

**The 64th Annual
Merck State Science Day Competition
May 19, 2014**

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 TEST view can be adjusted using the size control in the PDF viewer (eg Adobe Reader).

The test has **100 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.

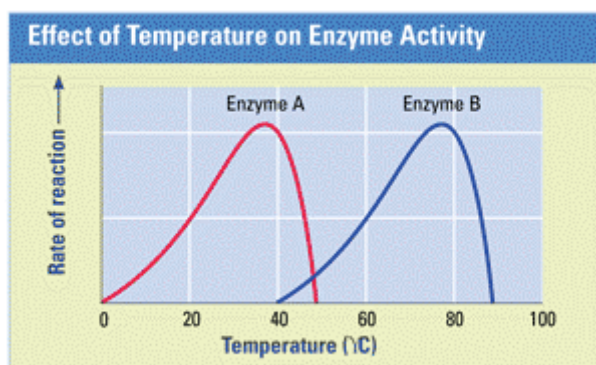
Multiple Choice

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

1. How are isotopes, specifically radioactive isotopes, useful in biology?
 - A) Determine the weight of an atom
 - B) Determine the age of fossils
 - C) Determine how electrons bind with protons
 - D) Determine the overall energy level of substances
 - E) None of the above are correct
2. Signal molecules, such as endorphins, bind to specific receptor molecules. Heroin, morphine, and other opiates will bind to these same receptor molecules. Why is this?
 - A) Endorphins, heroin, and morphine all have the same chemical formula.
 - B) Endorphins, heroin, and morphine all have the same molecular shape.
 - C) Endorphins, heroin, and morphine all have the same molecular weight.
 - D) Endorphins, heroin, and morphine all contain phosphorous.
 - E) None of the above are correct.
3. Water has a variety of properties. Which of the following properties is properly matched with the correct function of life?
 - A) Cohesion contributes to the transport of water and dissolved nutrients against gravity (in plants).
 - B) Cohesion contributes to the transport of water and dissolved nutrients towards gravity (in plants).
 - C) Adhesion of water in the walls of the cells helps counter the downward pull of gravity.
 - D) Both B and C are correct.
 - E) Both A and C are correct.
4. How does a water soluble protein such as lysozyme function in the human body?
 - A) Lysozyme binds to a specific water soluble receptor which in turn causes a chemical reaction.
 - B) Ionic and polar regions on the protein's surface attract water molecules; thereby dissolving the protein.
 - C) Lysozyme mixes with a colloid that dissolves it.
 - D) The hydrophilic end of lysozyme pairs up with the hydrophobic end of the cell membranes, in turn breaking down the protein.
 - E) The hydrophobic end of lysozyme pairs up with the hydrophilic end of the cell membranes, in turn breaking down the protein.
5. How many molecules of water are needed to completely hydrolyze a polymer that is 15 monomers long?
 - A) 15
 - B) 14
 - C) 16
 - D) 18
 - E) 13
6. How are cellulose and starch different?
 - A) Starch's monomers are in the alpha configuration while cellulose's monomers are in the beta configuration.
 - B) Starch's monomers are in the beta configuration while cellulose's monomers are in the alpha configuration.
 - C) Starch's shape is straight (never branched) while cellulose's shape is helical.
 - D) Starch's shape is helical while cellulose's shape is straight (never branched)
 - E) Both A and D are differences

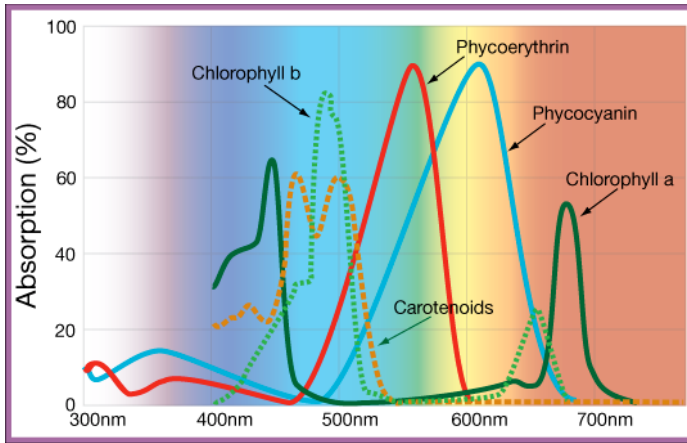
7. Which of the following statement (s) are *true* about phospholipids?
- A) A phospholipid has the same structural components as a fat.
 - B) The kink in one of the fatty acid tails of a phospholipid is due to a trans double bond.
 - C) All phospholipids are structurally identical
 - D) The phosphate group on the phospholipid head has a negative charge.
 - E) Small molecules usually bind to the fatty acid tails.
8. How does sickle cell hemoglobin differ from normal hemoglobin?
- A) The primary structure of sickle cell hemoglobin contains valine instead of glutamic acid.
 - B) The beta subunit in the secondary structure of a normal hemoglobin has the hydrophobic region exposed while the beta subunit of the sickle cell hemoglobin does not.
 - C) The primary structure of the sickle cell hemoglobin is composed of 20 amino acids while the primary structure of the normal hemoglobin is composed of 15 amino acids.
 - D) The quarternary structure of the sickle cell hemoglobin consists of four polypeptide subunits while the quarternary structure of the normal hemoglobin consists of two subunits.
 - E) None of the above are correct
9. After consuming a banana, which reaction (s) must occur for the amino acid monomers in the protein of the banana to be converted into proteins in your body?
- A) Dehydration Synthesis
 - B) Isomerization
 - C) Neutralization
 - D) Hydrolysis
 - E) Both A and D are correct
10. Why is the method of cell fractionation important to biologists?
- A) It separates prokaryotic cells from eukaryotic cells.
 - B) It isolates cell components which allows for further study of the function of the cell organelles.
 - C) It amplifies the size of the cells that the biologists are interested in studying.
 - D) It provides a fluorescence to the cells which makes the cells easier to explore.
 - E) It magnifies only the cells nucleus to study in more depth.
11. Which of the following is *NOT* true about central vacuoles in cells?
- A) Provide storage to the cell
 - B) Help in the breakdown of waste products
 - C) Prominent organelle in younger plant cells
 - D) Involved in the hydrolysis of macromolecules
 - E) Enlargement of vacuole is a major mechanism in plant growth
12. What is the role of the smooth endoplasmic reticulum in eukaryotic cells?
- A) Synthesis of lipids
 - B) Detoxification of drugs and poisons
 - C) Metabolism of carbohydrates
 - D) Storage of calcium ions
 - E) All of the above are correct
13. Cytoplasmic streaming in plant cells occurs due to the presence of which structure (s):
- A) Microtubules
 - B) Actin
 - C) Myosin
 - D) Cilia and Flagella
 - E) Both B and C are correct

14. Goldfish normally live in freshwater environments; however, a biology student places the goldfish in a saltwater tank. Why is this not a good idea?
- The student will be placing the goldfish into a hypertonic environment causing the fish's cells to shrivel.
 - The student will be placing the goldfish into a hypertonic environment causing the fish's cells to lyse.
 - The student will be placing the goldfish into a hypotonic environment causing the fish's cells to shrivel.
 - The student will be placing the goldfish into a hypotonic environment causing the fish's cells to lyse.
 - The student will be placing the goldfish into a hypertonic environment creating turgor pressure within the fish's cells.
15. The sodium-potassium pump is an example of what type of membrane protein:
- Integral Proteins
 - Peripheral Proteins
 - Channel Proteins
 - Carrier Proteins
 - None of the above are correct
16. Which of the following is *true* about endergonic reactions?
- The amount of free energy increases during endergonic reactions.
 - The amount of free energy decreases during endergonic reactions.
 - Endergonic reactions release free energy.
 - Endergonic reactions occur spontaneously.
 - Both B and C are correct.
17. Which of the following statement (s) are *true* about spontaneous changes?
- The free energy of the systems decreases.
 - The system becomes more stable.
 - The released free energy can be harnessed to do work.
 - Spontaneous changes are usually endergonic reactions.
- I, II, III, IV
 - I, III only
 - I, II, III
 - II, III only
 - II, III, IV



18. Based on the figure of enzymatic activity above, which statement (s) are true?
- Enzyme A functions optimally in a hot thermal vent.
 - Enzyme B functions optimally in the human body.
 - Enzyme A and B both denature at 50 degrees celcius.
 - Enzyme A and B never have the same rate of reaction.
 - None of the above are true.

19. _____ can be defined as the case in which a protein's function at one site is affected by the binding of a regulatory molecule at a separate site.
- A) Cooperativity
 - B) Cofactor
 - C) Allosteric Regulation
 - D) Feedback Inhibition
 - E) Coenzyme
20. How do enzymes lower the activation energy of reactions, thus, speeding up a reaction?
- A) Enzymes act as a template for substrate orientation.
 - B) Enzymes provide a favorable microenvironment.
 - C) Enzymes affect the amount of free energy for a reaction.
 - D) Both A and B are correct
 - E) Both B and C are correct
21. What molecule does acetyl co-A combine with to form citrate?
- A) Isocitrate
 - B) Oxaloacetate
 - C) Succinate
 - D) Glucose-6-Phosphate
 - E) Fructose- 1,6, Biphosphate
22. Cytochromes involved in the electron transport chain are structurally similar to which other molecule (s)?
- A) Ubiquinone
 - B) Flavin Mononucleotide
 - C) NADH
 - D) Hemoglobin
 - E) FADH₂
23. How are fermentation and cellular respiration similar?
- A) They are both anaerobic reactions.
 - B) They are both aerobic reactions.
 - C) They both rely on glycolysis to oxidize glucose to pyruvate.
 - D) They both use oxidative phosphorylation.
 - E) They both produce the same net amount of ATP.
24. Why are stomatas important in photosynthesis?
- A) Light independent reaction occurs in the stomata.
 - B) Energy from the sun is absorbed in the stomata.
 - C) Gas exchange takes place in the stomata.
 - D) ATP is produced in the stomata.
 - E) None of the above are correct.



25. Based on the graph above, what is true about carotenoids?
- Carotenoids are most efficient at absorbing light that has a wavelength of 700 nm.
 - Carotenoids are the least efficient at absorbing light that has a wavelength of 450 nm.
 - Carotenoids are equally efficient at absorbing light that has a wavelength of 450 nm and 500 nm.
 - Carotenoids have the biggest range of absorption in comparison to the other pigments in the graph.
 - Both A and C are correct
26. The reaction center of photosystem I is called P700. Why is this?
- There are approximately 700 chlorophyll molecules present there at any given time.
 - There are 700 electron acceptors located there.
 - The pigment in photosystem I most effectively absorbs light of wavelength 700 nm.
 - The pigment in photosystem I absorbs all wavelengths up to 700 nm.
 - It is named after the scientists who discovered it.
27. What are the three *main* phases in the light independent reaction?
- Carbon oxidation, carbon reduction, and isomerization
 - Carbon fixation, reduction, and regeneration of ribulose biphosphate
 - Reduction, carbon fixation, and chemiosmosis
 - Carbon fixation, regeneration of G3P, and reduction
 - Reduction, regeneration of G3P, carbon fixation
28. What is one of the *main* differences between C4 plants and CAM plants?
- C4 plants do not partake in the light independent reaction.
 - CAM plants do not partake in the light dependent reaction.
 - Carbon fixation of the light independent reaction occurs in different types of cells in C4 plants and the same cells in CAM plants.
 - Oxygen is the final electron acceptor in only CAM plants.
 - Sulfur dioxide is the final electron acceptor in only C4 plants.
29. Which stage of mitosis is generally considered to be the shortest in terms of time?
- Prophase
 - Metaphase
 - Anaphase
 - Telophase
 - Cytokinesis

30. Which of the following statement (s) are *true* about meiosis?
- A) During anaphase I the homologous chromosomes separate.
 - B) There is no interphase between meiosis I and meiosis II.
 - C) Crossing over usually occurs during prophase I.
 - D) At the end of meiosis II, four genetically different haploid cells are produced.
 - E) All of the above are correct
31. A body cell of a turkey contains 80 chromosomes. How many chromosomes would a turkey sperm cell contain?
- A) 20
 - B) 40
 - C) 80
 - D) 160
 - E) 240
32. How are mitosis and meiosis similar?
- A) They both produce diploid cells.
 - B) Crossing over occurs in prophase in both mitosis and meiosis.
 - C) They both are preceded by a replication of chromosomes.
 - D) Synapsis of homologous chromosomes occurs in both processes.
 - E) They both reduce the number of chromosomes by half.
33. Under what circumstances would crossing over during meiosis *not* contribute to genetic variation among daughter cells?
- A) If there are mutations in both the maternal and paternal chromatids that undergo crossing over.
 - B) If crossing over doesn't occur during prophase but rather in metaphase.
 - C) If the segments of the maternal and paternal chromatids that undergo crossing over are genetically identical.
 - D) If the organisms contain the same number of chromosomes in their gametes.
 - E) Impossible. Crossing over always results in genetically different cells that is why it is such an important part of evolution.
34. How many chromatids are in 5 duplicated chromosomes?
- A) 2
 - B) 5
 - C) 10
 - D) 20
 - E) 25
35. What was one of the earliest experiments conducted that alluded to the genetic role of DNA?
- A) Hershey & Chase's work with bacteriophages
 - B) Griffith's work with bacteria that causes pneumonia
 - C) Avery, McCarty, & MacLeod's experiments that deduced DNA was a transforming agent
 - D) Chargaff's analysis on the components of DNA
 - E) Watson & Crick's work on the structure of DNA
36. During DNA replication, which molecule removes the primer from the 5' end of both strands?
- A) Primase
 - B) DNA polymerase I
 - C) DNA polymerase III
 - D) DNA ligase
 - E) Helicase

37. Why does only eukaryotic DNA require telomeres?
- A) Prokaryotes are very tiny cells so telomeres would take up too much room.
 - B) Prokaryotic DNA is circular.
 - C) Prokaryotes have tetrameres instead of telomeres.
 - D) Prokaryotes do not perform DNA replication.
 - E) None of the above are correct
38. Why are polyribosomes beneficial to cells?
- A) They prevent the DNA from being degraded.
 - B) They allow the mRNA to move throughout the cytoplasm of the cell.
 - C) They aid in splicing the mRNA transcript.
 - D) They enable the cell to produce multiple copies of a polypeptide in a short time.
 - E) They allow DNA to be replicated from both 5'-3' ends and 3'-5' ends.
39. Which of the following types of mutations usually leads to a nonfunctional protein?
- A) Insertion
 - B) Deletion
 - C) Nonsense
 - D) Missense
 - E) Mutagen
40. An organism is able to produce more than one type of polypeptide from a single gene. This is due to which mechanism or molecule listed below?
- A) Histone acetylation
 - B) Retrotransposons
 - C) Pseudogene
 - D) RNA splicing
 - E) DNA methylation
41. Y-linked genes would be passed from
- A) mother to son.
 - B) mother to daughter.
 - C) father to son.
 - D) father to daughter.
 - E) more than one of the above is correct.

For question 42

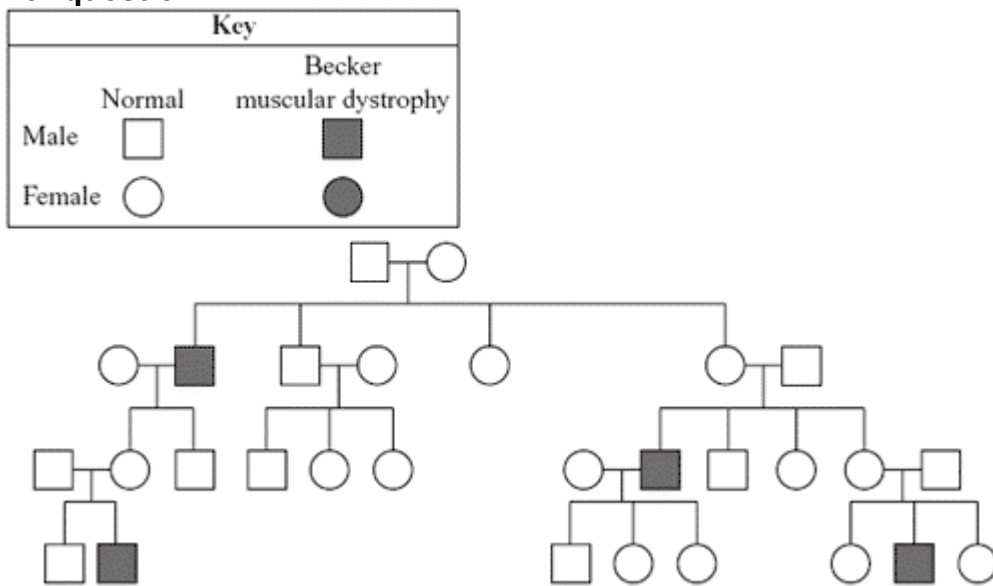


Image from <http://stangbio.wikispaces.com/Inheritance>

42. The most likely mode of inheritance from the pedigree above is
- autosomal dominant.
 - autosomal recessive.
 - sex-linked dominant.
 - sex-linked recessive.
 - incompletely dominant.
43. Why does one couple in the second generation NOT have any children with Becker muscular dystrophy?
- The condition is recessive and possibly hiding in one or more of the children.
 - The parents are not carriers of the condition.
 - The condition is only inherited from the father and this father does not carry the allele.
 - The family is small and random chance kept the condition from being passed to the children.
 - There is not enough information to decide.

Coat color in Labrador retrievers is determined by two genes. One allele (B) creates a dark black coat while the recessive version of this gene creates a brown coat. A second gene (E) determines whether or not pigment will be deposited in the fur. The dominant allele allows pigment; the recessive does not. Dogs homozygous for e will have a yellow coat.

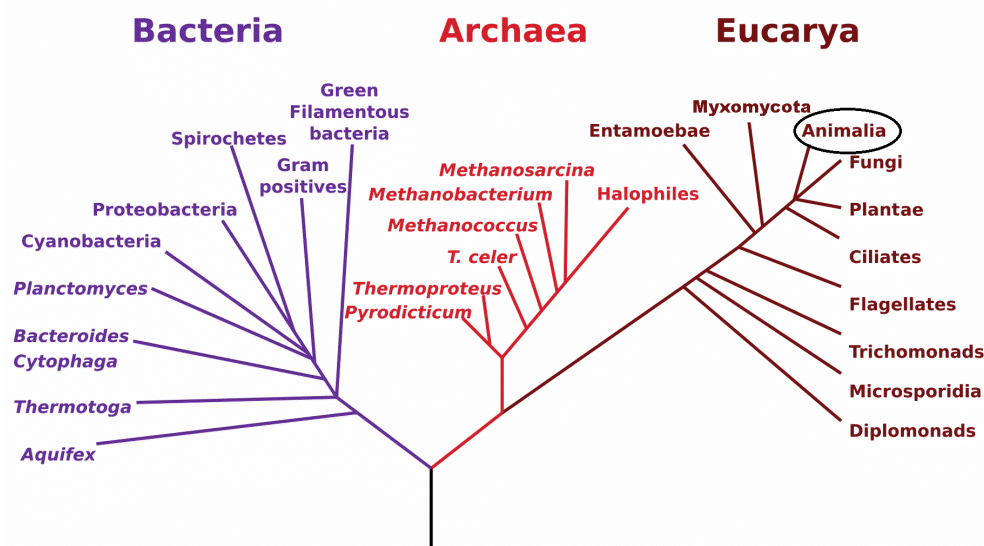
44. Which of the following mating is most likely to produce yellow puppies?
- EEBB x eebb
 - EeBb x EEbb
 - Eebb x EeBb
 - eeBb x EEbb
 - eeBB x EEbb
45. Which of the following pairs should have the most diverse set of coat colors in their puppies?
- EEBB x eebb
 - EeBb x eebb
 - EeBB x eebb
 - Eebb x eeBB
 - eeBB x Eebb

46. A student notices a plant with some green leaves and some white leaves. She picks some of each type of leaf, inserts them into moist soil and grows new plants. Most of the green leaves give rise to plants with all green leaves, but a few generate plants with both green and white leaves. The original white leaves generate short-lived plants with white leaves. She concludes that the white color is inherited
- A) in a simple dominant/ recessive pattern.
 - B) in an incompletely dominant pattern.
 - C) in a co-dominant pattern.
 - D) as a sex-linked gene.
 - E) in a non-Mendelian pattern.
47. Which of the following types of evidence did NOT help Darwin formulate his theory of evolution?
- A) studying types of tortoises
 - B) comparing organisms in England and South America
 - C) comparing cytochrome c sequences
 - D) studying fossil collections
 - E) comparing organisms in different regions of South America

Albinism in cats is caused by a recessive allele. One cat in a population of 25 feral cats is an albino.

48. What is the frequency of the albinism allele in this population?
- A) 0.04
 - B) 0.01
 - C) 0.2
 - D) 0.32
 - E) 0.8
49. This population of cats was studied again, 10 years later. Now the number of albino cats was 1 out of a population of 100. The researcher suggested which of the following explanations?
- A) Albino cats have larger litters than non-albino cats.
 - B) Albino cats have a better survival rate.
 - C) Albino cats have moved into the area.
 - D) Albino cats have a better adoption rate.
 - E) Albino cats have a high mutation rate.

Phylogenetic Tree of Life



50. Which of the following evidences would best fit this tree?
- A) All of these organisms share a common genetic code.
 - B) All of these groups have introns in their chromosomes.
 - C) All of these organisms are made of cells.
 - D) only 2 of the above
 - E) none of the above
51. According to this tree
- A) Bacteria are the ancestors of Eucarya.
 - B) Archaea are the ancestors of Eucarya.
 - C) Eucarya and Archaea share a more recent common ancestor with each other than with Bacteria.
 - D) Bacteria and Archea share a more recent common ancestor with each other than with Eucarya.
 - E) None of the above; phylogenetic trees do not indicate time.
52. Evidence suggesting that RNA was the first genetic material instead of DNA would include all of the following EXCEPT
- A) some RNAs have catalytic abilities.
 - B) some viruses use RNA as their genetic material.
 - C) all organisms use RNA.
 - D) RNA can occur in many different forms.
 - E) RNA can be self-replicating.
53. Which of the following are NOT homologous structures?
- A) cactus spines and oak tree leaves
 - B) pea tendrils and succulent leaves
 - C) Venus fly trap's "trap" and ash leaves
 - D) poinsettia red flowers and ivy leaves
 - E) broccoli tops and maple leaves
54. During mating season, males of a species may engage in combat or ritualized displays. This is an example of
- A) intrasexual selection.
 - B) intersexual selection.
 - C) random mating.
 - D) natural selection.
 - E) disruptive selection.
55. Two types of plants appear to be identical, live in the same habitat, yet they bloom at different times of the year. They continue to be separate species due to
- A) prezygotic isolating mechanisms.
 - B) mechanical isolating mechanisms.
 - C) allopatric speciation.
 - D) hybrid breakdown.
 - E) genetic isolation.
56. The variety of "Darwin's finches" is due to
- A) intersexual selection.
 - B) adaptive radiation.
 - C) evolutionary bottleneck.
 - D) artificial selection.
 - E) temporal isolation.

57. What taxonomic category is the grouping “mammalia”?
- domain
 - kingdom
 - phylum
 - class
 - order
58. Which of the following statements is TRUE?
- Ectotherms are cold-blooded.
 - An endotherm’s body temperature may vary periodically.
 - Venous blood is blue.
 - Positive feedback loops usually contribute to homeostasis.
 - Animal tissues fall into five main categories.
59. Which vitamin prevents scurvy?
- Vitamin A
 - Vitamin B2
 - Vitamin B6
 - Vitamin C
 - Vitamin D
60. The most important structure of the digestive system is the
- mouth.
 - stomach.
 - small intestine.
 - gall bladder.
 - large intestine.

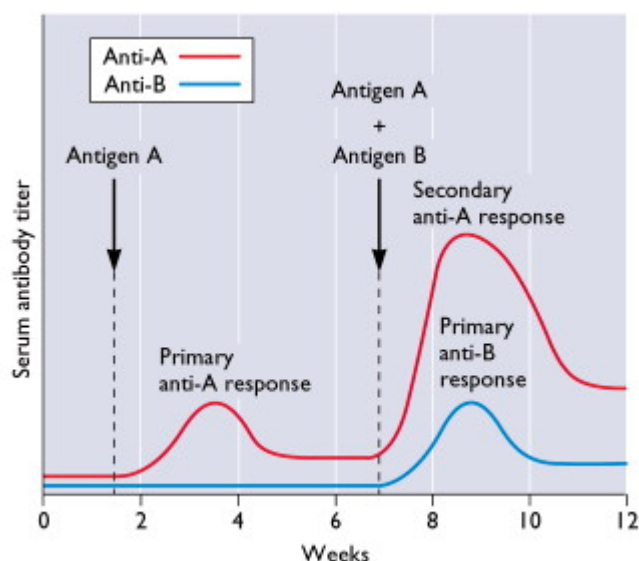


image from <http://www.virology.ws/wp-content/uploads/2009/07/immune-memory.jpg>

61. Which of the following statements is NOT supported by the graph?
- The immune response is specific.
 - The subject has been successfully vaccinated against Antigen A.
 - The immune response includes memory.
 - The subject may be successfully vaccinated against Antigen B.
 - Antigen A is more virulent than Antigen B.
62. The primary type of antibody produced during weeks 2-4 is
- IgA
 - IgD
 - IgE
 - IgG
 - IgM

63. Which of the following is NOT considered an autoimmune disease?
- A) systemic lupus erythematosus
 - B) muscular dystrophy
 - C) type I diabetes
 - D) multiple sclerosis
 - E) rheumatoid arthritis
64. When blood pressure or blood volume drops in the afferent glomerular arteriole, which of the following hormones would be released first?
- A) angiotensin II
 - B) FSH
 - C) thyroxin
 - D) melatonin
 - E) renin
65. A surge in _____ production triggers ovulation in human females.
- A) LH
 - B) progesterone
 - C) FSH
 - D) prolactin
 - E) oxytocin
66. If a hole forms between the right and left ventricles of a mammalian heart, then oxygen content in the _____ would be abnormally low.
- A) aorta
 - B) pulmonary artery
 - C) superior vena cava
 - D) inferior vena cava
 - E) pulmonary vein
67. You are walking in a forest and notice that many of the plants have wide leaves. There is little underbrush but many epiphytes. You are in a
- A) temperate rainforest.
 - B) tropical rainforest.
 - C) taiga.
 - D) tropical dry forest.
 - E) coniferous forest.
68. Large mammals are rarely found in
- A) tropical rainforests.
 - B) savannas.
 - C) taigas.
 - D) polar regions.
 - E) deserts.
69. Which New Jersey ecosystem is maintained by fire?
- A) temperate deciduous forest
 - B) pine barrens
 - C) coastal shores
 - D) bays
 - E) temperate grasslands.
70. Nevada is mostly desert due to
- A) prevailing easterly winds.
 - B) high altitude.
 - C) rain shadow effect.
 - D) low latitude.
 - E) high mean temperatures.

71. Acid precipitation is mainly caused by
- A) run-off from mining.
 - B) burning of coal.
 - C) depletion of the ozone layer.
 - D) climate change.
 - E) increased human population.
72. Barnegat Bay has experienced decreased dissolved oxygen levels, a harmful algal bloom and a loss of biodiversity. One of the most prominent recommendations to stop this decline is to
- A) reduce allowed catches by party boats.
 - B) regulate application of lawn fertilizer in the watershed area.
 - C) shut down the Oyster Creek nuclear facility.
 - D) rebuild the dunes destroyed by Superstorm Sandy.
 - E) prohibit jet skies and outboard motor use in the bay.
73. Snowy owls appeared in New Jersey in unexpectedly high numbers. This large migration happens at unpredictable intervals. The snowy owls are exhibiting a _____ population curve in New Jersey.
- A) explosive
 - B) logistic
 - C) exponential
 - D) irruptive
 - E) cyclic

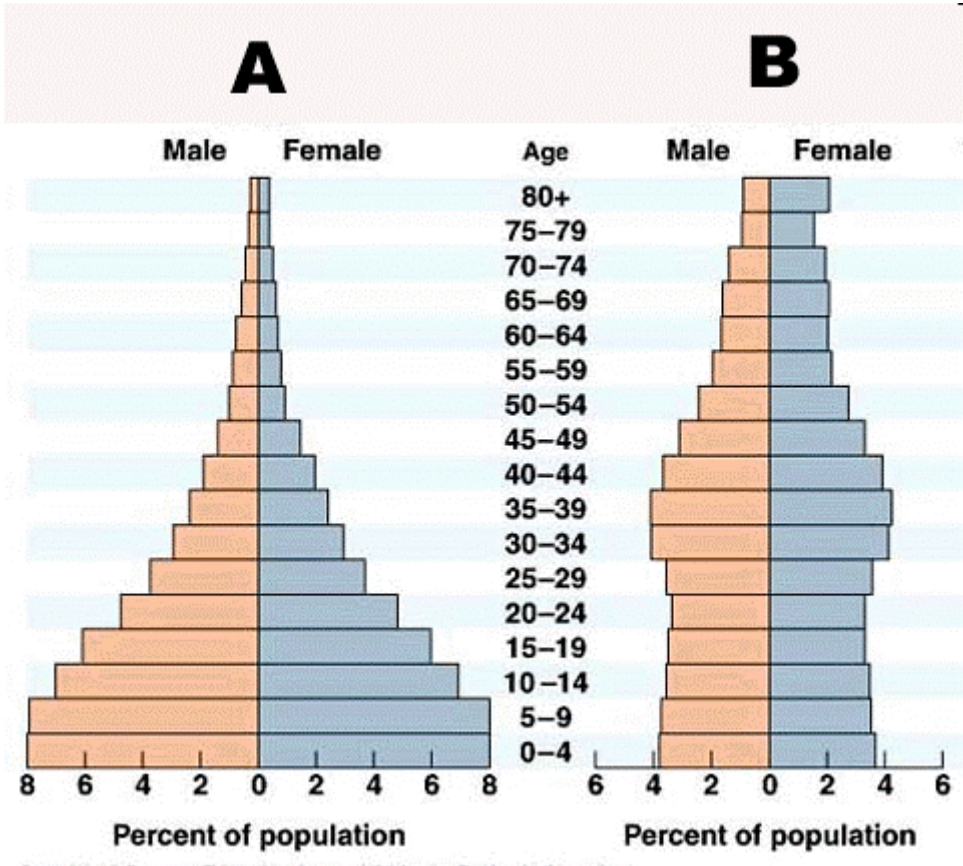


Image from <http://www.quia.com/files/quia/users/lmcgee/ecology/age-structure-diagram.gif>

74. Which of the follow statements is supported by the diagram?
- A) A is a developing country.
 - B) B is a country in Asia.
 - C) A has a larger population than B.
 - D) Males live longer lives than females.
 - E) A is a country in Europe.

75. Why are ketones and aldehydes similar?
- A) They are both hydrophilic.
 - B) They both contain a carbonyl group.
 - C) They both contain a carboxyl group
 - D) Both A and C are correct
 - E) Both A and B are correct
76. The amino acid, *threonine*, is structurally similar to which amino acid listed below:
- A) aspartic acid
 - B) lysine
 - C) glycine
 - D) serine
 - E) isoleucine
77. How do peroxisomes detoxify liver cells?
- A) Form vesicles that eliminate the poisons from the liver cells
 - B) Contain starch which absorbs any unnecessary molecule in the liver cells
 - C) Transfer hydrogen from the poisons in the liver cells
 - D) Contain cellulose which absorbs unnecessary molecules in the liver cells
 - E) Use energy from phosphate groups to eliminate waste products
78. How does cholesterol affect the fluidity of the plasma membrane?
- A) At lower temperatures it reduces the membrane fluidity by reducing phospholipid movement.
 - B) At moderate temperatures it hinders solidification by disrupting the regular packing of phospholipids.
 - C) At lower temperatures it increases the amount of water present in the cell.
 - D) At moderate temperatures it reduces the membrane fluidity by reducing phospholipid movement.
 - E) At higher temperatures it hinders solidification by disrupting the regular packing of phospholipids.
79. How would the saturation levels of membrane fatty acids differ in plants adapted to cold environments?
- A) Plants adapted to cold environments would be expected to have more saturated fatty acids in their membranes.
 - B) Plants adapted to cold environments would be expected to have more unsaturated fatty acids in their membranes.
 - C) Plants adapted to cold environments would have an equal number of saturated and unsaturated fatty acids in their membranes.
 - D) Plants adapted to cold environments would be expected to have more glycoproteins present in their membranes.
 - E) Plants adapted to cold environments would be expected to have less glycoproteins present in their membranes.
80. Which enzyme is most closely involved with regulating cellular respiration?
- A) Phosphofructokinase
 - B) Isomerase
 - C) Polymerase
 - D) Hexokinase
 - E) Aldolase

81. A biologist treats cells with a substance that prevents DNA synthesis. This treatment traps the cells in which part of the cell cycle?
- A) G0
 - B) G1
 - C) S
 - D) Prophase
 - E) Telophase
82. What mechanisms contribute to genetic variation arising from sexual reproduction?
- I. Crossing Over
 - II. Independent Assortment of Chromosomes
 - III. Random Fertilization
- A) I and II
 - B) I and III
 - C) II and III
 - D) II only
 - E) I, II, and III
83. During which stage (s) of a cell cycle would a chromosome consist of two identical chromatids?
- A) G1 phase
 - B) S phase
 - C) Anaphase
 - D) Telophase
 - E) None of the above are correct
84. An mRNA contains approximately 36 nucleotides. How many amino acids would you expect to find on the polypeptide chain that the mRNA codes for?
- A) 3
 - B) 6
 - C) 12
 - D) 21
 - E) 36
85. A dihybrid cross was performed between two animals, both heterozygous for each trait. Over a period of years, 50 offspring were recorded. The phenotype ratio of the offspring was 9:4:3. The best explanation for these results is
- A) this is the expected ratio for a dihybrid cross.
 - B) these genes must be linked.
 - C) there must be a lethal homozygous gene.
 - D) there is not a large enough population to obtain good results.
 - E) there must be an epistatic interaction between these genes.
86. If an organism with genotype AaBbCCDdEE is crossed with an organism with genotype AaBBccDdEe, what is the probability of an offspring having the genotype AABbCCDDEE?
- A) 1/2
 - B) 1/4
 - C) 1/32
 - D) 1/64
 - E) 1/128

Parakeet (budgie) feather basic color is determined by two alleles: yellow-based and white-based. The yellow-based allele (B) is dominant to the recessive white-based allele. A bird that has the yellow-based allele can display green color feathers while a bird with only the white-based allele will have blue color feathers. There are also two alleles that determine the darkness of a budgie's body color: the normal gene and the dark factor gene. The dark factor gene (D) is incompletely dominant to the recessive normal gene. Therefore there are three possible dark factor genetic combinations for any budgie; these interact with the base color in the following manner:

dd - normal light colored budgie (light green or sky blue).
Dd - dark green or cobalt
DD - olive or mauve

information from <http://www.budgieplace.com/>

87. A mauve budgie is mated with a light green budgie. Which of the following color combinations would be expected in the offspring?
- A) dark green and cobalt only
 - B) dark green, blue and light green
 - C) olive and cobalt only
 - D) olive and sky blue
 - E) none of the above
88. A dark green budgie could have all of the following genotypes EXCEPT
- A) DdBb
 - B) DdBB
 - C) Ddbb
 - D) ddBB
 - E) more than one of the above would not apply
89. *Hox* genes are important to evolutionary theory because they
- A) are highly conserved from species to species.
 - B) play different roles in the development of different species.
 - C) are very similar in both plants and animals.
 - D) explain how major body plans can change rapidly.
 - E) are involved in the development of human speech.
90. Which of the following is mismatched?
- A) digestive system - villi
 - B) respiratory system - alveoli
 - C) excretory system - nephron
 - D) integumentary - sweat glands
 - E) muscular system - neuron
91. Which of the following is the correct sequence of embryonic development?
1. invagination
 2. cleavage
 3. gastrulation
 4. organogenesis
 5. blastulation
- A) 1 --> 2-->3 --> 4 -->5
 - B) 2 --> 3 --> 4 --> 1 --> 5
 - C) 2 --> 4 --> 5 --> 1 --> 3
 - D) 2 --> 5--> 3 --> 1 --> 4
 - E) 2 --> 1 --> 5 --> 3 --> 4

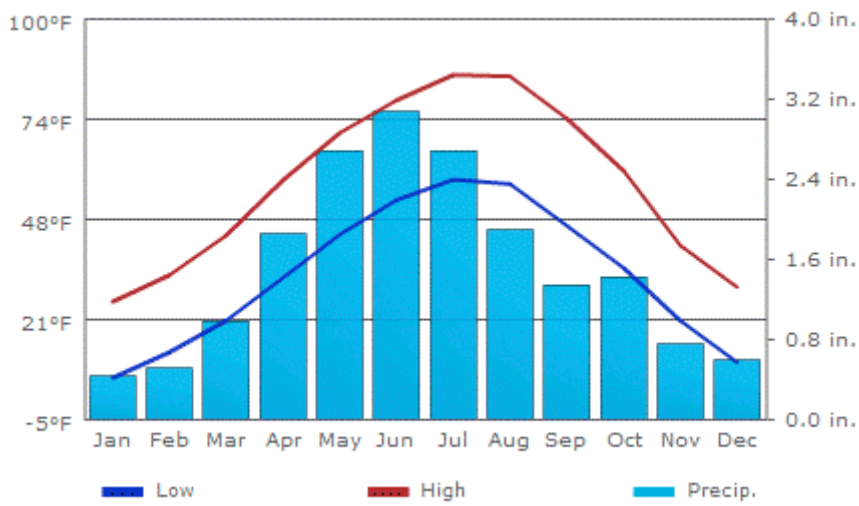
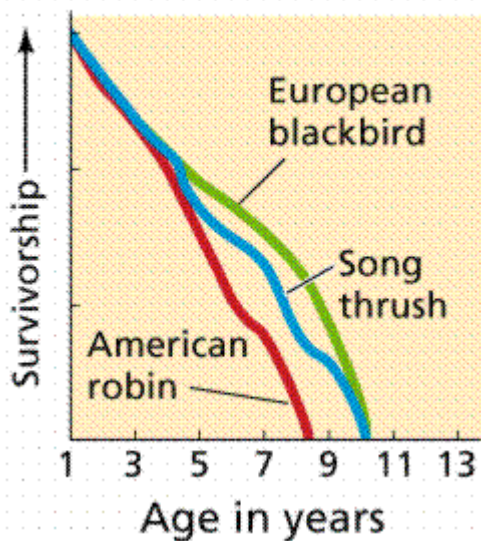


image from <http://www.usclimatedata.com/images/climate-chart/ussd0192-climate-lemmon.gif>

92. The climatogram is typical of a
- prairie.
 - temperate desert.
 - temperate deciduous forest.
 - savanna.
 - taiga.

(c) Some wild birds



(d) Dall sheep

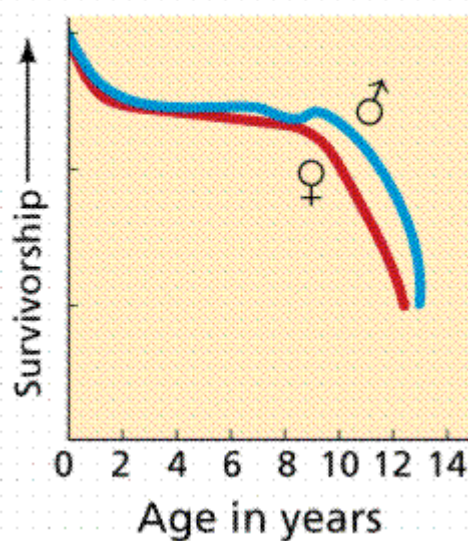


image from http://www2.estrellamountain.edu/faculty/farabee/BIOBK/lifehist_2.gif

93. The Dall sheep population curve is typical of a _____ life history.
- Type I
 - Type II
 - Type III
 - Type IV
 - Type V

94. The Dall sheep appear to be
- r-strategists.
 - k-strategists.
 - endangered.
 - invasive.
 - l-strategists.

Matching

The following choices may be used once, more than once, or not at all.

- | | |
|-----------------------|----------------------|
| A) alveolata | D) bryophytes |
| B) chlorophyta | E) pterophyta |
| C) zygomycota | |

- 95.** This group represents the transition from an aquatic to a terrestrial environment.
- 96.** This group represents ancestors of plants.
- 97.** Bread mold belongs to this group.
- 98.** Members of this group are responsible for red tides.
- 99.** This group contains vascular tissue.
- 100.** This group has a dominant gametophyte stage.

==== End of Test ===