AP BIOLOGY: SECTION I

MULTIPLE-CHOICE QUESTIONS

Time—1 hour and 30 minutes
For the multiple-choice questions that follow, select the best answer and fill in the appropriate letter on the answer sheet.

1. Destruction of microfilaments would most adversely affect which of the following?

A. Cell division

B. Cilia

C. Flagella

D. Muscular contraction

2. Imagine that for a particular species of moth, females are primed to respond to two types of male mating calls. Males who produce an in-between version will not succeed at obtaining a mate and will therefore have low reproductive success. This is an example of

A. directional selection.

B. stabilizing selection.

C. artificial selection.

D. disruptive selection.

3. Which of the following is a specialized feature of plants that live in hot and dry regions?

A. Stomata that open and close

B. Transpiration

C. Photophosphorylation

D. C_4 photosynthesis

4. A virus that carries the reverse transcriptase enzyme is

A. a retrovirus.

B. a prion.

C. a viroid.

D. a DNA virus.

5. Ants live on acacia trees and are able to feast on the sugar produced by the trees. The tree is protected by the ants' attack on any foreign insects that may harm the tree. This is an example of

A. parasitism.

B. commensualism.

C. mutualism.

D. symbiosis.

6. Halophiles would be classified into which major kingdom?

A. Monera

B. Protista

C. Plantae

D. Fungi

7. A reaction that breaks down compounds by the addition of water is known as

A. a hydrolysis reaction.

B. a dehydration reaction.

C. an endergonic reaction.

D. an exergonic reaction.

8. In humans, the developing embryo tends to attach to this structure.

A. Fallopian tube

B. Oviduct

C. Endometrium

D. Cervix

9. Plants that produce a single spore type that gives rise to bisexual gametophytes are called

A. heterosporous.

B. gymnosperms.

C. homosporous.

D. angiosperms.

10. In humans, spermatogenesis, the process of male gamete formation, occurs in the

A. seminiferous tubules.

B. epididymis.

C. vas deferens.

D. seminal vesicles.

11. Which of the following is an example of aneuploidy?

A. Cri-du-chat syndrome

B. Chronic myelogenous leukemia

C. Turner syndrome

D. Achondroplasia

12. Among the following choices, which one would most readily move through a selectively permeable membrane?

A. Small, uncharged polar molecule

B. Large, uncharged polar molecule

C. Glucose

D. Sodium ion

13. Which of the following is not a lipid?

A. Steroid

B. Fat

C. Phospholipid

D. Glycogen

14. Which of the following hormones is *not* released by the anterior pituitary gland?

A. Follicle-stimulating hormone (FSH)

B. Antidiuretic hormone (ADH)

C. Growth hormone (GH or STH)

D. Adrenocorticotropic hormone (ACTH)

15. Which of the following is the *least* specific taxonomic classification category?

A. Division

B. Order

C. Family

D. Genus

16. These cells control the opening and closing of a plant' s stomata:

A. Guard cells

B. Collenchyma cells

C. Parenchyma cells

D. Mesophyll cells

17. Imagine that 9 percent of a population of anteaters have a short snout (recessive), while 91 percent have a long snout (dominant). If this population is in Hardy–Weinberg equilibrium, what is the expected frequency (in percent) of the heterozygous condition?

A. 30.0

B. 34.0

C. 38.0

D. 42.0

18. The situation in which a gene at one locus alters the phenotypic expression of a gene at another locus is known as

A. incomplete dominance.

B. codominance.

C. pleiotropy.

D. epistasis.

19. The oxygen produced during the light reactions of photosynthesis comes directly from

A. H_2O.

B. H_2O_2.

C. $C_2H_3O_2$.

D. CO_2.

20. An organism that alternates between a haploid and a diploid multicellular stage during its life cycle is most probably a

A. shark.

B. human.

C. pine tree.

D. amoeba.

21. The presence of which of the following organelles or structures would most convincingly indicate that a cell is a eukaryote and not a prokaryote?

A. Plasma membrane

B. Cell wall

C. Lysosome

D. Ribosome

22. Traits that are similar between organisms that arose from a common ancestor are known as

A. convergent characters.

B. homologous characters.

C. vestigial characters.

D. divergent characters.

23. The process by which a huge amount of DNA is created from a small amount of DNA in a very short amount of time is known as

A. cloning.

B. transformation.

C. polymerase chain reaction.

D. gel electrophoresis.

24. A compound contains a COOH group. What functional group is that?

A. Carbonyl group

B. Carboxyl group

C. Hydroxyl group

D. Phosphate group

25. Which of the following forms of cell transport requires the input of energy?

A. Diffusion

B. Osmosis

C. Facilitated diffusion

D. Active transport

26. Homologous chromosomes are chromosomes that

A. are found only in identical twins.

B. are formed during mitosis.

C. split apart during meiosis II.

D. resemble one another in shape, size, and function.

27. Which of the following is an incorrect statement about DNA replication?

A. It occurs in the nucleus.

B. It occurs in a semiconservative fashion.

C. Helicase is the enzyme that adds the nucleotides to the growing strand.

D. DNA polymerase can build only in a 5′-to-3′ direction.

28. Warning coloration adopted by animals that possess a chemical defense mechanism is known as

A. cryptic coloration.

B. deceptive markings.

C. aposematic coloration.

D. batesian mimicry.

29. In a large pond that consists of long-finned fish and short-finned fish, a tornado wreaks havoc on the pond, killing 50 percent of the fish population. By chance, most of the fish killed were short-finned varieties, and in the subsequent generation there were fewer fish with short fins. This is an example of

A. gene flow.

B. bottleneck.

C. balanced polymorphism.

D. allopatric speciation.

30. Which of the following structures would not have developed from the mesoderm?

A. Muscle

B. Heart

C. Kidneys

D. Liver

31. Which of the following is not a characteristic of bryophytes?

A. They were the first land plants.

B. They contain a waxy cuticle to protect against water loss.

C. They package their gametes into gametangia.

D. The dominant generation is the sporophyte.

32. The cyclic pathway of photosynthesis occurs because

A. the Calvin cycle uses more ATP than NADPH.

B. it can occur in regions lacking light.

C. it is a more efficient way to produce oxygen.

D. it is a more efficient way to produce the NADPH needed for the Calvin cycle.

33. Which of the following conditions is an X-linked condition?

A. Hemophilia

B. Tay-Sachs disease

C. Cystic fibrosis

D. Sickle cell anemia

34. The uptake of foreign DNA from the surrounding environment is known as

A. generalized transduction.

B. specialized transduction.

C. conjugation.

D. transformation.

35. Most of the digestion of food occurs in the

A. esophagus.

B. stomach.

C. small intestine.

D. large intestine.

36. You have just come back from visiting the redwood forests in California and were amazed at how *wide* those trees were. What process is responsible for the increase in width of these trees?

A. Growth of guard cells

B. Growth of collenchyma cells

C. Growth of apical meristem cells

D. Growth of lateral meristem cells

37. The trophoblast formed during the early stages of human embryology eventually develops into the

A. placenta.

B. embryo.

C. hypoblast.

D. morula.

38. What biome is known for having the greatest diversity of species?

A. Taiga

B. Temperate grasslands

C. Tropical forest

D. Savanna

39. In hypercholesterolemia, a genetic condition found in humans, individuals who are HH have normal cholesterol levels, those who are hh have horrifically high cholesterol levels, and those who are Hh have cholesterol levels that are somewhere in between. This is an example of

A. dominance.

B. incomplete dominance.

C. codominance.

E. epistasis.

40. The light-dependent reactions of photosynthesis occur in the

A. nucleus.

B. cytoplasm.

C. thylakoid membrane.

D. stroma.

41. Which of the following is a characteristic of an R-selected strategist?

A. Low reproductive rate

B. Extensive postnatal care

C. Relatively constant population size

D. J-shaped growth curve

42. Which of the following statements about mitosis is correct?

A. Mitosis makes up 30 percent of the cell cycle.

B. The order of mitosis is prophase, anaphase, metaphase, telophase.

C. Single-cell eukaryotes undergo mitosis as part of asexual reproduction.

D. Cell plates are formed in animal cells during mitosis.

43. A vine that wraps around the trunk of a tree is displaying the concept known as

A. photoperiodism.

B. thigmotropism.

C. gravitropism.

D. phototropism.

44. This hormone is known for assisting in the closing of the stomata, and inhibition of cell growth.

A. Abscisic acid

B. Cytokinin

C. Ethylene

D. Gibberellin

45. Antigen invader → B-cell meets antigen → B-cell differentiates into plasma cells and memory cells → plasma cells produce antibodies → antibodies eliminate antigen. The preceding sequence of events is a description of

A. cell-mediated immunity.

B. humoral immunity.

C. nonspecific immunity.

D. cytotoxic T-cell maturation.

For questions 46–48, please use the following answers:

A. Abscisic acid

B. Cytokinins

C. Ethylene

D. Gibberellins

46. This hormone is known to promote cell division in plant roots and shoots.

47. This hormone is known to regulate stem elongation, germination, flowering, and other developmental processes.

48. This hormone is produced in the roots of a plant in response to decreased soil water potential and other situations in which the plant may be under stress.

For questions 49–52, please use the following answers:

A. Glycolysis

B. Oxidative phosphorylation

C. Chemiosmosis

D. Fermentation

49. This reaction occurs in the mitochondria and involves the formation of ATP from NADH and $FADH_2$.

50. The coupling of the movement of electrons down the electron transport chain with the formation of ATP using the driving force provided by the proton gradient.

51. This reaction occurs in the cytoplasm and has as its products 2 ATP, 2 NADH, and 2-pyruvate.

52. This reaction is performed by cells in an effort to regenerate the NAD^+ required for glycolysis to continue.

For questions 53–56, please use the following answer choices:

A. Associative learning

B. Insight learning

C. Imprinting

D. Altruistic behavior

53. The ability to reason through a problem the first time through with no prior experience.

54. Action in which an organism helps another, even if it comes at its own expense.

55. Process by which an animal substitutes one stimulus for another to get the same response.

56. Innate behavior learned during a critical period early in life.

For questions 57–60, please use the information from the following laboratory experiment:

You are working as a summer intern at the local university laboratory, and a lab technician comes into your room, throws a few graphs and tables at you, and mutters, "Interpret this data for me . . . I need to go play golf. I' ll be back this afternoon for your report." Analyze the data this technician so kindly gave to you, and use it to answer questions 60–63. The reaction rates reported in the tables are relative to the original rate of the reaction in the absence of the enzymes. The three enzymes used are all being added to the same reactants to determine which should be used in the future.

Room Temperature (25°C), pH 7

ENZYME	REACTION RATE
1	1.24
2	1.51
3	1.33

57. If you had also been given a graph that plotted the moles of product produced versus time, what would have been the best way to calculate the rate for the reaction?

A. Calculate the average of the slope of the curve for the first and last minute of reaction.

B. Calculate the slope of the curve for the portion of the curve that is constant.

C. Calculate the slope of the curve for the portion where the slope begins to flatten out.

D. Add up the total number of moles produced during each time interval and divide by the total number of time intervals measured.

58. Over the interval measured, at what temperature does enzyme 2 appear to have its optimal efficiency?

A. 10°C

B. 15°C

C. 20°C

D. 25°C

Varying Temperature, Constant (pH 7)

ENZYME	0°C	5°C	10°C	15°C	20°C	25°C	30°C	35°C	40°C
1	1.00	1.02	1.04	1.19	1.20	1.24	1.29	1.27	1.22
2	1.01	1.12	1.35	1.39	1.65	1.51	1.40	1.12	1.01
3	1.06	1.21	1.55	1.44	1.35	1.33	1.15	1.10	1.06

Varying pH, Constant Temperature = 25°C

ENZYME	4	5	6	7	8	9	10
1	1.54	1.51	1.33	1.24	1.20	1.08	1.05
2	1.75	1.71	1.62	1.51	1.32	1.10	1.01
3	1.52	1.45	1.40	1.33	1.20	1.09	1.04

59. Which of the following statements about enzyme 3 is incorrect?

A. At a pH of 6 and a temperature of 25°C, it is more efficient than enzyme 2 but less efficient than enzyme 1.

B. It functions more efficiently in the acidic pH range than the basic pH range.

C. At 30°C and a pH of 7, it is less efficient than both enzymes 1 and 2.

D. Over the interval given, its optimal temperature at a pH of 7 is 10°C.

60. Which of the following statements can be made from review of these data?

A. Enzyme 1 functions most efficiently in a basic environment and at a lower temperature.

B. Enzyme 1 functions more efficiently than enzyme 2 at 10°C and a pH of 7.

C. The pH does not affect the efficiency of enzyme 3.

D. All three enzymes function more efficiently in an acidic environment than a basic environment.

AP Biology Diagnostic Exam: Section II

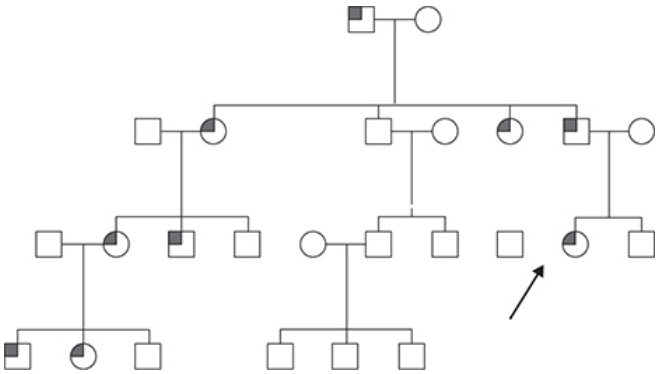
FREE–RESPONSE QUESTIONS

Time—1 hour and 30 minutes

(The first 10 minutes is a reading period. Do not begin writing until the 10-minute period has passed.)Questions 1 and 2 are long free-response questions that should require about 20 minutes each. Questions 3–6 are short-response questions that should require approximately 8–10 minutes each. Outline form is not acceptable. Answers should be in essay form.

1. Inheritance, Pedigrees, and Calculations

Huntington’ s disease is a genetic illness that leads to degeneration of the central nervous system. Symptoms typically do not present until between 30 and 40 years of age.



A. A pedigree is shown at the left. The grey marks indicate that the individual has Huntington's. What type of inheritance pattern is suspected? Explain your reasoning.

B. The couple indicated by the arrow are planning to have a child. Assume the husband is healthy. Create a Punnett square to demonstrate the risk of inheritance for their offspring.

C. A randomized trial is run to examine whether "Drug Lauder" delayed the emergence of symptoms among individuals who carried the genetic trait for inheritance. Age at first emergence of symptoms is shown under the patient.

DRUG STATUS	PATIENT 1	PATIENT 2	PATIENT 3	PATIENT 4	PATIENT 5	PATIENT 6
Control	32	29	41			
Lauder, 50mg				47	46	42

On the axis provided below, create an appropriately labeled bar graph of the average age of symptom onset of the two populations.

Average age of symptom onset by years of age

2. Digestion, Cellular Respiration, and Evolution

Adequate nutritional intake, along with absorption of nutrients, is necessary for bodily functioning.

A. Cellular respiration, comprised of glycolysis, the Krebs cycle, and the electron transport chain, utilizes the glucose from food in order to synthesize ATP. The majority of ATP is created in the electron transport chain. Briefly explain how the electron transport chain creates ATP.

A researcher is interested in the small and large intestines. He has recognized a new syndrome that significantly reduces nutrient absorption.

B. Briefly differentiate the functions of the small and large intestines.

C. If a patient's small intestine is completely removed, hypothesize the impact that this could have on his weight.

DRUG STATUS	PATIENT 1	P2	P3	P4	P5	P6	P7	P8	MEAN NUTRIENT ABSORPTION LEVEL
Control	50	43	76	34					50.75
New Drug					100	78	76	87	85.25

The researcher runs a pilot study to determine whether a newly developed drug is effective in treating patients with significantly reduced nutrient absorption. Nutrient absorption levels for each patient and the means are shown above.

D. Interpret the preliminary results shown.

E. Suggest one limitation of the above study, or propose one variable that should be controlled if the study is repeated.

3. Scientists have recently discovered that the raccoon population in rural New York communicates using chemical signals, via pheromones. The scientists consequently developed four pheromones in an attempt to replicate the natural pheromone. They measured the response time of five raccoons to the developed chemical compounds as an indication of chemical similarity between the developed and natural pheromones. The response times are provided, along with the average response time and standard error of the mean for each developed pheromone.

A. Animals communicate through several mechanisms. Briefly describe TWO methods of communication.

B. Based on the mean response times and the standard error of the mean, explain which pheromone most closely aligned to the raccoon' s naturally produced pheromones.

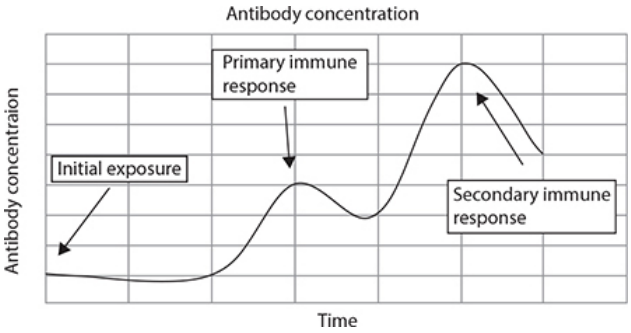
C. A follow up study on raccoon pheromone response time is planned to determine whether response to pheromones is an innate or learned response. Response times will be compared between baby raccoons, young raccoons, and adult raccoons. Hypothesize what the data will show if the response to pheromones is an innate response.

PHEROMONE	RACCOON 1	RACCOON 2	RACCOON 3	RACCOON 4	RACCOON 5	MEAN RESPONSE TIME	STANDARD ERROR OF THE MEAN (SEM)
I	15	13	16	7	8	11.8	1.8
II	10	8	7	11	15	10.2	1.4
III	3	6	5	9	4	5.4	1.0

4. A young girl presents to the emergency department with symptoms suggesting the effects of a bacterial pathogen. Her parents report that they did not vaccinate their daughter against this particular pathogen.

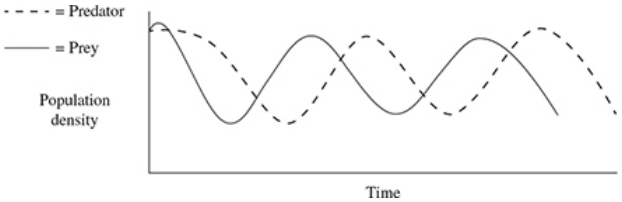
A. Briefly describe TWO components of the innate/primary immune response.

B. If the child had received a vaccination for this particular pathogen, how would the adaptive/secondary immune response differ? Reference the graph shown below.

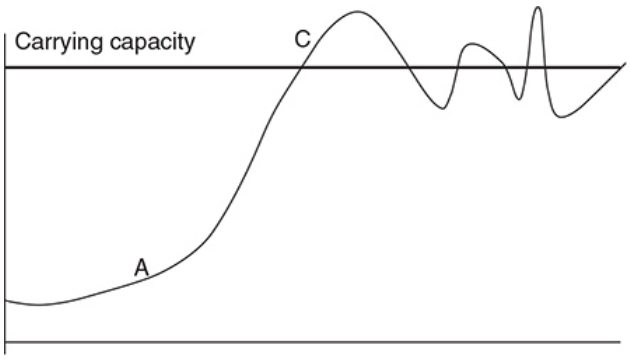


5. A population of foxes and rabbits in Environment A exhibits the expected predator–prey population curve seen below.

A. Explain the relationship represented by the curve.



B. A bacterial pathogen completely wipes out the population of foxes. Researchers closely watch the rabbit population and notice a new population curve. Explain this new curve. In your explanation, be sure to explain the fluctuations seen at the new carrying capacity.



6. A population of wild cats lives in a temperate environment with four seasons. The cats have three main fur colors—white, light brown, and black.

A scientist decides to transplant a random sample of these cats to an environment covered in snow throughout the full year. He notices that as time passes, the cats with one fur color tend to live longer and evade predators better than those with the other two fur colors.

A. Identify the cats with the fur color you expect to live longer in this new environment and explain your reasoning.

B. The scientist is also interested in better understanding the evolutionary relationships between the wild cats and several other wild species. He collected data on various traits. Construct a visual representation of the evolutionary relationships from the data provided.

Species	TRAIT A	TRAIT B	TRAIT C
Animal 1	+	−	−
Animal 2	+	−	+
Animal 3	+	+	+
Animal 4	−	−	−

Answers and Explanations

MULTIPLE-CHOICE QUESTIONS

1. D—This question deals with the cytoskeleton of cells. Cell division, cilia, and flagella would be compromised if the *microtubules* were damaged. Microfilaments, made from actin, are important to muscular contraction. Chitin is a polysaccharide found in fungi.

2. D—This is a prime example of disruptive selection. Take a look at the material from Chapter 12 on the various types of selection. The illustrations there are worth reviewing.

3. D—C_4 photosynthesis is an adaptive photosynthetic process that attempts to counter the problems that hot and dry weather causes for plants. Be sure that you read about and understand the various forms of photosynthesis for the exam.

4. A—Retroviruses are RNA viruses that carry with them the reverse transcriptase enzyme. When they take over a host cell, they first use the enzyme to convert themselves into DNA. They next incorporate into the DNA of the host, and begin the process of viral replication. The HIV virus of AIDS is a well-known retrovirus.

5. C—Mutualism is the interaction in which both parties involved benefit.

6. A—Halophiles are a member of the archaebacteria subgroup of the monerans.

7. A—This question deals with five types of reactions you should be familiar with for the AP Biology exam. A hydrolysis reaction is one in which water is added, causing the formation of a compound.

8. C—Fertilization tends to occur in the oviduct, also known as the *fallopian tube* . The ovum is produced in the ovary, and the cervix is the passageway from the uterus to the vagina.

9. C—Homosporous plants, such as ferns, give rise to bisexual gametophytes.

10. A—You should learn the general processes of spermatogenesis and oogenesis in humans for the AP Biology exam.

11. C—Turner syndrome (XO) is an example of aneuploidy—conditions in which individuals have an abnormal number of chromosomes. These conditions can be monosomies, as is the case with Turner, or they can be trisomies, as is the case with Down, Klinefelter, and other syndromes.

12. A—The selectively permeable membrane is a lipid bilayer composed of phospholipids, proteins, and other macromolecules. Small, uncharged polar molecules and lipids are able to pass through these membranes without difficulty.

13. D—Glycogen is a carbohydrate. The three major types of lipids you should know are fats, phospholipids, and steroids. Cholesterol is a type of steroid.

14. B—This hormone, which is involved in controlling the function of the kidney, is released from the posterior pituitary.

15. A—The stupid phrase we use to remember this classification hierarchy is "Karaoke players can order free grape soda" — kingdom, phylum, class, order, family, genus, and species. This question is sneaky because it requires you to know that a division is the plant kingdom's version of the phylum. The kingdom is the least specific subdivision, and the species the most specific. Therefore, A is the correct answer.

16. A—Guard cells are the cells responsible for controlling the opening and closing of the stomata of a plant.

17. D—If 9 percent of the population is recessive (ss), then $q^2 = 0.09$. Taking the square root of 0.09 gives us $q = 0.30$. Knowing as we do that $p + q = 1$, $p + 0.30 = 1$, and $p = 0.70$. The frequency of the heterozygous condition = $2pq = 2(0.30)(0.70) = 42\%$.

18. D—Epistasis exists when a gene at one locus affects a gene at another locus.

19. A—The inputs to the light reactions include light and water. During these reactions, photolysis occurs, which is the splitting of H_2O into hydrogen ions and oxygen atoms. These oxygen atoms from the water pair together immediately to form the oxygen we breathe.

20. C—This life cycle is the one known as "alternation of generations." It is the plant life cycle. Pine trees are the only ones among the choices that would show such a cycle.

21. C—Prokaryotes are known for their simplicity. They do not contain a nucleus, nor do they contain membrane-bound organelles. They do have a few structures to remember: cell wall, plasma membrane, ribosomes, and a nucleoid. Lysosomes are found in eukaryotes, not prokaryotes.

22. B—Traits are said to be homologous if they are similar because their host organisms arose from a common ancestor. For example, the bone structure in bird wings is homologous in all bird species.

23. C—Polymerase chain reaction is the high-speed cloning machine of molecular genetics. It occurs at a much faster rate than does cloning.

24. B—Functional groups are a pain in the neck. But you need to be able to recognize them on the exam. Most often, the test asks students to identify functional groups by structure.

25. D—Active transport requires energy. The major types of cell transport you need to know for the exam are diffusion, osmosis, facilitated diffusion, endocytosis, exocytosis, and active transport.

26. D—Homologous chromosomes resemble one another in shape, size, and function. They pair up during meiosis and separate from each other during meiosis I.

27. C—DNA polymerase is the superstar enzyme of the replication process, which occurs during the S phase of the cell cycle in the nucleus of a cell. The process does occur in semiconservative fashion. You should learn the basic concepts behind replication as they are explained in Chapter 11.

28. C—Learn the defense mechanisms well from predator–prey relationships in Chapter 18. They will be represented on the exam.

29. B—A bottleneck is a specific example of genetic drift: the sudden change in allele frequencies due to random events.

30. D—You should learn the list of structures derived from endoderm, mesoderm, and ectoderm. (This could be an easy multiple-choice question for you if you do.)

31. D—The dominant generation for bryophytes is the gametophyte (n) generation. They are the only plants for which this is true.

32. A—The Calvin cycle uses a disproportionate amount of ATP relative to NADPH. The cyclic light reactions exist to make up for this disparity. The cyclic reactions do not produce NADPH, nor do they produce oxygen.

33. A—Tay-Sachs disease, cystic fibrosis, and sickle cell anemia are all autosomal recessive conditions. It will serve you well to learn the most common autosomal recessive conditions, X-linked conditions, and autosomal dominant conditions.

34. D—It will serve you well for this exam to be reasonably familiar with biotechnology laboratory techniques. Lab procedures show up often on free-response questions and the later multiple-choice sections of the exam.

35. C—The small intestine hosts the most digestion of the digestive tract.

36. D—This is known as *cambium*.

37. A—The inner cell mass gives rise to the embryo, which eventually gives rise to the epiblast and hypoblast. The morula is an early stage of development.

38. C—Biomes are annoying and tough to memorize. Learn as much as you can about them without taking up too much time. . . . More often than not there will be two to three multiple-choice questions about them. But you want to make sure you learn enough to work your way through a free-response question if you were to be so unfortunate as to have one on your test.

39. B—Incomplete dominance is the situation in which the heterozygous genotype produces an "intermediate" phenotype rather than the dominant phenotype; neither allele dominates the other.

40. C—The light-dependent reactions occur in the thylakoid membrane. The dark reactions, known as the *Calvin cycle*, occur in the stroma.

41. D—A J-shaped growth curve is characteristic of exponentially growing populations. That is a characteristic of R-selected strategists.

42. C—Mitosis makes up 10 percent of the cell cycle; the correct order of the stages is prophase, metaphase, anaphase, telophase; mitosis is not performed by prokaryotic cells; and cell plates are formed in plant cells.

43. B—Thigmotropism, phototropism, and gravitropism are the major tropisms you need to know for plants. Thigmotropism, the growth response of a plant to touch, is the least understood of the bunch.

44. A—There are five plant hormones you should know for the exam. Auxin seems to come up the most, but it would serve you well to know the basic functions of all five of them.

45. B—Humoral immunity is another name for antibody-mediated immunity. Cell-mediated immunity involves T-cells and the direct cellular destruction of invaders such as viruses.

46. B

47. D

48. A

49. B—Each NADH is able to produce up to 3 ATP. Each $FADH_2$ can produce up to 2 ATP.

50. C—You have to know the concept of chemiosmosis for the AP exam. Make sure you study it well in Chapter 7.

51. A—Glycolysis is the conversion of glucose into pyruvate that occurs in the cytoplasm and is the first step of both aerobic and anaerobic respiration.

52. D—Fermentation is anaerobic respiration, and it is the process that begins with glycolysis and ends with the regeneration of NAD^+.

53. B—Chapter 17 is fairly short and concise. We left it to the bare bones for you to learn. We would suggest you learn this chapter well because it could be worth a good 5–7 points for you on the exam if you are lucky. ☺

54. D

55. A

56. C

57. B—The rate of reaction for an enzyme-aided reaction is best estimated by taking the slope of the constant portion of the moles–time plot.

58. C—They will test your ability to interpret data on this exam. You should make sure that you are able to look at a chart and interpret information given to you. This enzyme does indeed function most efficiently at 20°C. Above and below that temperature, the reaction rate is lower.

59. A—At a pH of 6 and a temperature of 25°C, enzyme 3 is actually LESS efficient than enzyme 2 and MORE efficient than enzyme 1.

60. D—This question requires you to know that a pH below 7 (pH < 7) is acidic and a pH above 7 (pH > 7) is basic. It is true that all three enzymes increase the rate of reaction more when in acidic environments than basic environments.

Free–Response Grading Outline

1. A. Autosomal dominance inheritance is suspected. Looking at the pedigree, each generation is affected by the illness, which supports dominant as opposed to recessive inheritance. Recessive inheritance would instead show frequent skipping of generations in the pedigree. Autosomal as opposed to sex-linked inheritance is suspected, since males and females are equally affected.

B. To create the Punnett square, we need to determine whether the individual in row 5 is homozygous or heterozygous for the trait. Since one of her parents is unaffected, we can assume she is heterozygous. We are also told that her husband is healthy and, thus, homozygous recessive.

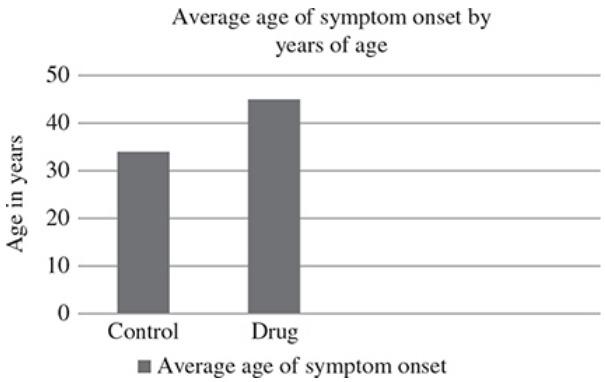
	H	h
h	Hh	hh
h	Hh	hh

The Punnett square above suggests that each offspring maintains a 50% chance of inheriting the disease.

C. First calculate the average age of symptom onset for each of the two conditions:

$$\text{Control} = \frac{32 + 29 + 41}{3} = 34 \text{ yrs old}$$

$$\text{Drug} = \frac{47 + 46 + 42}{3} = 45 \text{ yrs old}$$



2. A. The electron transport chain creates a proton gradient which sends protons (H^+) out of the mitochondrial matrix using the energy-carrying NADH and $FADH_2$. This proton is then allowed to flow back down through the ATP synthase and create the ATP necessary for bodily function.

B. The small intestine, comprised of the duodenum, jejunum, and ileum, is where the bulk of digestion and absorption occurs. The large intestine, comprised of the cecum, colon, and rectum, has the function of reabsorbing water from digested material and working to eliminate waste.

C. Since the small intestine is the primary site of nutrient absorption, if the small intestine is completely removed, the patient would consequently experience inadequate nutrition. Subsequently, we would be worried that the patient's weight would decrease.

D. The preliminary results suggest that the drug has higher levels of absorption than the control.

E. A limitation of the study is the small sample size. A few variables that should be controlled include age/sex/ethnicity of patients, time that the study drug is administered, dosage of the study drug, etc.

3. A. Communication types include:

- Visual: the use of visual cues to relay meaning. Examples include peacock feather coloring, bared teeth, rolling over on back.
- Tactile: the use of touch to relay meaning. For example, monkeys will groom each other as a sign of affection.
- Auditory: the use of various sounds to relay meaning. For example, the frog chirp to attract a mate.
- Chemical: the use of chemical signals via pheromones. Pheromones play a significant role in animal mating.

B. Pheromone III demonstrated the fastest mean of the three pheromones tested and thus would be more likely to resemble the natural raccoon pheromones.

C. An innate response is a behavior that does not need to be taught. Thus if the response to pheromones is innate, the response time of the young raccoons to the pheromones will be similar to the response time of the older raccoons.

4. A. Components of the innate immune response:

- Physical barriers like the skin, GI tract, respiratory tract, nose hairs
- Broad defenses like mucous secretions, stomach acid, saliva, tears
- Aspects of the general immune response like the complement system, phagocytosis of pathogens via macrophages and neutrophils, inflammation to call in additional immune support, NK cells

B. Secondary exposure

- Response time would be faster
- Indicated by the presence of memory cells
- Production of antibodies is greater in quantity, and they demonstrate higher affinity.

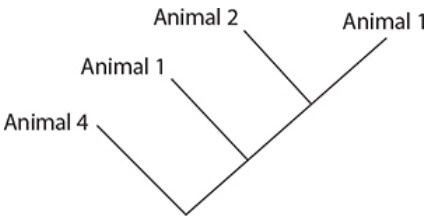
5. A. The curve demonstrates that the population concentrations are correlated. The foxes rely on the rabbits for food. As the foxes consume more rabbits, the fox population will grow due to higher supply levels. At some point, the rabbit population will have a higher death rate than birth rate, and thus the population will diminish. Consequently, the fox population will too decrease. Then with decreased predation by the foxes, the rabbit population will be able to rejuvenate.

B. With the fox population and predation removed, the rabbits will be able to sustain exponential population growth. At some point, the rabbit population will reach a new carrying capacity, the maximum population size that the environment can support, and thus will level off.

6. A. This is a type of directional selection, where one extreme of the phenotype is "safer" or more adaptive in the environment. In this situation, the environment has snow year around. Thus the cats that have white fur are able to blend into their environment better than the cats with black or brown fur and evade predation more successfully.

B. To create a cladogram, it is often easier to determine outliers for each trait. Beginning with Trait A, Animals 1–3 all have the trait, but Animal 4 does not.

Animal 4 also does not have Traits B and C. Next with Trait C, Animals 2 and 3 share the trait, but Animal 1 does not. Lastly with Trait B, only Animal 3 has the trait.



Scoring and Interpretation
AP BIOLOGY DIAGNOSTIC EXAM

Multiple–Choice Questions:

number of correct answers: _____
number of incorrect answers: _____
number of blank answers: _____

$$\frac{\text{multiple–choice number correct}}{} \times 1.15 = \frac{}{\text{Section I raw score}}$$

Free–Response Questions:

1. ___ / 10

2. ___ / 10

3. ___ / 4

4. ___ / 4

5. ___ / 4

6. ___ / 4

Add up the total points accumulated in the six questions and multiply the sum by 1.92 to obtain the free-response raw score:

$$\frac{\text{free–response points}}{} \times 1.92 = \frac{}{\text{Section II raw score}}$$

CALCULATE YOUR SCORE

Now combine the raw scores from the multiple-choice and free-response sections to obtain your new raw score for the entire practice exam. Use the ranges listed below to determine your grade for this exam. Don't worry about how we arrived at the following ranges, and remember that they are rough estimates on questions that are not actual AP exam questions . . . do not read too much into them.

Raw Score	Approximate AP Score
83–138	5
63–82	4
48–62	3
26–47	2
0–25	1

If this test went amazingly well for you . . . rock and roll . . . but as we just said, your journey is just beginning, and that means you have time to supplement your knowledge even more before the big day! Use your time well.

If this test went poorly for you, don't worry; as has been said twice now, your journey is just beginning and you have plenty of time to learn what you need to know for this exam. Just use this as an exercise in focus that has shown you what you need to concentrate on between now and early May. Good luck!

For more AP practice tests, please visit www.crackap.com or links below.

AP World History Practice Tests
AP US History Practice Tests
AP European History Practice Tests
AP US Government and Politics Practice Tests
AP Psychology Practice Tests
AP Biology Practice Tests
AP Chemistry Practice Tests
AP Macroeconomics Practice Tests
AP Microeconomics Practice Tests
AP Statistics Practice Tests
AP English Language and Composition Practice Tests
AP English Literature and Composition Practice Tests
AP Calculus AB Practice Tests
AP Calculus BC Practice Tests
AP Physics 1 Practice Tests
AP Physics 2 Practice Tests
AP Physics C: Mechanics Practice Tests
AP Physics C: Electricity and Magnetism Practice Tests

AP practice tests download
https://www.crackap.com/ap-downloads/

AP Prep Books
https://www.crackap.com/ap-books/