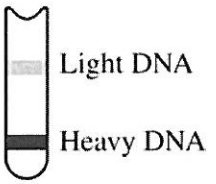
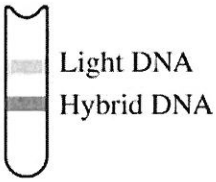
23. In the experiments by Meselson and Stahl that demonstrated the semiconservative replication of DNA, the researchers cultured bacteria in a medium containing a heavy isotope of nitrogen, ^{15}N. They then moved the bacteria to a medium containing ^{14}N, the lighter, more common isotope of nitrogen. After each round of replication, the researchers extracted the DNA and centrifuged the solution to separate the DNA bands by density. The test tubes below illustrate the possible banding pattern found after two bacterial generations (two rounds of DNA replication). Which test tube best illustrates the bands predicted by the semiconservative model of DNA replication?

(A) 

(B) 

(C) 

(D) 

(E) 

24. In most dicot seeds, which of the following structures is responsible for the storage of carbohydrates?

(A) Seed coat
(B) Cotyledon
(C) Radicle
(D) Plumule
(E) Embryo

25. In mammals, which of the following substances is produced in a muscle that operates anaerobically?

(A) Acetyl CoA
(B) Citrate
(C) NADPH
(D) Lactate
(E) Oxygen

26. Which of the following immune system cells is most severely depleted by HIV/AIDS ?

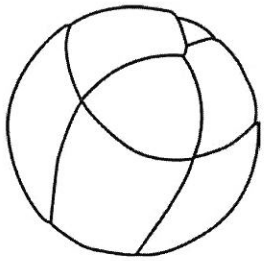
(A) Plasma B cells
(B) Memory B cells
(C) Helper T cells
(D) Cytotoxic ("Killer") T cells
(E) Memory T cells

27. The primary producers of the deep sea communities associated with hot water vents are

(A) plants
(B) tube worms
(C) photosynthetic algae
(D) cyanobacteria
(E) chemoautotrophic bacteria

28. A scientist studying the oxygen concentration in sealed chambers containing cultured plant cells finds that when the chambers are illuminated, the concentration of oxygen increases. However, when the chambers are kept in the dark, the concentration of oxygen decreases. Why does the oxygen concentration decrease when the chamber is kept in the dark?

(A) Plant cell mitochondria consume oxygen by aerobic respiration.
(B) Plant cell chloroplasts run the photosynthetic pathways backward to consume oxygen.
(C) Plant cell chloroplasts switch their structure and function and become mitochondria.
(D) The chambers must not be properly sealed, so that oxygen is leaking out.
(E) The cultures in the chambers must be contaminated with some animal cells, since only animal cells consume oxygen.



29. The unequal division of the cytoplasm among frog embryo cells during early cleavage, as shown in the diagram, results from

(A) different amounts of DNA
(B) gastrulation of the embryo
(C) formation of the blastula
(D) segregation of the maternal and paternal cells
(E) uneven distribution of yolk

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30. Production of ATP occurs in all of the following processes EXCEPT

(A) glycolysis
(B) Krebs cycle
(C) electron transport system and chemiosmosis
(D) light-dependent reactions of photosynthesis
(E) light-independent reactions of photosynthesis

31. Which of the following statements most correctly represents the organization of living systems from smallest to largest?

(A) Molecules → organs → cells → organisms
(B) Cells → tissues → molecules → ecosystems → communities
(C) Organisms → molecules → cells → atoms
(D) Atoms → molecules → cells → organisms → ecosystems
(E) Organs → plants → animals → cells

32. The functional similarity of the mandibles (hinged jaws) of insects and those of mammals is an example of

(A) homology
(B) analogy
(C) divergent evolution
(D) adaptive radiation
(E) punctuated equilibrium

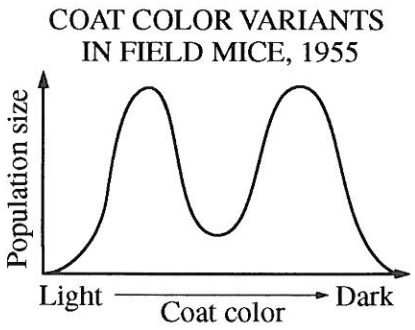
33. Which of the following pairs of plants are most closely related?

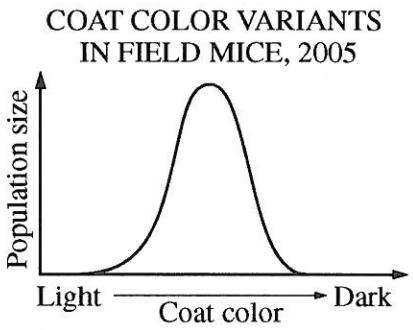
I. Broad bean (*Vicia faba*)
II. Soybean (*Glycine max*)
III. Kidney bean (*Phaseolus vulgaris*)
IV. Barley (*Hordeum vulgaris*)
V. Scarlet runner bean (*Phaseolus coccineus*)

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

34. Milk kept past the expiration date often spoils, tastes sour, and develops stringy curds. This can be explained by which of the following?

(A) Fermentation produces ethanol and fibrous by-products.
(B) Yeasts form citric acid, which causes the yeast cells to form long chains.
(C) Bacteria produce lactic acid, which lowers the pH and denatures the milk proteins.
(D) The Krebs cycle is converted to the Calvin cycle.
(E) The production of fatty acid raises the temperature and polymerizes lactose.





35. A research study sampled populations of field mice annually over the course of 50 years. The population was categorized by coat color. Data from the beginning and end of the study are graphed above. What type of selection is represented by the change in the data from 1955 to 2005 ?

(A) Directional selection
(B) Stabilizing selection
(C) Bimodal selection
(D) Disruptive selection
(E) Sexual selection

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36. Which of the following occurs in both fermentation and aerobic cellular respiration?

(A) Oxygen and carbon dioxide are consumed.
(B) FAD is reduced, driving ATP synthesis.
(C) Proton gradients are produced across membranes.
(D) ATP is synthesized from ADP and inorganic phosphate.
(E) Most of the energy from glucose is released as carbon dioxide.

37. Which of the following best summarizes the theory of punctuated equilibrium?

(A) After periods of directional selection, the allelic frequencies in a population will reach equilibrium and then undergo disruptive selection.
(B) Most species evolve gradually, with discrete changes appearing in the fossil record at short, regular intervals.
(C) Once one species achieves evolutionary dominance, all of the remaining species must compete among themselves for selective advantages; only then will the dominant species be challenged.
(D) To ensure survival of the fittest, natural selection eliminates those species that disrupt the balance of nature.
(E) Most taxa experience relatively short periods during which they undergo rapid change, followed by relatively long periods during which they undergo relatively little change.

38. Which of the following organisms possesses both a system of blood vessels and a digestive tract in which food travels in only one direction?

(A) Sponges
(B) Flatworms
(C) Annelids
(D) Roundworms
(E) Sea anemones

39. Which of the following features are common to all gas exchange systems in animals?

(A) Active transport removes carbon dioxide from the respiratory structures.
(B) Materials flow in one direction only.
(C) An intake system is comprised of a series of tubes.
(D) Transfer is made by counter-current exchange.
(E) Gasses diffuse across a moist membrane.

40. Which of the following occurs in the immediate fight-or-flight response to danger or fear?

(A) An increase in glycogen synthesis
(B) An increase in digestive activity
(C) Release of ACTH from the pituitary
(D) An increase in glucose catabolism
(E) A decrease in noradrenaline

41. During the fall, a chipmunk experiences a sustained period of cold weather. The chipmunk's thyroid gland responds by secreting a greater quantity of thyroxin. Which of the following represents the most accurate pathway from the central nervous system (CNS) to the target cells?

(A) CNS → hypothalamus → anterior pituitary → thyroid → thyroxin → target cells.
(B) CNS → adrenal medulla → thyroid → thyroxin → target cells.
(C) CNS → motor neurons → muscle cells → thyroxin → target cells.
(D) CNS → posterior pituitary → oxytocin → thyroid → thyroxin → target cells.
(E) CNS → pancreas → insulin → sugar into cells → target cells.

42. Which of the following ions is significantly involved in the opening and closing of the stomata?

(A) Calcium
(B) Nitrogen
(C) Potassium
(D) Magnesium
(E) Iron

43. Which of the following best explains why many different species can live together within an ecosystem with limited resources?

(A) Each species lives in a slightly different habitat.
(B) Each species occupies a different niche.
(C) Each species inhabits a different biome.
(D) Each species makes up a different population.
(E) Each species functions at a different trophic level.

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