



**The 65th Annual
Merck State Science Day Competition
May 19, 2015**

BIOLOGY

DIRECTIONS

The "answer panel" at the bottom of the window is pre-set to show 10 answer boxes per page.

1. The current question has a black border.
2. Enter your answer choice using the keyboard.
3. Click **Confirm** to record your answer.
4. Questions that have been answered will be tinted **Green**
5. Any answer can be edited. **Confirm** the correction.
6. > moves to the next set of questions (< moves back)
7. Click on any number to answer that question.
8. **Confirm** all entries. Each answer is recorded only when **Confirm** is used.
9. When finished, use **FINISHED TEST** in lower left.

Hint: The size of the lettering in the bottom answer panel can be adjusted using CTRL + to magnify the browser view.

The test has **120 items** that will be scored. You have **90** minutes in which to answer all the questions.

There is only one correct answer per question. Do not spend too much time on any one question. Do the items you find easier first, and then go back to those you find more difficult or time consuming during the time you have remaining. Your individual score will be computed on the basis of the number of correctly answered items.

Multiple Choice

Identify the choice that best completes the statement or answers the question and place your selection ON THE ANSWER PANEL, then "Confirm."

1. The deficiency of which trace element can result in an enlarged thyroid known as a goiter.
 - A) Calcium
 - B) Oxygen
 - C) Iodine
 - D) Phosphorous
 - E) Sulfur
2. An oxygen atom has eight protons and the most common isotope of oxygen has eight neutrons. A rarer isotope of oxygen has ten neutrons. Which of the following are correct?
 - A) The atomic number of oxygen is eight
 - B) The mass number of oxygen is approximately eighteen
 - C) The mass number of oxygen is approximately sixteen
 - D) Both A and B are correct
 - E) Both A and C are correct
3. Morphine, heroin, and other opiate drugs produce similar effects as endorphins in the human body. Why does this occur?
 - A) All of the molecules are comprised of the same amount of carbon
 - B) All of the molecules are comprised of the same amount of nitrogen
 - C) All of the molecules have a similar molecular shape
 - D) All of the molecules have a similar pH
 - E) All of the molecules have the same number of subatomic particles
4. Why are trees, such as the giant redwoods in California, able to transport water?
 - I. Adhesion of water to the cell walls resists the downward pull of gravity
 - II. Cohesion due to hydrogen bonding helps hold together the column of water within cells
 - III. Cohesion of water to the cell walls resists the downward pull of gravity
 - IV. Adhesion due to hydrogen bonding helps hold together the column of water within cells
 - A) I only
 - B) III only
 - C) I, II
 - D) I, II, III
 - E) II, IV
5. Why are organisms, such as humans, able to resist changes in their own temperature?
 - A) Cohesion of water molecules
 - B) Kinetic energy within human cells
 - C) Adhesion of water molecules
 - D) Synthesis of ATP molecules
 - E) High specific heat of water

6. What evidence supports the claim that “water is not a universal solvent”?
- A) The pH of water can fluctuate
 - B) The high specific heat of water
 - C) The temperatures at which water freezes and boils
 - D) Cells placed in water do not dissolve
 - E) None of the above support the claim
7. The pH of hydrochloric acid in the stomach is approximately 2 while the pH of urine is approximately 6. How much more acidic is hydrochloric acid in comparison to urine?
- A) 40x
 - B) 100x
 - C) 400x
 - D) 10,000x
 - E) 40,000x
8. Which of the following gases was **NOT** included in Stanley Miller’s simulation of the early earth’s atmosphere?
- A) Methane
 - B) Oxygen
 - C) Water
 - D) Ammonia
 - E) Hydrogen
9. How do aldehydes and ketones differ?
- A) The placement of the carbonyl group within the carbon skeleton
 - B) The polarity of the carbon skeleton
 - C) The placement of the carboxyl group within the carbon skeleton
 - D) The pH of the carbon skeleton
 - E) None of the above are correct
10. Which of the following monosaccharides are matched with the appropriate disaccharide?
- A) Glucose and Glucose- Lactose
 - B) Glucose and Galactose- Lactose
 - C) Glucose and Fructose- Maltose
 - D) Glucose and Galactose- Maltose
 - E) Glucose and Fructose- Maltose
11. Why does a denatured protein no longer work properly?
- A) The amount of carbon atoms has been altered
 - B) The shape of the polypeptide chain has been affected
 - C) The polarity of the protein has been lost
 - D) The hydrophilic component of the protein was lost
 - E) None of the above are correct
12. How is a nucleoside different from a nucleotide?
- A) Nucleotides contain sulfur
 - B) Nucleosides contain phosphate groups
 - C) Nucleotides and nucleosides must contain different amounts of carbon
 - D) Nucleosides are only made of ribose
 - E) None of the above are correct

13. A scientist wanted to examine the surface texture of a human hair. Which research tool would be the most appropriate to study this specimen?
- A) Light Microscope
 - B) Scanning Electron Microscope
 - C) Transmission Electron Microscope
 - D) Centrifuge
 - E) PCR Machine
14. Where do most of the cell's metabolic activities occur?
- A) Nucleus
 - B) Cytoplasm
 - C) Endoplasmic Reticulum
 - D) Lysosome
 - E) Golgi Apparatus
15. Which of the following statements are true about prokaryotic cells?
- A) Their diameters are approximately 100 micrometers in length
 - B) All prokaryotic cells contain pili
 - C) They do not contain plasma membranes, only cell walls
 - D) The DNA is enclosed in a membrane bound organelle
 - E) They have a greater surface area to volume ratio than eukaryotic cells
16. Which of the following is present in an animal cell but **NOT** in a plant cell?
- A) Chloroplast
 - B) Plasmodesmata
 - C) Central Vacuole
 - D) Centrioles
 - E) Cell Wall
17. How are a chloroplast and mitochondrion similar?
- A) They are both mobile and move around the cell
 - B) They both contain at least two membranes
 - C) They both contain at least two vacuoles
 - D) Both B and C are correct
 - E) Both A and B are correct
18. Microtubules are most likely to be involved in which cell process:
- A) Movement of RNA from Nucleus to Ribosome
 - B) Anchorage of the Nucleus
 - C) Formation of the Nuclear Lamina
 - D) Chromosome Movement in Mitosis
 - E) Cell Motility such as pseudopodia
19. How does cholesterol directly affect the plasma membrane of cells?
- A) Depending upon the location of the cells, cholesterol changes the pH of the membrane
 - B) Cholesterol causes the membrane proteins to be excited
 - C) Depending upon the temperature, cholesterol reduces membrane fluidity
 - D) Cholesterol affects the amount of ions that are taken in/out of a cell
 - E) Cholesterol affects the transport of proteins in/out of the cell

20. Which type (s) of intercellular junction is responsible for communication between cells?
- A) Tight Junctions
 - B) Desmosomes
 - C) Gap Junctions
 - D) Both A and B are correct
 - E) Both A and C are correct
21. Why do hospitals give patients IVs containing saline solutions rather than pure water?
- A) Pure water would cause cells to lyse
 - B) Pure water would cause the cells to shrivel up
 - C) Pure water would cause all the sodium ions to passively diffuse out of the cells
 - D) Pure water would cause all the potassium ions to passively diffuse out of the cells
 - E) None of the above are correct
22. Which of the following statement (s) about passive transport is **NOT** correct?
- A) Osmosis is an example of passive transport
 - B) Passive transport does not require energy
 - C) Endocytosis is a type of passive transport
 - D) Passive transport could not occur without a concentration gradient
 - E) Transport proteins are associated with certain types of passive transport
23. In the sodium-potassium pump, what stimulates the phosphorylation of ATP?
- A) Binding of potassium molecules
 - B) Binding of sodium molecules
 - C) Releasing of potassium molecules
 - D) Releasing of sodium molecules
 - E) Both C and D are correct
24. Why do cells perform pinocytosis?
- A) The cells needs to create ATP
 - B) The cells need to create turgur pressure
 - C) The cells need to create a concentration gradient; thus being able to move molecules from a low concentration to a high concentration
 - D) The cells need to excrete the dissolved substances
 - E) The cells need the molecules that are dissolved in the fluid they take in
25. Cellular respiration is an example of:
- A) Metabolism
 - B) Catabolism
 - C) Anabolism
 - D) Both A and C are correct
 - E) Both A and B are correct

26. Which of the following statement (s) are **True**?

- I. Amount of free energy increases during endergonic reactions
- II. Amount of free energy increases during exergonic reactions
- III. Exergonic reactions are considered spontaneous reactions
- IV. Endergonic reactions are considered nonspontaneous reactions

- A) I, III
- B) II, IV
- C) I, II, III
- D) I, III, IV
- E) I only

27. How does ATP transfer energy from exergonic to endergonic processes in the cell?

- A) ATP transfers ribose molecules to other parts of the cell
- B) ADP dephosphorylates ATP
- C) ATP transfers energy to endergonic processes by phosphorylating other molecules
- D) ATP lowers the activation energy
- E) None of the above are correct

28. Which of the following enzymes would digest a fat?

- A) Lipase
- B) Fatase
- C) Protease
- D) Sucrase
- E) Lactase

29. In what ways, do enzymes lower the activation energy of a reaction?

- A) The substrate affects the temperature which therefore increases the rate of reaction
- B) The active site phosphorylates an ADP molecule
- C) The substrate affects the pH level of the cell
- D) The active site provides a template for the substrates to come together for the reaction to occur
- E) None of the above are correct

30. Which of the following could be enzyme inhibitors?

- A) Sarin
- B) DDT
- C) Antibiotics
- D) Poisons
- E) All of the above could potentially be enzyme inhibitors

31. Which of the following statement (s) are **TRUE** about allosteric regulation?

- I. Most allosterically regulated enzymes are constructed from two or more polypeptide chains
- II. The products of ATP hydrolysis have no impact on allosteric regulation
- III. Cooperativity amplifies the response of enzymes to substrates
- IV. Allosteric regulation involves activators but not inhibitors

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

32. Which process phosphorylates ADP through substrate level phosphorylation?

- A) Glycolysis
- B) Citric Acid Cycle
- C) Electron Transport Chain
- D) Both A and B are correct
- E) Both B and C are correct

33. Which of the following statement (s) are **TRUE** about glycolysis?

- I. No carbon dioxide is released
- II. It can occur in the presence or absence of oxygen
- III. There is a net yield of 4 ATP
- IV. Water is not released

- A) I,IV
- B) II, III, IV
- C) II, III
- D) I only
- E) I,II

34. After glycolysis, why must pyruvate enter the mitochondrion via active transport?

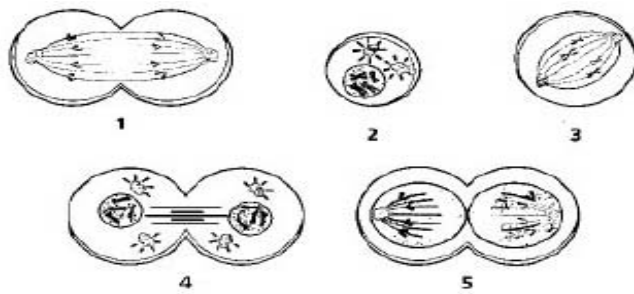
- A) Pyruvate is too large
- B) Pyruvate is a charged molecule
- C) Pyruvate is a non stable molecule
- D) Pyruvate will interact with molecules such as carbon dioxide
- E) Pyruvate will denature

35. During the citric acid cycle, citrate is converted to its isomer, isocitrate. How does this happen?

- A) Citrate loses a carbon dioxide molecule forming isocitrate
- B) Acetyl coA combines with citrate to form isocitrate
- C) ATP is dephorylated convering citrate to isocitrate
- D) Citrate loses a water molecule forming isocitrate
- E) Pyruvate combines with acetyl co A to form isocitrate

36. The electron transport chain consists of four complexes. Which of the following molecules is appropriately matched with the complex it is found in during this process?
- A) Cytochrome A- complex I
 - B) Cytochrome B- complex IV
 - C) Iron-Sulfur Protein (Fe-S)- complex IV
 - D) Flavin Mononucleotide (FMN)- complex I
 - E) Flavin Mononucleotide (FMN)- complex IV
37. If there was no oxygen present during cellular respiration, what would occur?
- A) Glucose would not be converted to pyruvate
 - B) All the enzymes would not function properly
 - C) Acetyl coA would not be created
 - D) Hydrogen ions would not be pumped into the mitochondrion's intermembrane
 - E) Pyruvate would not be able to enter the mitochondrion
38. How are alcoholic fermentation and lactic acid fermentation similar?
- A) They both release oxygen
 - B) They both reduce FADH to FAD₂
 - C) They both convert glycolysis to acetaldehyde
 - D) They both release carbon dioxide
 - E) They both produce a net of 2 ATP
39. Why are the pigment carotenoids important to plants?
- A) They broaden the spectrum of colors that can drive photosynthesis
 - B) They increase the rate of activation energy
 - C) They absorb blue and violet wavelengths
 - D) They decrease the amount of water that is released by photosynthesis
 - E) None of the above are correct
40. How are the noncyclic electron flow and the cyclic electron flow in photosynthesis different?
- A) Cyclic electron flow does not produce NADPH
 - B) Noncyclic electron flow does not produce ATP
 - C) Noncyclic electron flow does not need light
 - D) Cyclic electron flow involves photosystem I only
 - E) Both A and D
41. Overall, what is the purpose of the light dependent reaction of photosynthesis?
- A) Produce high energy sugars
 - B) Release carbon dioxide
 - C) Convert glucose to pyruvate
 - D) Produce chemical energy
 - E) Breakdown water
42. Which enzyme (s) is needed to start the Calvin Cycle?
- A) Rubisco
 - B) Glucose
 - C) Ribulase
 - D) Phosphatase
 - E) Both C and D are needed

43. Cacti and pineapples are examples of:
- A) C3 Plants
 - B) C4 Plants
 - C) CAM Plants
 - D) Heterotrophic Plants
 - E) None of the above are correct
44. Which of the following are properly matched?
- A) Light dependent reaction- takes place in the stroma
 - B) Light dependent reaction- converts carbon dioxide to carbohydrates
 - C) Light dependent reaction- produces high energy sugars
 - D) Calvin Cycle- takes place in the thylakoid
 - E) Calvin Cycle- indirectly depends on light energy
45. How does long distance cell signaling work?
- A) A secreting cell acts on nearby target cells by discharging a growth factor
 - B) A nerve cell releases neurotransmitters into a synapse, targeting the target cell
 - C) Cell junctions allow molecules to pass readily between cells without crossing the plasma membrane
 - D) Endocrine cells secrete hormones into body fluids, such as the blood, which reach other body cells
 - E) Cells communicate by interactions that occur between molecules that protrude from the cell surface
46. Which part of mitotic division is the longest and shortest, respectively?
- A) Prophase; telophase
 - B) Telophase; metaphase
 - C) Metaphase; anaphase
 - D) Anaphase; prophase
 - E) Prophase; anaphase
47. A scientist treats cells with a chemical that prevents DNA replication. Which part of the cell cycle would this treatment trap the cells?
- A) G1
 - B) S
 - C) G2
 - D) Mitosis
 - E) Cytokinesis
48. A cell contains ten sister chromatids. After anaphase, how many centromeres does this cell contain?
- A) none
 - B) 2
 - C) 5
 - D) 10
 - E) 20



49.

Place the steps of cellular division in the correct order

- A) 1,2,4,5,3
- B) 1,2,3,4,5
- C) 2,3,1,4,5
- D) 2,1,3,5,4
- E) 1,2,4,3,5

50. A genetic counselor performs a karyotype and finds that the individual has three #21 chromosomes. What disorder does this individual most likely have?

- A) Klinefelter Syndrome
- B) Turner Syndrome
- C) Cri du Chat Syndrome
- D) Down's Syndrome
- E) Newcastle Syndrome

51. In which phase of meiosis does crossing over occur?

- A) Prophase I
- B) Prophase II
- C) Metaphase I
- D) Metaphase II
- E) None of the above are correct

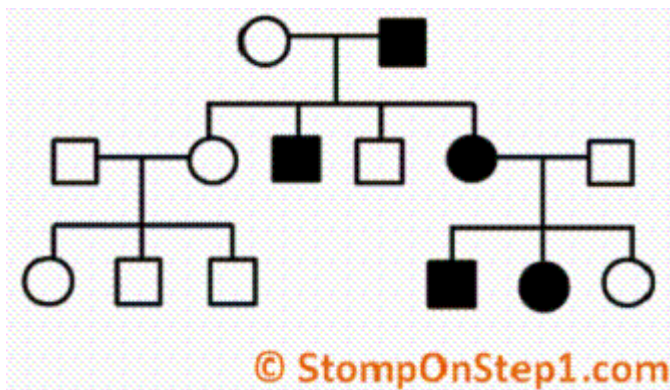
52. Turkeys have a diploid number of 80, cows have a diploid number of 60, and gorillas have a diploid number of 48. Assuming no crossing over occurs, which organism (s) would be expected to have the greatest amount of genetic variation?

- A) Gorillas
- B) Turkeys
- C) Cows
- D) Gorillas and cows would be about the same
- E) An equal amount would be expected amongst all three species

53. A somatic cell of a rabbit contains 44 chromosomes. How many chromosomes would there be in a rabbit's gamete?

- A) 88
- B) 44
- C) 22
- D) 11
- E) 6

54. How could a malignant tumor in a human body cell be different from a benign tumor in a human body cell?
- A) There could be a different number of chromosomes
 - B) There could be a difference in polarity of the cells
 - C) There could be an excessive amount of ATP
 - D) There could be many cells undergoing binary fission
 - E) There could be no crossing over
55. Purple flowers are dominant to white flowers in pea plants. If two hybrid pea plants are crossed, what proportion of the offspring are expected to have a homozygous genotype?
- A) 0%
 - B) 25%
 - C) 50%
 - D) 75%
 - E) 100%
56. Assuming that short fur is dominant to long fur and black fur is dominant to white fur, if a heterozygous black, homozygous short haired parent is crossed with a white, long haired parent, which percent of the offspring would be expected to be heterozygous for both traits?
- A) 0%
 - B) 25%
 - C) 50%
 - D) 75%
 - E) 100%
57. All the offspring in the F1 generation have a heterozygous genotype for hair length. Which of the following most likely represents the genotype of the P generation?
- A) Both heterozygous for the trait
 - B) Heterozygous and homozygous recessive
 - C) Homozygous dominant and heterozygous
 - D) Homozygous dominant and homozygous recessive
 - E) Heterozygous and homozygous dominant
58. Two orange fruits were crossed. The F1 generation had the following phenotypes- red, yellow, and orange. Which concept best explains these results?
- A) Principle of dominance
 - B) Co-dominance
 - C) Incomplete dominance
 - D) Polygenic inheritance
 - E) Sex linkage



59. The pedigree above most likely represents which type of inheritance:
- Autosomal dominant
 - Autosomal recessive
 - Sex Linked dominant
 - Sex Linked recessive
 - Incomplete dominance
60. A man with blood type B marries a woman with blood type A. Their child has blood type O. What other genotypes and in what frequencies would you expect in offspring from this marriage?
- AB blood; 50%
 - AB blood; 75%
 - B blood; 25%
 - A blood; 50%
 - A blood; 75%
61. Genes X, Y, and Z are located on the same chromosome. Testcrosses show that recombination frequency between X and Y is 30% and between X and Z is 15%. What is the linear order of these genes?
- X-Z-Y
 - Z-X-Y
 - X-Y-Z
 - Both A and B are possible
 - Both A and C are possible
62. Susan and Mark do not have Duchene muscular dystrophy, but their firstborn son does have it. How likely is it that their next son will have the disease?
- 0%
 - 25%
 - 50%
 - 75%
 - 100%
63. Nondisjunction during the second meiotic division would result in:
- All $2n-1$ gametes
 - All $2n + 1$ gametes
 - All n gametes
 - Two $2n$ gametes and two n gametes
 - Two n gametes, one $n+1$ gamete, and one $n-1$ gamete

64. In humans, how many of the chromosomes have been observed in an aneuploid condition?
- A) X and Y chromosomes only
 - B) X and Y chromosomes and chromosome #21
 - C) Chromosome #18, #13, and #21
 - D) Chromosome #21 only
 - E) Observed in all the chromosomes
65. Which of the following statement (s) is correct about genomic imprinting and sex linkage?
- I. Imprinted genes are usually on autosomes
 - II. Imprinted genes usually affect females only
 - III. Sex linked genes are usually on autosomes
 - IV. Sex linked genes affect males and females equally
- A) I only
 - B) IV only
 - C) I,III
 - D) II, IV
 - E) I,II, III
66. The *Philadelphia Chromosome* is a result of which type of chromosomal abnormality:
- A) Deletion
 - B) Insertion
 - C) Inversion
 - D) Translocation
 - E) Nondisjunction
67. In Griffith's famous experiments, he coins the observed phenomenon *transformation*. Which of the following below best describes this phenomenon?
- A) Change in genotype due to assimilation of external DNA
 - B) Change in phenotype due to assimilation of external DNA
 - C) Change in genotype and phenotype due to assimilation of external proteins
 - D) Change in genotype and phenotype due to assimilation of external DNA
 - E) None of the above accurately describe transformation
68. Which of the following scientists were **NOT** involved with the discovery of DNA's structure and function?
- A) Chargaff
 - B) Hershey & Chase
 - C) LaMarck
 - D) Avery
 - E) Franklin
69. During DNA replication, nucleotides are added to a growing DNA strand. How are these added molecules similar to an ATP molecule?
- A) They both contain the sugar ribose
 - B) They both contain the sugar deoxyribose
 - C) They both contain three phosphate groups
 - D) They both contain adenine and guanine
 - E) They both contain cytosine and thymine

70. What role does helicase play in DNA replication?
- Unwinds parental double helix at the replication forks
 - Binds to and stabilizes single-stranded DNA until it can be used as a template
 - Corrects “overwinding”
 - Joins Okazaki fragments
 - Removes primer from the 5’ end
71. The Okazaki fragments during DNA replication fail to elongate. Which protein is most likely working with limitations?
- Primase
 - DNA polymerase III
 - DNA polymerase I
 - Ligase
 - Helicase
72. How do telomeres preserve eukaryotic genes?
- Telomeres contain multiple repetitions of genes
 - Telomeres correct any mutations that may have occurred during DNA replication
 - Telomeres act as a primer to begin DNA replication
 - Telomeres ensure that genes are not “lost” during multiple rounds of DNA replication
 - Telomeres ensure that DNA is wound around the histones properly
73. A certain protein is comprised of 300 amino acids. Approximately how many codons comprise this protein?
- 30
 - 100
 - 300
 - 900
 - 1200

	U	C	A	G
U	UUU = phe UUC = phe UUA = leu UUG = leu	UCU = ser UCC = ser UCA = ser UCG = ser	UAU = tyr UAC = tyr UAA = stop UAG = stop	UGU = cys UGC = cys UGA = stop UGG = trp
C	CUU = leu CUC = leu CUA = leu CUG = leu	CCU = pro CCC = pro CCA = pro CCG = pro	CAU = his CAC = his CAA = gln CAG = gln	CGU = arg CGC = arg CGA = arg CGG = arg
A	AUU = ile AUC = ile AUA = ile AUG = met	ACU = thr ACC = thr ACA = thr ACG = thr	AAU = asn AAC = asn AAA = lys AAG = lys	AGU = ser AGC = ser AGA = arg AGG = arg
G	GUU = val GUC = val GUA = val GUG = val	GCU = ala GCC = ala GCA = ala GCG = ala	GAU = asp GAC = asp GAA = glu GAG = glu	GGU = gly GGC = gly GGA = gly GGG = gly

74.

The anti-codons that matched up with a mRNA strand include: UAC CGA UCA GCA ACU. Using the chart above, what amino acids make up this polypeptide chain?

- tyr-arg-ser-ala-thr
- met-leu-arg-ser-cys
- met-ala-ser-arg-stop
- tyr- ala-ser-ser-stop
- None of the above are correct

75. Why are TATA boxes important in transcription that occurs in eukaryotic cells?
- A) Prevent the proteins from being denatured
 - B) Allow the tRNA to bring the appropriate amino acid
 - C) Prevent the degradation of the mRNA molecule
 - D) Needed in forming the initiation complex in eukaryotes
 - E) Synthesize helicase
76. How are snRNPs related to spliceosomes?
- A) snRNPs separate the introns on spliceosomes
 - B) snRNPs separate the exons on spliceosomes
 - C) snRNPs help the spliceosomes move mRNA to the cytoplasm
 - D) Spliceosomes denatures snRNPs
 - E) snRNPs along with additional proteins form a spliceosome
77. Which of the following mutations are the most detrimental?
- A) Base-pair substitution
 - B) Insertion
 - C) Missense mutations
 - D) Deletion
 - E) Both B and D are the most detrimental
78. Place the following events in the correct sequence.
- I. Amino Acid Activation
 - II. Transcription
 - III. Translation
 - IV. Formation of Initiation Complex
 - V. RNA Processing
- A) II-V-IV-I-III
 - B) IV-V-II-I-III
 - C) I-II-IV-III-V
 - D) V-II-I-III-IV
 - E) II-III-I-IV-V
79. Gradualism, the idea that profound change can take place through the cumulative effect of slow but continuous processes, was proposed by whom:
- A) Cuvier
 - B) Hutton
 - C) Malthus
 - D) Lamarck
 - E) Mendel

80. Which of the following statement (s) are correct about evolution by natural selection:

- I. A population is the smallest unit that can evolve
- II. Evolution can be measured as changes in relative proportions of heritable variations
- III. Favorable traits depends on the environment
- IV. A community is the smallest unit that can evolve
- V. Evolution occurs because organisms have an innate drive to become more complex

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

81. What is the frequency of heterozygotes, Bb, in randomly mating population in which the frequency of the dominant phenotypes is 0.19?

- A) .18
- B) .81
- C) .9
- D) .1
- E) .19

82. X is an autosomal recessive disorder in humans. The frequency of affected newborns is 1 in 14,000. Assuming random mating, what is the frequency of heterozygotes?

- A) .0085
- B) .017
- C) .9915
- D) .085
- E) .17

83. Upon examining 25 gene loci of a population of seals that inhabit northern California, the scientists found that there were no variations. However, inspection of 25 gene loci of a population of seals that inhabit southern California, the scientists found that there was a considerable amount of variation. How can these results be explained?

- A) Analogy
- B) Sexual Recombination
- C) Bottleneck Effect
- D) Biogeography
- E) Homology

84. A population of finches displays two different beak sizes. The smaller beaks are useful to feed on soft seeds while the larger beaks specialize in cracking hard seeds. This example best illustrates which of the following terms:

- A) Stabilizing Selection
- B) Genetic Drift
- C) Hardy-Weinburg Equilibrium
- D) Founder Effect
- E) Disruptive Selection

85. *A giraffe stretches his neck to reach leaves on the high branches* would illustrate which theory:
- A) Use and Disuse
 - B) Punctuated Equilibrium
 - C) Inheritance of Acquired Characteristics
 - D) Natural Selection
 - E) Polymorphism
86. Why is height variation in humans not considered an example of phenotypic polymorphism?
- A) Gene flow of the alleles for height do not increase or decrease within the population
 - B) Alleles that code for height are a result of a genetic mutation
 - C) Height is an example of directional selection, thus, can not be considered a morph
 - D) Heights vary along a continuum not consisting of distinct and separate morphs
 - E) None of the above statements are correct
87. Two bird species in a forest are not known to interbreed. One species feeds and mates in the treetops while the other on the ground. However, when put in captivity, these two species will interbreed and produce viable offspring. What type of reproductive barrier most likely keeps these species separate?
- A) Hybrid Breakdown
 - B) Temporal Isolation
 - C) Habitat Isolation
 - D) Behavioral Isolation
 - E) Gametic Isolation
88. Which of the following statement (s) are true about punctuated equilibrium?
- A) Suggests that Darwin's theory of evolution by natural selection is incorrect
 - B) Implies that evolution only happens in rapid bursts
 - C) Predicts that evolutionary change takes place in short periods of time tied to speciation events
 - D) Disproves adaptive radiation
 - E) None of the above are true about punctuated equilibrium
89. How does artificial selection produce rapid changes in the phenotypes of organisms?
- A) By changing the frequency of alleles and selecting for new combinations of traits
 - B) By stimulating the species to increase the production of new mutations
 - C) By changing the number of chromosomes
 - D) By selecting only dominant genotypes
 - E) By allowing individuals with all genetic combinations to survive and reproduce equally
90. The bones of a human arm are homologous to structures in all of the following EXCEPT:
- A) Cat forelimb
 - B) Whale flipper
 - C) Bat wing
 - D) Bird wing
 - E) Human arm is homologous to all of these

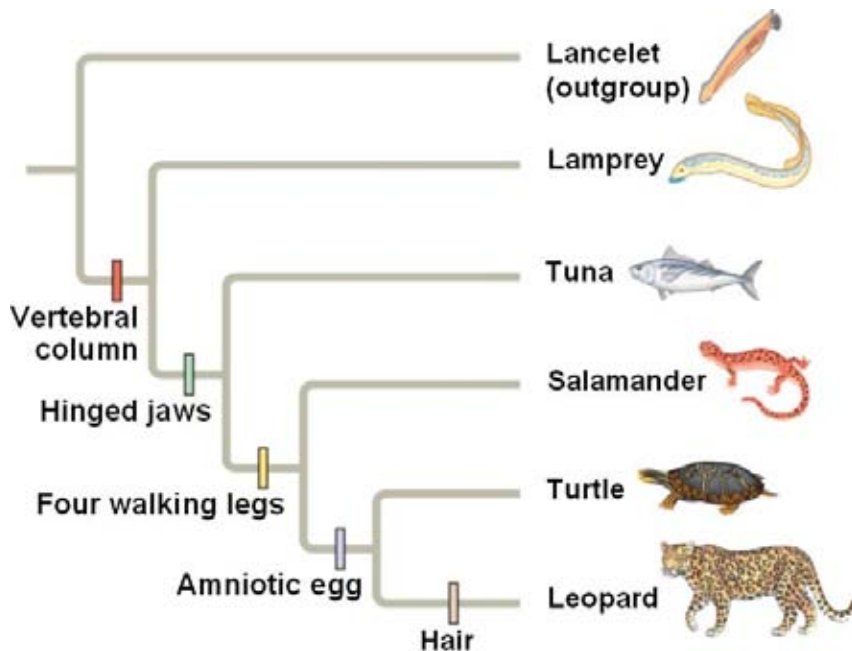
91. Australian and North American moles look very similar in appearance but their reproductive systems are dissimilar. This example would best illustrate:

- A) Homology
- B) Analogy
- C) Taxonomy
- D) Biogeography
- E) Embryology

92. Which of the following is/are correct about orthologous genes?

- I. They are homologous genes that are passed in a straight line from one generation to the next
- II. Involve gene duplication so more than one copy is in the same genome
- III. Diverge after speciation resulting in genes found in separate gene pools
- IV. Diverge within the same gene pool

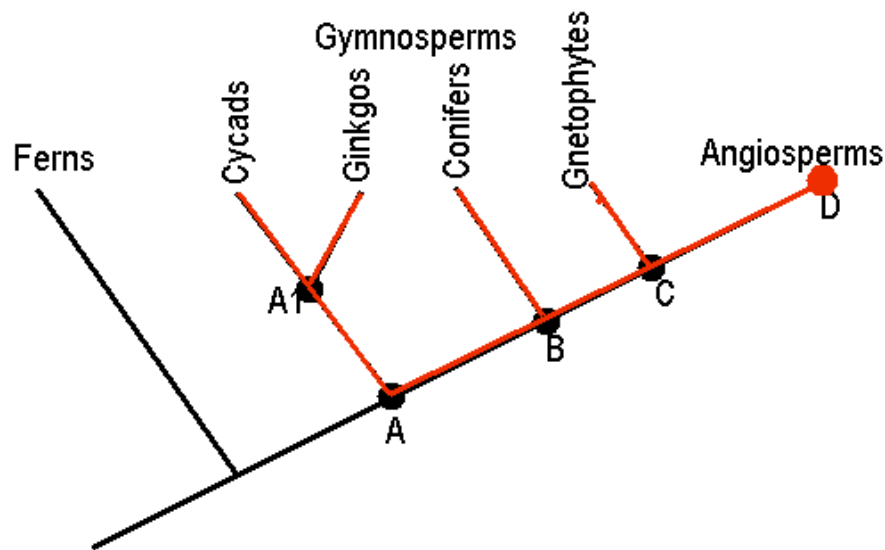
- A) I only
- B) II only
- C) I, III
- D) II, IV
- E) III, IV



93.

Based on the figure above, which conclusion (s) can you make?

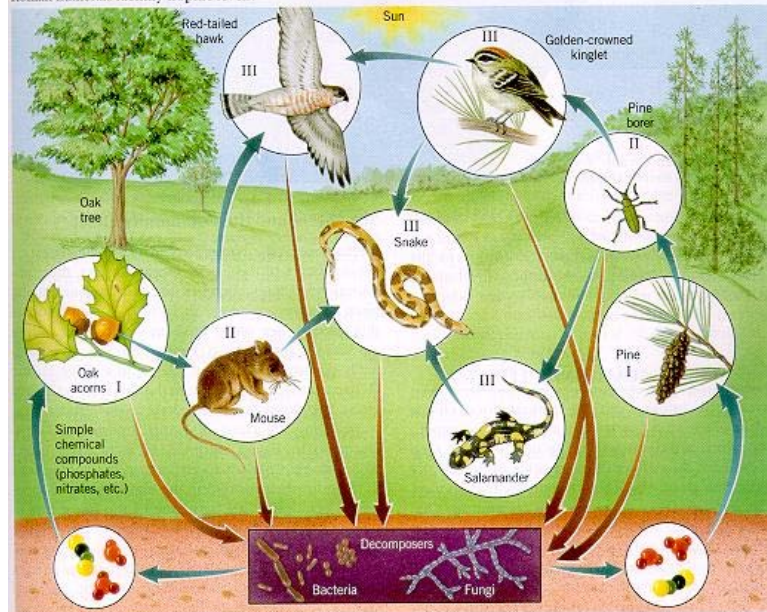
- A) Leopards are the most closely related to turtles
- B) Lampreys and tuna did not have a common ancestor
- C) Salamanders create amniotic eggs
- D) The only organisms with a hinged jaw are tuna and salamanders
- E) Lampreys do not have a vertebral column



94. The figure above represents:
- Monophyletic Grouping
 - Paraphyletic Grouping
 - Polyphyletic Grouping
 - Hierarchical Classification
 - Ultrametric Tree
95. How are ultrametric trees and phylograms different?
- There are no differences between the two
 - Phylograms account for the common ancestor while ultrametric trees do not
 - Phylgrams' branching patterns are equal lengths while ultrametric trees branching patterns vary
 - Ultrametric trees use data from fossil records while phylograms do not readily use fossil records
 - Phylograms do not show evolutionary rates while ultrametric trees do
96. Scientists speculate that the early earth's atmosphere was most likely comprised of:
- Nitrogen
 - Oxygen
 - Carbon Dioxide
 - Ammonia
 - Both A and C are correct
97. Which of the following biomes would you NOT expect to find in the Continental United States?
- Temperate Forest
 - Chaparral
 - Desert
 - Temperate Grassland
 - Tundra

98. Male stickleback fish will always attack other male fish that invade their nesting territory. The stimulus for the attack behavior is the red underside of the intruder. The male stickleback will not attack any intruding fish lacking a red belly. This behavior illustrates which theory?
- A) Imprinting
 - B) Fixed Action Pattern
 - C) Interspecific Competition
 - D) Population Dynamics
 - E) Migration
99. Why would organisms engage in the dispersion pattern of *clumped*?
- A) Increases effectiveness of hunting
 - B) Increases mating behavior
 - C) Environmental Factors
 - D) Increases aggressive interactions amongst neighbors
 - E) All are correct except for D
100. Ecologists have estimated that in a certain area there are enough resources available to sustain 1,000 white tail deer. Examining the population the ecologists find that there are 2,000 deer living in that area. This scenario describes:
- A) Density Independent Resources
 - B) Carrying Capacity
 - C) Interspecific Competition
 - D) Exponential Model
 - E) Overshooting
101. Raccoons would ideally like to feed on fruits and berries but due to competition with other organisms they have begun to feed on garbage. How does this example relate to the niche of the raccoons?
- I. Illustrates the difference between being a specialist and a generalist
 - II. Highlights the fundamental niche versus the realized niche
 - III. Specifies the variation dealing with interspecific and intraspecific competition
 - IV. Illustrates how raccoons are examples of keystone predators
- A) I only
 - B) III only
 - C) I & II
 - D) II, III, IV
 - E) II & IV
102. Scientists discovered that green algae grows on the fur of sloths, providing camouflage for the sloth while the algae is exposed to the sunlight in a dark forest. What type of relationship does this example illustrate?
- A) Symbiotic
 - B) Commensalism
 - C) Mutualism
 - D) Parasitism
 - E) Both A and C are correct

FIGURE 6.3 Food webs: (a) a typical terrestrial food web. Roman numerals identify trophic levels.



103.

Referring to the food web above, what would happen if there was an increase in the salamander population?

- I. The mouse population would decrease
- II. The snake population would increase
- III. The pine borer (insect) would decrease
- IV. The pine tree population would increase
- V. The golden crown kinglet would decrease
- A) II, III, IV
- B) I, II, III
- C) IV, V
- D) I, II, III, IV, V
- E) II, III, IV, V

104. Which of the following is **NOT** an example of a keystone species?

- A) Beaver
- B) Sea Otter
- C) Wolf
- D) Sea Urchins
- E) Both A and C are not keystone species

105. Which biome has the highest total net primary production rate?

- A) Open Ocean
- B) Savanna
- C) Desert
- D) Tundra
- E) Chaparral

- 106.** Why is an ecosystem's net primary production lower than its gross primary production?
- A) Gross primary production accounts for the evaporation of nutrients such as water
 - B) Net primary production takes into account runoff
 - C) Net primary production accounts for the loss of organic material due to cellular respiration
 - D) Gross primary production does not account for eutrophication
 - E) Both A and B are correct
- 107.** In the phosphorous cycle, where does the initial phosphate that begins the process come from?
- A) Weathering of rocks
 - B) Breakdown of ATP
 - C) Bacteria converting nutrients in the soil
 - D) Photosynthesis
 - E) Excretion of waste products
- 108.** The decline of pelicans, ospreys, and eagles after World War II was due to:
- A) Biological Magnification
 - B) Rising Carbon Dioxide Levels
 - C) Increase in Earth's Temperature
 - D) DDT
 - E) Both A and D are correct
- 109.** Which statement below accurately describes the function of vitamin D?
- A) Antioxidant
 - B) Important in blood clotting
 - C) Aids in absorption and use of calcium
 - D) Component of NAD⁺
 - E) Used in collagen synthesis
- 110.** Where does chemical digestion first begin in humans?
- A) Mouth
 - B) Esophagus
 - C) Stomach
 - D) Small Intestine
 - E) Large Intestine
- 111.** In general, why do herbivores have longer alimentary canals relative to their body size than carnivores?
- A) Carnivores have sharper teeth so they don't require as much absorption
 - B) Carnivores don't have as many enzymes to break down protein
 - C) Herbivores require more time for digestion and more surface area for absorption of nutrients
 - D) Herbivores' saliva does not contain amylase so more chemical digestion is needed in thier intestines
 - E) Both A and D are correct
- 112.** Which is the only oxygen rich vein in the human body?
- A) Inferior vena cava
 - B) Superior vena cava
 - C) Carotid vein
 - D) Pulmonary vein
 - E) Jugular vein

- 113.** Erythrocytes lack mitochondria. Given this information, erythrocytes most likely can not perform which cellular processes:
- A)** DNA Replication
 - B)** Transcription
 - C)** Translation
 - D)** Aerobic Respiration
 - E)** Protein Synthesis
- 114.** How do macrophages recognize infectious agents?
- A)** Infectious agents release histamine
 - B)** Receptors on the macrophage bind to the infectious agent
 - C)** Increase in blood flow near the entry of the infectious agent
 - D)** Decrease in blood flow near the entry of the infectious agent
 - E)** Fluctuation in the amount of carbon dioxide/oxygen in the body
- 115.** Organisms, such as mammals, release waste in the form of urea. What is a disadvantage of excreting this specific type of waste product?
- A)** Urea is very toxic
 - B)** Requires a large amount of water
 - C)** Expends a lot of energy to produce
 - D)** Requires a large amount of other nutrients to create such as carbon dioxide
 - E)** All of the above are disadvantages of urea
- 116.** Which of the following organs are properly matched with the hormone they release?
- A)** Parathyroid Gland- melatonin
 - B)** Pituitary Gland- Epinephrine
 - C)** Pancreas- Insulin
 - D)** Pineal Gland- Glucagon
 - E)** Thyroid- Androgen
- 117.** Which of the following is an example of positive feedback?
- A)** Body temperature regulation
 - B)** Glucose level regulation in the blood
 - C)** Decreasing eyesight
 - D)** Contractions during childbirth
 - E)** Stomach acid pH regulation
- 118.** What is the most abundant tissue in most organisms?
- A)** Connective
 - B)** Muscle
 - C)** Nervous
 - D)** Epithelial
 - E)** Brain

- 119.** Identify the correct pair:
- A)** Clotting elements- increase in temperature
 - B)** Histamines- initiates inflammatory response
 - C)** Prostaglandins- clot the blood
 - D)** Pyrogens- increases blood flow
 - E)** Neutrophils- carries oxygen
- 120.** What is the relationship between carbon dioxide concentration, pH levels, and breathing?
- A)** Carbon dioxide increases or blood pH decreases- breathing speeds up
 - B)** Carbon dioxide decreases or blood pH decreases- breathing speeds up
 - C)** Carbon dioxide increases or blood pH increases- breathing speeds up
 - D)** Carbon dioxide increases or blood pH decreases- breathing slows down
 - E)** Carbon dioxide decreases or blood pH increases- breathing speeds up

END OF TEST