Practice Test 2

1. YOUR NAME: _____

(Print) Last First M.I.

SIGNATURE: _____ **DATE:** _____ / _____ / _____

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(Print) Number and Street

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City State Zip Code

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(Print)

IMPORTANT: Please fill in these boxes exactly as shown on the back cover of your test book.

2. TEST FORM

3. TEST CODE

4. REGISTRATION NUMBER

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2	D	3	3	3	3	3	3	3	3	3
3	E	4	4	4	4	4	4	4	4	4
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5	G	6	6	6	6	6	6	6	6	6
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5. YOUR NAME

First 4 letters of last name				FIRST INIT	MID INIT
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6. DATE OF BIRTH

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JUN	3	3	3	3
JUL		4	4	4
AUG		5	5	5
SEP		6	6	6
OCT		7	7	7
NOV		8	8	8
DEC		9	9	9

7. SEX

- MALE
- FEMALE

Section 1

Start with number 1 for each new section.
If a section has fewer questions than answer spaces, leave the extra answer spaces blank.

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120. A B C D

AP® Biology Exam

SECTION I: Multiple-Choice Questions

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

At a Glance

Total Time
1 hour and 30 minutes
Number of Questions
69
Percent of Total Score
50%
Writing Instrument
Pencil required

Instructions

Section I of this examination contains 69 multiple-choice questions. These are broken down into Part A (63 multiple-choice questions) and Part B (6 grid-in questions).

Indicate all of your answers to the multiple-choice questions on the answer sheet. No credit will be given for anything written in this exam booklet, but you may use the booklet for notes or scratch work. After you have decided which of the suggested answers is best, completely fill in the corresponding oval on the answer sheet. Give only one answer to each question. If you change an answer, be sure that the previous mark is erased completely. Here is a sample question and answer.

Sample Question   Sample Answer

Chicago is a   Ⓐ ⬤ Ⓒ Ⓓ

(A)   state
(B)   city
(C)   country
(D)   continent

Use your time effectively, working as quickly as you can without losing accuracy. Do not spend too much time on any one question. Go on to other questions and come back to the ones you have not answered if you have time. It is not expected that everyone will know the answers to all the multiple-choice questions.

About Guessing

Many candidates wonder whether or not to guess the answers to questions about which they are not certain. Multiple choice scores are based on the number of questions answered correctly. Points are not deducted for incorrect answers, and no points are awarded for unanswered questions. Because points are not deducted for incorrect answers, you are encouraged to answer all multiple-choice questions. On any questions you do not know the answer to, you should eliminate as many choices as you can, and then select the best answer among the remaining choices.

BIOLOGY

SECTION I

69 Questions
Time—90 minutes

Directions: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the one that is best in each case and then fill in the corresponding oval on the answer sheet.

1. In general, animal cells differ from plant cells in that animal cells have

   (A) a cell wall made of cellulose
   (B) lysosomes
   (C) large vacuoles that store water
   (D) centrioles within centrosomes

2. A cell from the leaf of the aquatic plant Elodea was soaked in a 15 percent sugar solution, and its contents soon separated from the cell wall and formed a mass in the center of the cell. All of the following statements are true about this event EXCEPT

   (A) the vacuole lost water and became smaller
   (B) the space between the cell wall and the cell membrane expanded
   (C) the large vacuole contained a solution with much lower water potential than that of the sugar solution
   (D) the concentration of solutes in the extracellular environment is hypertonic with respect to the cell's interior

3. A chemical agent is found to denature acetylcholinesterase in the synaptic cleft. What effect will this agent have on acetylcholine?

   (A) Acetylcholine will not be released from the presynaptic membrane.
   (B) Acetylcholine will not bind to receptor proteins on the postsynaptic membrane.
   (C) Acetylcholine will not diffuse across the cleft to the postsynaptic membrane.
   (D) Acetylcholine will not be degraded in the synaptic cleft.

4. The base composition of DNA varies from one species to another. Which of the following ratios would you expect to remain constant in the DNA?

   (A) Cytosine : Adenine
   (B) Pyrimidine : Purine
   (C) Adenine : Guanine
   (D) Guanine : Deoxyribose

Questions 5–6 refer to the following passage.

Consider the following pathway of reactions catalyzed by enzymes (shown in numbers):

$$A \xrightarrow{1} B \xrightarrow{2} C \xrightarrow{3} D \xrightarrow{4} E \xrightarrow{5} F$$
$$\searrow^{6}$$
$$X \xrightarrow{7} Y$$
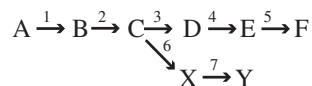
5. Which of the following situations represents feedback inhibition?

   (A) Protein D activating enzyme 4
   (B) Protein B stimulating enzyme 1
   (C) Protein 7 inhibiting enzyme C
   (D) Protein X inhibiting enzyme 2

6. An increase in substance F leads to the inhibition of enzyme 3. All of the following are results of the process EXCEPT

   (A) an increase in substance X
   (B) increased activity of enzyme 6
   (C) decreased activity of enzyme 4
   (D) increased activity of enzyme 5

7. If a competitive inhibitor bound to enzyme 1, which of the following would be decreased?

   I. Protein A
   II. Protein C
   III. Protein X

   (A) I only
   (B) II only
   (C) II and III
   (D) I, II, and III

GO ON TO THE NEXT PAGE.

Questions 8–11 refer to the following passage.

The affinity of hemoglobin for oxygen is reduced by many factors, including low pH and high CO_2. The graph below shows the different dissociation curves that maternal (normal) hemoglobin and fetal hemoglobin have.
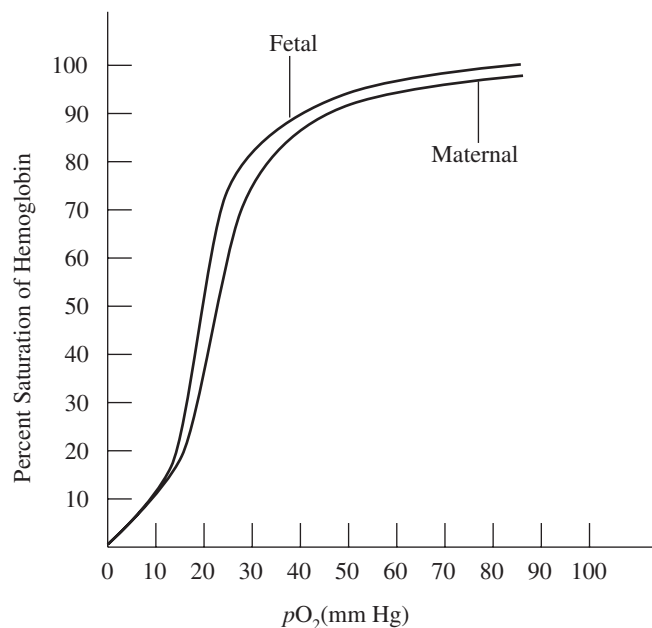
8. Based on the graph, it can be concluded that
   (A) fetal hemoglobin surrenders O_2 more readily than maternal hemoglobin
   (B) the dissociation curve of fetal hemoglobin is to the right of maternal hemoglobin
   (C) fetal hemoglobin has a higher affinity for O_2 than does maternal hemoglobin
   (D) fetal and maternal hemoglobin differ in structure

9. Which of the following processes would likely shift the normal dissociation curve to the right?
   (A) Photosynthesis
   (B) Respiration
   (C) Fermentation
   (D) Mitosis

10. Hemoglobin's affinity for O_2
   (A) decreases as blood pH decreases
   (B) increases as H^+ concentration increases
   (C) increases as blood pH decreases
   (D) decreases as OH^- concentration increases

11. How much pO_2 would it take in an extremely CO_2-rich environment to saturate hemoglobin 90 percent?
   (A) 15
   (B) 30
   (C) 45
   (D) 60

12. All of the following are differences between prokaryotes and eukaryotes EXCEPT
   (A) eukaryotes have linear chromosomes, while prokaryotes have circular chromosomes
   (B) eukaryotes possess double stranded DNA, while prokaryotes possess single stranded DNA
   (C) eukaryotes process their mRNA, while in prokaryotes, transcription and translation occur simultaneously
   (D) eukaryotes contain membrane-bound organelles, while prokaryotes do not

13. In minks, the gene for brown fur (B) is dominant over the gene for silver fur (b). Which set of genotypes represents a cross that could produce offspring with silver fur from parents that both have brown fur?
   (A) BB × BB
   (B) BB × Bb
   (C) Bb × Bb
   (D) Bb × bb

14. All viruses contain at least these two principal components:
   (A) DNA and proteins
   (B) nucleic acids and a capsid
   (C) DNA and a cell membrane
   (D) RNA and a cell wall

15. All of the following are examples of hydrolysis EXCEPT
   (A) conversion of fats to fatty acids and glycerol
   (B) conversion of proteins to amino acids
   (C) conversion of starch to simple sugars
   (D) conversion of pyruvic acid to acetyl-CoA

16. In cells, which of the following can catalyze reactions involving hydrogen peroxide, provide cellular energy, and make proteins, in that order?
   (A) Peroxisomes, mitochondria, and ribosomes
   (B) Peroxisomes, mitochondria, and lysosomes
   (C) Peroxisomes, mitochondria, and Golgi apparatus
   (D) Lysosomes, chloroplasts, and ribosomes

GO ON TO THE NEXT PAGE.

Questions 17 and 18 refer to the following passage.

The Loop of Henle is a structure within each of the million nephrons within a kidney. As shown in the figure, the two sides have different permeabilities, and there is differential movement across each membrane. The Loop acts as a counter-current multiplier that makes the medulla of the kidney very osmotic. The longer the loop, the higher and more powerful the osmolarity gradient that is created. The gradient is required for the reclamation of water from the urine collecting duct. On the right side of the figure is the urine collecting duct. If the body needs to retain water, and anti-diuretic hormone makes this region permeable to water, and the osmotic pull of the medulla reclaims the water, out of the collecting duct, which makes the urine more concentrated.
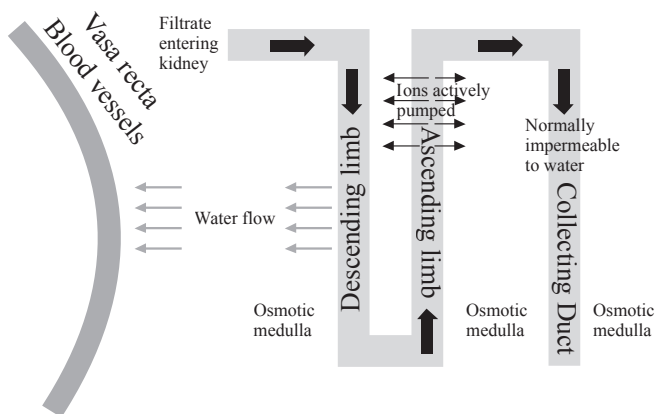
17. Which of the following statements correctly describes the state of things near the top of the descending limb?

(A) The fluid within the descending limb is hypotonic to fluid in the space surrounding the tubule.
(B) The blood within the vasa recta is hypotonic to the filtrate within the descending limb.
(C) The fluid in the area surrounding the tubule is hypertonic to the blood in the vasa recta.
(D) The water in the area surrounding the tubule has a higher water potential than the water in the descending tubule.

18. What type of transport is occurring when water flows out of the descending tubule?

(A) Simple diffusion
(B) Facilitated diffusion
(C) Active transport
(D) Secondary active transport

19. If an inhibitor of anti-diuretic hormone, such as caffeine, was ingested, what would be the result?

(A) Aquaporins would appear in the collecting duct.
(B) Aquaporins would increase in number in the collecting duct.
(C) It would block aquaporins like a competitive inhibitor.
(D) Aquaporins would not appear in the collecting duct.

20. The ability to reclaim water from the collecting duct is directly related to the osmotic pull of the medulla. Kangaroo rats are know to produce extremely concentrated urine. Compared to a human, the nephrons in kangaroo rats must have

(A) thick walls that are impermeable to water
(B) shorter Loops of Henle
(C) longer Loops of Henle
(D) shorter collecting ducts

Questions 21 and 22 refer to the following graph.

The graph below shows the growth curve of a bacterial culture.
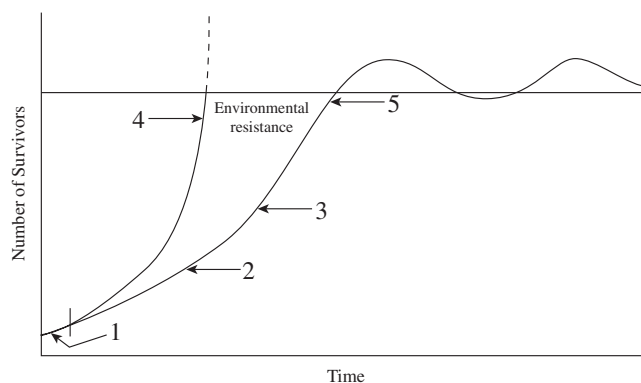
21. Which of the following represents the carrying capacity of the environment?

(A) 2
(B) 3
(C) 4
(D) 5

22. Which of the following shows the exponential growth curve of the population?

(A) 1
(B) 2
(C) 3
(D) 4

GO ON TO THE NEXT PAGE.

23. In plants, the tendency of climbing vines to twine their tendrils around a trellis is called

    (A) thigmotropism
    (B) hydrotropism
    (C) phototropism
    (D) geotropism

24. Females with Turner's syndrome have a high incidence of hemophilia, a recessive, X-linked trait. Based on this information, it can be inferred that females with this condition

    (A) have an extra X chromosome
    (B) have an extra Y chromosome
    (C) lack an X chromosome
    (D) have red blood cells that clump

25. When a retrovirus inserted its DNA into the middle of a bacterial gene, it altered the normal reading frame by one base pair. This type of mutation is called

    (A) duplication
    (B) translocation
    (C) inversion
    (D) frameshift mutation

26. The principal inorganic compound found in living things is

    (A) carbon
    (B) oxygen
    (C) water
    (D) glucose

27. Metafemale syndrome, a disorder in which a female has an extra X chromosome, is the result of nondisjunction. This failure in oogenesis would first be apparent when

    (A) the homologous chromosomes are lined up in the middle
    (B) the sister chromatids are lined up in the middle
    (C) the nuclear envelope breaks down before meiosis
    (D) the homologous chromosomes are pulling apart

28. All of the following are modes of asexual reproduction EXCEPT

    (A) sporulation
    (B) fission
    (C) budding
    (D) meiosis

29. Invertebrate immune systems possess which of the following?

    (A) Killer T-cells
    (B) Phagocytes
    (C) B-cells
    (D) Helper T-cells

Questions 30–32 refer to the following passage.

The following are important pieces of replication and transcription machinery:
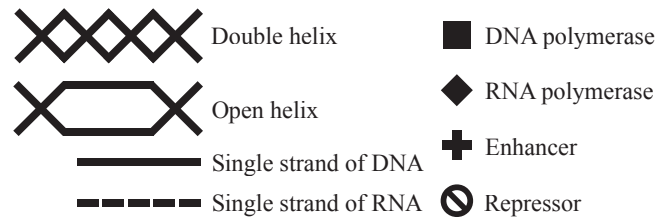
30. Which of the following figures would be present without helicase?

    (A)
    (B)
    (C)
    (D)

31. What situation might have occurred to produce the following situation?

    (A) Stalled DNA replication
    (B) Initiation of transcription
    (C) Repression of transcription
    (D) Crossing-over in meiosis

32. Put these four situations in the correct order:

    I.
    II.
    III.
    IV.

    (A) I, III, IV, II
    (B) I, IV, II, III
    (C) IV, I, III, II
    (D) I, III, II, IV

GO ON TO THE NEXT PAGE.

33. Photosynthesis requires

    (A) glucose, light, CO_2
    (B) light, CO_2, water
    (C) water, soil, O_2
    (D) O_2, water, light

34. Which of following conclusions was made by Avery, MacLeod, and McCarty?

    (A) The double helix is the structure of a DNA molecule
    (B) DNA is the hereditary material
    (C) DNA replication is semi-conservative
    (D) DNA polymerase only adds bases to the 3' side of DNA

35. Which of the following processes occur in the cytoplasm of an eukaryotic cell?

    I. DNA replication

    II. Transcription

    III. Translation

    (A) I only
    (B) III only
    (C) II and III only
    (D) I, II, and III

36. Crossing-over during meiosis permits scientists to determine

    (A) the chance for variation in zygotes
    (B) the rate of mutations
    (C) the distance between genes on a chromosome
    (D) which traits are dominant or recessive

37. An animal cell that is permeable to water but not salts has an internal NaCl concentration of 10%. If placed in freshwater the cell will

    (A) plasmolyze
    (B) swell and eventually lyse
    (C) endocytose water into a large central vacuole
    (D) shrivel

38. Three distinct bird species, flicker, woodpecker, and elf owl, all inhabit a large cactus, *Cereus giganteus*, in the desert of Arizona. Since competition among these birds rarely occurs, the most likely explanation for this phenomenon is that these birds

    (A) have a short supply of resources
    (B) have different ecological niches
    (C) do not live together long
    (D) are unable to breed

39. Lampreys attach to the skin of lake trout and absorb nutrients from its body. This relationship is an example of

    (A) commensalism
    (B) parasitism
    (C) mutualism
    (D) gravitropism

40. The nucleotide sequence of a template DNA molecule is 5'-C-A-T-3'. A mRNA molecule with a complementary codon is transcribed from the DNA. What would the sequence of the anticodon that binds to this mRNA be?

    (A) 5'-G-T-A-3'
    (B) 5'-G-U-A-3'
    (C) 5'-C-A-U-3'
    (D) 5-'U-A-C-3'

41. Viruses are considered an exception to the cell theory because they

    (A) are not independent organisms
    (B) have only a few genes
    (C) move about via their tails
    (D) have evolved from ancestral protists

GO ON TO THE NEXT PAGE.

Questions 42–44 refer to the following passage.

It is difficult to determine exactly how life began. Answer the following questions as if the following data had been collected billions of years ago.

	4 billion years ago	3.5 billion years ago	3.25 billion years ago	3 billion years ago
Atmospheric carbon dioxide	Present	Present	Present	Present
Atmospheric oxygen	Absent	Absent	Absent	Present
RNA	Absent	Present	Present	Present
Protein	Absent	Absent	Present	Present
DNA	Absent	Absent	Present	Present
Life	Absent	Present	Present	Present

42. Which best describes the origin of life according to the data?

(A) Life required an environment with atmospheric oxygen and any type of nucleic acids
(B) Life required an environment with atmospheric carbon dioxide, but not atmospheric oxygen
(C) Life required an environment with self-replicating nucleic acids that can take on many shapes
(D) Life required an environment with nucleic acids and proteins, but not atmospheric oxygen

43. When is the earliest that functional ribosomes could have been found?

(A) Between 4 billion and 3.5 billion years ago
(B) Between 3.5 billion and 3.25 billion years ago
(C) Between 3.25 billion and 3 billion years ago
(D) Between 3 billion years ago and the present

44. Photosynthesis likely began_____ billion years ago when the first _____ appeared.

(A) 4.5; autotrophs
(B) 3.2; autotrophs
(C) 3.5; heterotrophs
(D) 3.2; heterotroph

45. The sequence of amino acids in hemoglobin molecules of humans is more similar to that of chimpanzees than it is to the hemoglobin of dogs. This similarity suggests that

(A) humans and dogs are more closely related than humans and chimpanzees
(B) humans and chimpanzees are more closely related than humans and dogs
(C) humans are related to chimpanzees but not to dogs
(D) humans and chimpanzees are closely analogous

46. Two individuals, one with type B blood and one with type AB blood, have a child. The probability that the child has type O blood is

(A) 0%
(B) 25%
(C) 50%
(D) 100%

Questions 47 and 48 refer to the following bar graph, which shows the relative biomass of four different populations of a particular food pyramid.

Relative Biomass

Population A
Population B
Population C
Population D
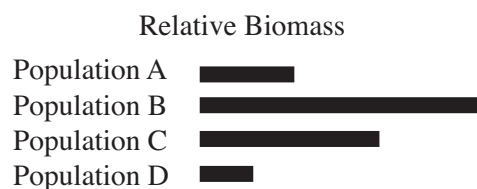
47. The largest amount of energy is available to

(A) population A
(B) population B
(C) population C
(D) population D

48. Which of the following would be the most likely result if there was an increase in the number of organisms in population C?

(A) The biomass of population D will remain the same.
(B) The biomass of population B will decrease.
(C) The biomass of population A will steadily decrease.
(D) The food source available to population C would increase.

GO ON TO THE NEXT PAGE.

Questions 49–52 refer to the following illustration and information.

The cell cycle is a series of events in the life of a dividing eukaryotic cell. It consists of four stages: G_1, S, G_2, and M. The duration of the cell cycle varies from one species to another and from one cell type to another. The G_1 phase varies the most. For example, embryonic cells can pass through the G_1 phase so quickly that it hardly exists, whereas neurons are arrested in the cell cycle and do not divide.
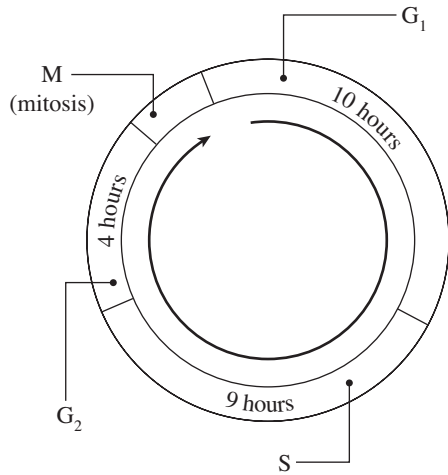
49. During which phase do chromosomes replicate?
    (A) G_1
    (B) S
    (C) G_2
    (D) M

50. In mammalian cells, the first sign of mitosis beginning is the
    (A) appearance of chromosomes
    (B) separation of chromatids
    (C) disappearance of the cell membrane
    (D) replication of chromosomes

51. Mitosis occurs in all of the following types of cells EXCEPT
    (A) epidermal cells
    (B) hair cells
    (C) red blood cells
    (D) pancreatic cells

52. Since neurons are destined never to divide again, what conclusion can be made?
    (A) These cells will go through cell division.
    (B) These cells will be permanently arrested in the G_1 phase.
    (C) These cells will be permanently arrested in the M phase.
    (D) These cells will quickly enter the S phase.

Questions 53–56 refer to the following graphs, which show the permeability of (p) ions during an action potential in a ventricular contractile cardiac fiber. The left graph shows the membrane potential changes, and the right shows the corresponding ion permeabilities over the time frame of the action potential.
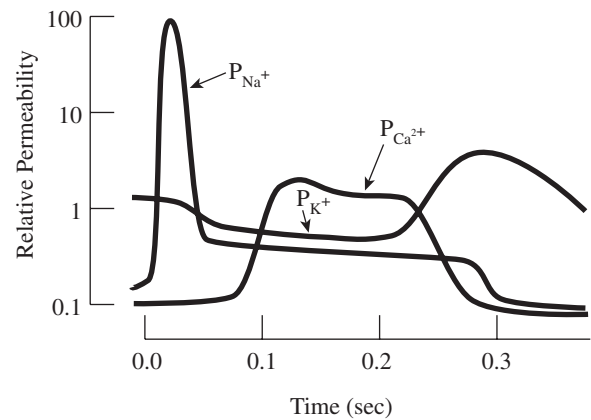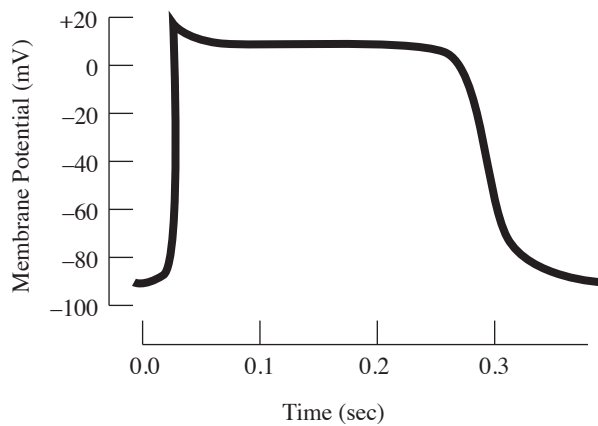
53. Based on the graph, the resting membrane potential of the muscle fibers is closest to

   (A) –90 mV
   (B) –70 mV
   (C) 0 mV
   (D) +70 mV

54. Which of the following statements is true concerning the initial phase of depolarization?

   (A) Voltage-gated K^+ channels open in the plasma membrane.
   (B) The concentration of Ca^{2+} ions within the plasma membrane becomes more negative.
   (C) The membrane potential stays close to –40 mV.
   (D) The permeability to Na^+ ions increases.

55. In cardiac fibers, the duration of an action potential is approximately

   (A) 0.10 secs
   (B) 0.20 secs
   (C) 0.25 secs
   (D) 0.30 secs

56. The action potential of skeletal muscle cells is much shorter than that of cardiac cells. Which of the following facts about cardiac muscle best explains this?

   (A) The membrane is permeable to Na^+, not K^+.
   (B) Voltage-gated K^+ channels open during depolarization, not repolarization.
   (C) Depolarization is prolonged compared to that in skeletal muscle fibers.
   (D) The refractory period is shorter than that of skeletal muscle fibers.

GO ON TO THE NEXT PAGE.

Questions 57 and 58 refer to the data below concerning the general animal body plan of four organisms.

Characteristic	Sea anemone	Hagfish	Eel	Salamander
Vertebral column		+	+	+
Jaws			+	+
Walking legs				+

Note: + indicates a feature presence in an organism.

57. The two most closely related organisms are

 (A) sea anemone and hagfish
 (B) eel and salamander
 (C) hagfish and eel
 (D) sea anemone and salamander

58. The correct order of evolution for the traits above is

 (A) jaws – vertebral column – walking legs
 (B) walking legs – jaws – vertebral column
 (C) jaws – walking legs – vertebral column
 (D) vertebral column – jaws – walking legs

59. Pre- and post-zygotic barriers exist that prevent two different species from producing viable offspring. All of the following are pre-zygotic barriers EXCEPT

 (A) anatomical differences preventing copulation
 (B) different temporality of mating
 (C) sterility of offspring
 (D) incompatible mating songs

60. Birds and insects have both adapted wings to travel by flight. The wings of birds and insects are an example of

 (A) divergent evolution
 (B) convergent evolution
 (C) speciation
 (D) mutation

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Questions 61–63 refer to the following synthetic pathway of nRNA pyrimidine, cytidine 5' triphosphate, CTP. This pathway begins with the condensation of two small molecules by the enzyme aspartate transcarbamylase (ATCase).
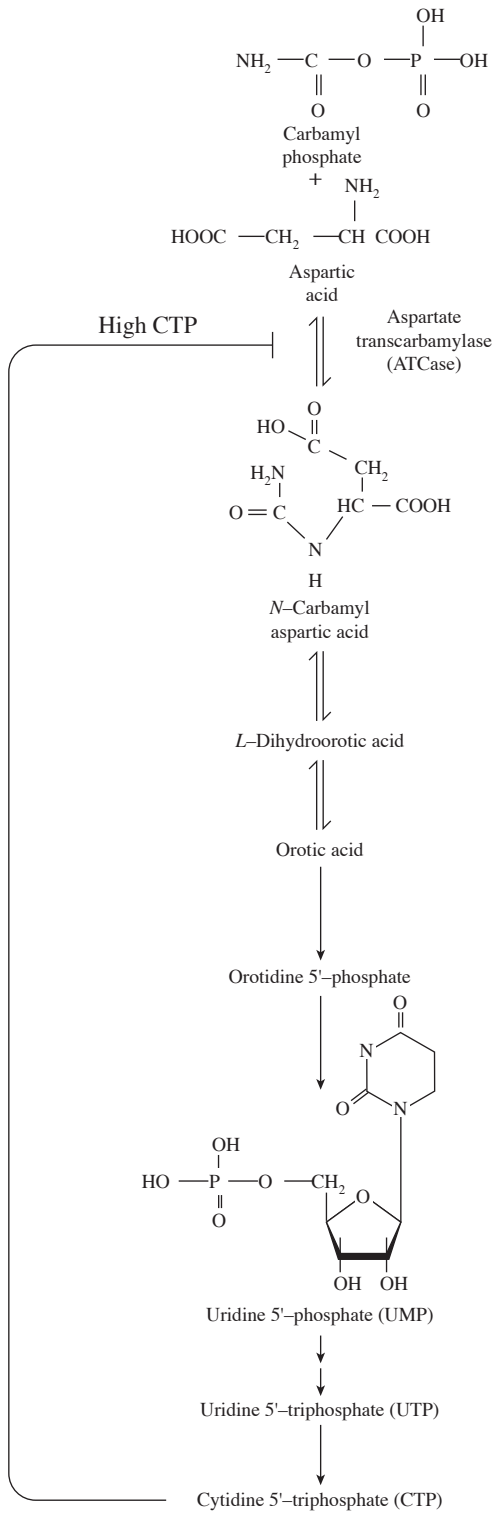
Regulation of CTP biosynthesis

61. Which of the following is true when the level of CTP is low in a cell?

   (A) CTP is converted to ATCase.
   (B) The metabolic traffic down the pathway increases.
   (C) ATCase is inhibited, which slows down CTP synthesis.
   (D) The final product of the pathway is reduced.

62. This enzymatic phenomenon is an example of

   (A) transcription
   (B) feedback inhibition
   (C) dehydration synthesis
   (D) photosynthesis

63. The biosynthesis of cytidine 5'-triphosphate requires

   (A) a ribose sugar, a phosphate group, and a nitrogen base
   (B) a deoxyribose sugar, a phosphate group, and a nitrogen base
   (C) a ribose sugar, phosphate groups, and a nitrogen base
   (D) a deoxyribose sugar, phosphate groups, and a nitrogen base

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Directions: Part B consists of questions requiring numeric answers. Calculate the correct answer for each question.

64. In a diploid organism with the genotype AaBbCCDDEE, how many genetically distinct kinds of gametes would be produced?

65. Under favorable conditions, bacteria divide every 20 minutes. If a single bacterium replicated according to this condition, how many bacterial cells would one expect to find at the end of three hours?

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66. In snapdragon plants that display intermediate dominance, the allele CR produces red flowers and CW produces white flowers. If a homozygous, red-flowered snapdragon is crossed with a homozygous, white-flowered snapdragon, what will the percentage of pink offspring be?

	/	/	/	
.	.	.	.	.
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

67. Translation is an energy-intensive process. Each tRNA that brings an amino acid costs 2 ATP to make. Every codon that binds in the ribosome costs 1 ATP. There is also a cost of 1 ATP every time the mRNA must shift to the next codon. Approximately how many ATPs are required to synthesize a protein containing 115 amino acids?

	/	/	/	
.	.	.	.	.
0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

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<u>Question 68</u> refers to the following experiment.

A group of *Daphnia,* small crustaceans known as water fleas, was placed in one of three culture jars of different sizes to determine their reproductive rate. There were 100 females in the jar. The graph below shows the average number of offspring produced per female each day in each jar of pond water.
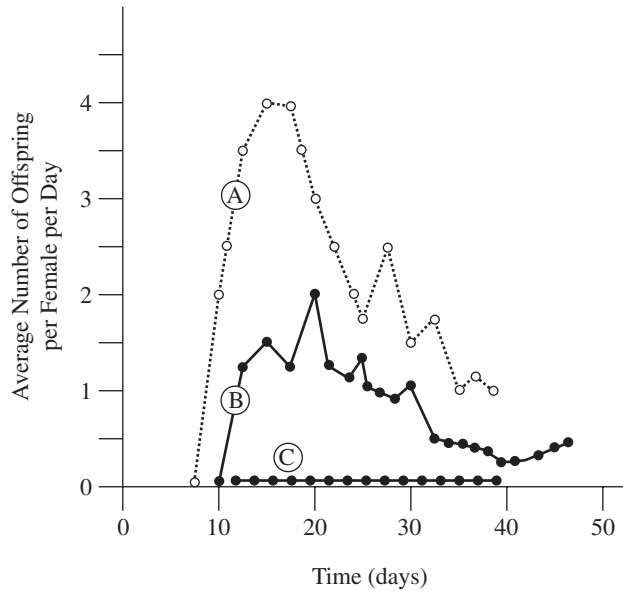
Key: (A) Water fleas in a 1-liter jar of pond water
(B) Water fleas in a 0.5-liter jar of pond water
(C) Water fleas in a 0.25-liter jar of pond water

68. What is the total number of offspring born in the 0.5-liter jar on the twentieth day?

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69. On average, there is a 90 percent reduction of productivity for each trophic level. Based on this information, 10,000 pounds of grass should be able to support how many pounds of crickets?

STOP

END OF SECTION I

IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY CHECK YOUR WORK ON THIS SECTION. DO NOT GO ON TO SECTION II UNTIL YOU ARE TOLD TO DO SO.

BIOLOGY

SECTION II

8 Questions
Planning Time—10 minutes
Writing Time—80 minutes

<u>Directions</u>: Questions 1 and 2 are long free-response questions that should require about 22 minutes each to answer and are worth 10 points each. Questions 3 through 8 are short free-response questions that should require about 6 minutes each to answer. Questions 3 through 5 are worth 4 points each, and questions 6 through 8 are worth 3 points each.

Read each question carefully and completely. Write your response in the space provided following each question. Only material written in the space provided will be scored. Answers must be written out in paragraph form. Outlines, bulleted lists, or diagrams alone are not acceptable.

1. Chlorophyll is one of a class of pigments that absorb light energy in photosynthesis.
   (a) **<u>Describe</u>** the function of chlorophyll and what is meant by its absorption spectrum.
   (b) **<u>Design</u>** an experiment to investigate the absorption spectrum of a pigment given to you in a solution and make a mock graph. Using the mock results of your experiment, what color should the pigment appear as?

2. Natural selection is said to act on individuals, but evolution occurs in populations. **<u>Explain</u>** each process and **<u>show</u>** that the statement is true using an example with individuals in a population. **<u>Identify</u>** variation within the population. **<u>Identify</u>** a selective pressure. **<u>Create</u>** a graph illustrating the changes to the population makeup over time.

3. **<u>Describe</u>** the chemical nature of genes. Name two types of gene mutations that could occur during replication.

4. In large multicellular organisms, signaling is necessary to maintain homeostasis. **<u>Compare</u>** and **<u>contrast</u>** the endocrine system and the nervous system with a focus on how they send signals.

5. **<u>Describe</u>** why fermentation is a less efficient way to produce energy than aerobic respiration.

6. **<u>Define</u>** analogous structures and **<u>describe</u>** how similar selective pressures can occur in two unrelated species.

7. **<u>Describe</u>** symbiosis and give an example involving humans.

8. Genes can be transferred from parent to offspring, but there are many other ways that they can be transferred, either naturally or using biotechnology. **<u>Describe</u>** two ways that genes can be transferred and **<u>explain</u>** why these types of transfers are helpful.

STOP

END OF EXAM