

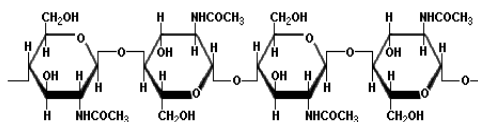
Science League Biology II January 2012

Choose the answer that best completes the statements or questions below and fill in the appropriate response on the scan-tron. If you change your answer be sure to completely erase your first choice, please **PRINT** your name, school, area, and which test you are taking on the scan-tron. This exam is for AP level students.

1. In ammonium chloride salt (NH_4Cl) the anion is a single chloride ion, Cl^- . What is the cation of NH_4Cl ?
 - a. N, with a charge of +3
 - b. H, with a charge of +1
 - c. NH_4 with a charge of +4
 - d. H_2 with a charge of +4
 - e. NH_4 with a charge of +1
2. A London Dispersion interaction is the weak attraction between:
 - a. a polar molecule and a nearby nonpolar molecule.
 - b. the nucleus of one molecule and the electrons of a nearby molecule.
 - c. the electrons of one molecule and the electrons of a nearby molecule.
 - d. a polar molecule and a nearby molecule that is also polar.
 - e. none of these choices..
3. The figure below is picture of a molecule that can:



- a. be found in DNA
 - b. be found in RNA
 - c. be found in an energy producing molecule
 - d. a & c
 - e. a, b, and c.
4. A particular cell's main function is the formation of protein for export outside the cell. Therefore the following organelle(s) would be numerous in this cell:
 - a. RER
 - b. free ribosomes
 - c. Golgi Apparatus
 - d. a and c but not b
 - e. b and c but not a
 5. Viewing the following molecule where might you find it?



- a. Plant cell
 - b. Fungal cell
 - c. Bacteria cell
 - d. a and b but not c
 - e. none of the above
6. Which of the following substances are produced by the light reactions of photosynthesis?
 - a. ATP and NADPH
 - b. ATP and NADH
 - c. ATP and FADH
 - d. NADH and glucose
 - e. NADPH and glucose
 7. A homicide has been committed and the killer left some cellular material behind. Which of the following organelles might yield a clue as to whom the murderer is?
 - a. ribosomes
 - b. chloroplasts
 - c. mitochondria
 - d. lysosomes
 - e. SER

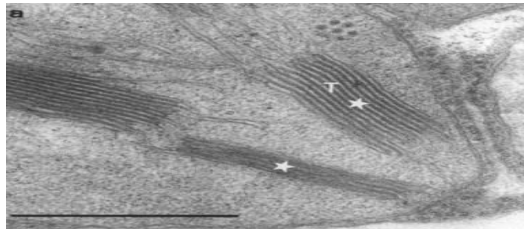
Use the following information to answer the following questions 8-9.

Succinate dehydrogenase catalyzes the conversion of succinate to fumarate. The reaction is inhibited by malonic acid, which resembles succinate but cannot be acted upon by succinate dehydrogenase. Increasing the ratio of succinate to malonic acid reduces the inhibitory effect of malonic acid.

8. Based on this information, which of the following is correct?
 - a. Malonic acid is the product, and fumarate is a competitive inhibitor.
 - b. Succinate dehydrogenase is the enzyme, and malonic acid is the substrate.
 - c. Succinate dehydrogenase is the enzyme, and fumarate is the substrate.
 - d. Succinate is the substrate, and fumarate is the product.
 - e. Fumarate is the product, and malonic acid is a noncompetitive inhibitor.

9. What is the purpose of using malonic acid in this experiment?
 - a. It is a competitive inhibitor.
 - b. It is a noncompetitive inhibitor.
 - c. It replaces the usual enzyme.
 - d. It is able to bind to succinate.
 - e. It blocks the binding of fumarate.

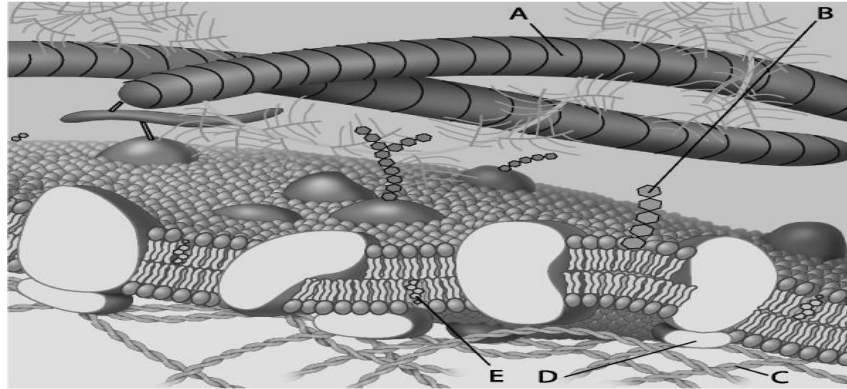
10. Right at the edge of the plasma membrane there is an electrochemical gradient. This gradient, moving from outside the cell to inside the cell, is approximately _____ mV and is the result of _____.
 - a. -70, more cations inside the cell than anions outside the cell
 - b. +70, more cations inside the cell than anions outside the cell
 - c. -70, more anions inside the cell than cations outside the cell
 - d. +70, more anions inside the cell than cations outside the cell



11. Examine the figure above. What process takes place at the sites where the white stars are located?
 - a. Calvin Cycle
 - b. Capturing of sunlight
 - c. Krebs Cycle
 - d. Glycolysis

12. A botanist studies a new species of plant and finds that it does not consume carbon dioxide during the day. Which of the following is true about the plant?
 - a. It only performs the Calvin cycle during the day.
 - b. It only performs the Calvin Cycle at the same time as the light reactions.
 - c. It only performs the Calvin cycle when it rains.
 - d. It only performs the Calvin Cycle at night.
 - e. It's not performing the Calvin cycle but the Cam cycle.

Use the figure to answer questions 13-15

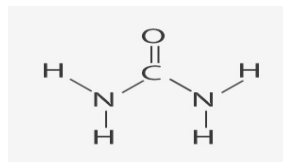


13. Which labeled structure is most likely made up of the protein tubulin?
14. Which labeled structure most likely contains a carbohydrate?
15. Which labeled structure is most likely produced by the smooth endoplasmic reticulum?
16. Who set up a closed system to mimic Earth's early atmosphere and discharged electrical sparks through it so that a variety of organic compounds common in organisms were formed?
 - a. Hermann Kolbe
 - b. Jakob Berzelius
 - c. Stanley Miller
 - d. August Kekulé
 - e. Friedrich Wohler

Use the following information for questions 17- 18

Solution A has a pH of 12. Solution B has a pH of 2.35. Solution C has a pH of 5 while solution D has a pH of 7.35.

17. Which statement is true regarding the hydrogen ion concentration in the four solutions?
 - a. Solution C has 10,000,000 times less hydrogen ions than solution A.
 - b. Solution B has 1,000 times more hydrogen ions that solution C.
 - c. Solution A is the strongest acid.
 - d. Solution D is a neutral solution.
 - e. Solution D has 100,000 fewer-hydrogen ions than solution B.
18. What would happen to pepsin, an enzyme that works best in the stomach where the pH is low, if it were placed into solution A?
 - a. Only the primary structure of pepsin would be left.
 - b. Only the primary and secondary structure of pepsin would be left
 - c. Only the tertiary structure of pepsin would be left.
 - d. The enzyme would still work but very slowly.
 - e. There would be no structural change.
19. Which of the following people's synthesis of this compound from inorganic starting materials provided evidence against vitalism?



- a. Jakob Berzelius
 - b. Hermann Kolbe
 - c. Friedrich Wohler
 - d. Stanley Miller
 - e. August Kekulé
20. Which of the following is not found in all proteins?
 - a. Primary Structure
 - b. Secondary Structure
 - c. Tertiary Structure
 - d. Quaternary Structure
 - e. All are found in all proteins

21. The breakdown of glucose into pyruvic acid occurs during the process of _____ that takes place in the _____.
- Glycolysis, mitochondria
 - Glycolysis, cytoplasm
 - Lactic acid fermentation, mitochondria
 - Lactic acid fermentation, cytoplasm
 - The Krebs Cycle, cytoplasm
22. A cell whose cytoplasm has a concentration of 0.04 molar glucose is placed in a test tube containing a solution of 0.02 molar glucose. Assuming that glucose is not actively transported into the cell, which of the following terms describes the tonicity of the external solution relative to the cytoplasm of the cell?
- turgid
 - hypotonic
 - flaccid
 - hypertonic
 - isotonic
23. When glucose is broken down to pyruvic acid, which of the following is true:
- There are 2 molecules of pyruvic acid formed in the cytoplasm.
 - There are 3 molecules of pyruvic acid formed in the cytoplasm.
 - There are 2 molecules of pyruvic acid formed in the mitochondria.
 - There are 3 molecules of pyruvic acid formed in the mitochondria.
24. Which change below could make carbon-12 radioactive?
- Change the number of protons
 - Change the number of electrons
 - Change the number of neutrons
 - Change the atomic number
 - Change it to an ion

Use the following figures to answer question 25;

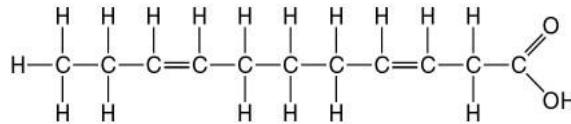


Figure A

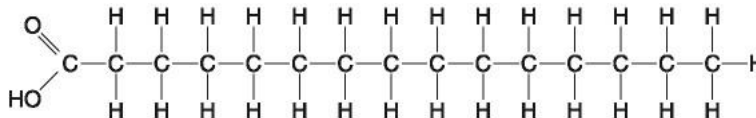


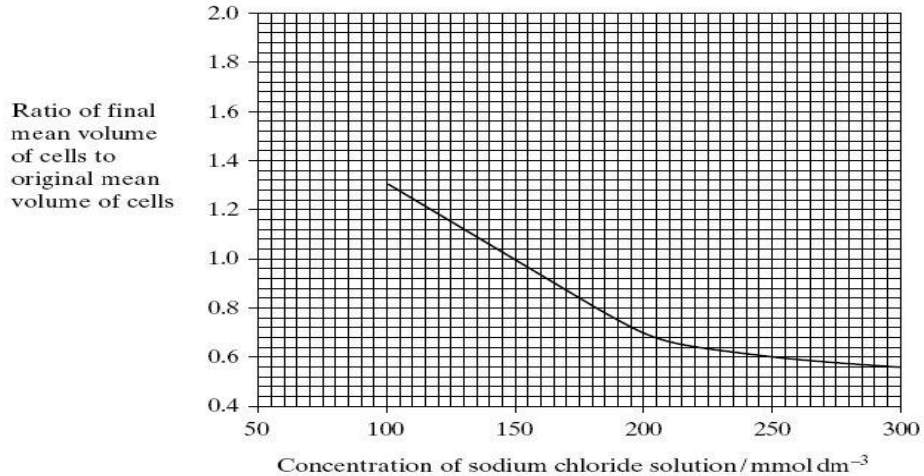
Figure B

25. Which of the following statements is **true**?
- Figure A is saturated
 - Figure B is unsaturated
 - Figure A & B are both carbohydrates
 - Figure A & B are both fatty acids
 - Figure B can be hydrogenated
26. Which of the following best explains why different enzymes work best at different pHs?
- Different enzymes are made from different amino acids.
 - The three-dimensional folding of an enzyme is affected by the concentration of hydrogen ions in its environment.
 - Enzymes that are present at low pH's work best at low pHs.
 - Cells change their pH to regulate enzyme activity.
 - Enzymes can increase or decrease the pH of a cell to become active or inactive.

27. All of the following are true concerning mitochondria and chloroplasts **except**:
- They both have electron transport chains for ATP production.
 - They both perform chemiosmosis.
 - They both have a double membrane and ribosomes.
 - They both perform mainly anabolic reactions.
28. A biologist is studying kidney tubules in small mammals. She wants specifically to examine the juxtaposition of different types of cells in these structures. The cells in question can be distinguished by external shape, size, and 3-dimensional characteristics. What would be the optimum method for her study?
- Light microscopy using living unstained material
 - light microscopy using stains specific to kidney function
 - scanning electron microscopy
 - transmission electron microscopy
 - cell fractionation
29. ATP is produced in all of the following processes **except**:
- Cyclic light reactions.
 - Non-cyclic light reactions.
 - Glycolysis.
 - Chemiosmosis
 - The Calvin Cycle
30. All of the following are true regarding chemiosmosis **except**:
- Protons are pumped by ATP synthase.
 - It occurs in both chloroplasts and mitochondria.
 - It requires high-energy electrons to provide the energy to pump protons across a membrane.
 - In the chloroplast, low-energy electrons are obtained from water, then energized (excited) by sunlight.
 - In the mitochondria, high-energy electrons are obtained from glucose.
31. The destruction of which of the following would most cripple a cell's ability to undergo cell division?
- Microfilaments
 - Microtubules
 - Intermediate Filaments
 - Actin fibers
 - Collagen fibers
32. Which of the following pieces of evidence most strongly supports the common origin of all life on Earth?
- All organisms have undergone evolution.
 - All organisms reproduce.
 - All organisms require energy.
 - All organisms use essentially the same genetic code.
 - All organisms show heritable variation.
33. The fluidity of the plasma membrane could be decreased by:
- Phospholipids becoming more unsaturated.
 - Increasing cholesterol levels.
 - Decreasing cholesterol levels.
 - a & b
 - a & c

Use the following graph to answer questions 34 to 37. The red blood cells were obtained from a blood bank and were all from the same male, age 29 with type O negative blood:

- 5 Red blood cells were left for the same length of time in sodium chloride solutions of different concentrations. The final mean volume of the red cells was then compared with the original mean volume. The results are shown in the graph.



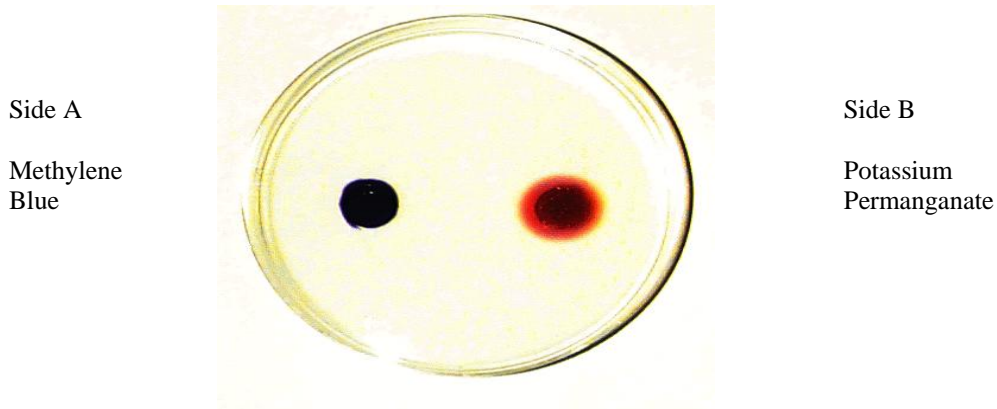
34. Based on the graph above, what concentration of sodium chloride would be considered isotonic for red blood cells:
- 100 sodium chloride solution/mm³ dm⁻³.
 - 150 sodium chloride solution/mm³ dm⁻³.
 - 200 sodium chloride solution/mm³ dm⁻³.
 - 250 sodium chloride solution/mm³ dm⁻³.
 - None of the above.
35. Red blood cells in a sodium chloride concentration of 300 mmol dm⁻³ are:
- Turgid
 - Lysed
 - In a hypotonic solution
 - In a hypertonic solution
 - None of the above
36. What would you expect to happen to red blood cells if they were placed in a sodium chloride concentration of 50 mmol dm⁻³:
- Cells undergo hemolysis.
 - Cells undergo crenation.
 - Cells maintain their size.
 - Cells become flaccid.
 - Cells shrink then become turgid.
37. Which of the following are you as the researcher least likely to have control over:
- Volume of the sodium chloride concentration used.
 - Time the red blood cells were exposed to the concentration.
 - Age of the red blood cells.
 - The source of the red blood cells.
 - The instrument used measure the mass of the red blood cells.
38. The components of wax are:
- Glycerol and 3 long fatty acid chains.
 - Glycerol and 2 long fatty acid chains
 - Glycerol and 1 long fatty acid chain.
 - A large alcohol and 1 long fatty acid chain
 - A large alcohol and 2 long fatty acid chains

39. A large starch molecule is broken down into small units. If you isolate a subunit that is made up of 4 glucose molecules, what would its chemical formula be?
- $C_{24}H_{48}O_{24}$
 - $C_{20}H_{40}O_{20}$
 - $C_{24}H_{40}O_{24}$
 - $C_{24}H_{56}O_{28}$
 - $C_{24}H_{42}O_{21}$
40. Removal of a cell's ribosomes would result in a cell's inability to utilize which of the following molecules?
- Phenylalanine
 - Carbon monoxide
 - Carbon dioxide
 - Nitrogen
 - Phosphorus
41. A factor that contributed greatly to the prolonged existences of simple organic molecules in the Earth's pre-biotic oceans were:
- The presence of simple amino acids
 - The virtual absence of atmospheric oxygen.
 - The lack of high concentrations of atmospheric ammonia.
 - The presence of rudimentary enzymes.
 - The extremely low concentration of atmospheric methane.
42. A molecule of pyruvate can yield a net _____ ATP molecules.
- Two
 - Three
 - Ten
 - Fifteen
 - Thirty six
43. An autoimmune disease is the result of uncontrolled cell destruction. What organelle would you expect to be most active during this disease?
- Golgi apparatus
 - Nucleus
 - Lysosomes
 - RER
 - SER
44. You have two beakers. One contains a solution of HCl at pH = 4.0. The other contains a solution of NaOH at pH = 8.0. Into a third beaker, you slowly and cautiously pour 20 mL of the HCL and 20 mL of the NaOH. After complete stirring, the pH of the mixture will be:
- Basic
 - Acidic
 - Neutral
 - Not enough information to determine
45. Which of the following is an example of a protein?
- sucrase
 - guanine
 - keratin
 - testosterone
 - none of the above
46. Which of the following is the functional group in glycerol?
- $-COOH$
 - $-SH$
 - $-NH_2$
 - $-OH$
 - $-PO_4$
47. Using the functional groups in # 46, which ones are present in the molecule glycine?
- a and b
 - a and c
 - a and e
 - c and d
 - c and e
48. Oxygen free radicals can damage the cell, what organelle protects cells from their devastating effect?
- Lysosomes
 - SER
 - RER
 - Golgi Apparatus
 - Peroxisomes
49. Which of the following does not easily diffuse across a selectively permeable membrane?
- Lipids
 - CO_2
 - O_2
 - Na^+
 - H_2O

50. During the process of cellular respiration which product(s) yield(s) the most energy for the cell?
- ATP
 - NADH from Krebs cycle
 - FADH₂
 - All yield an equal amount
 - None of the above
51. Some blood tests rely on collecting tiny samples of blood in small diameter glass tubes that are placed against drops of blood caused by a pin prick. The blood flows up the tube because of:
- Cohesion
 - Adhesion
 - Non-polar properties of blood
 - a & b
 - all of the above
52. White blood cells protect the body by attacking bacteria and then destroying the bacteria once they are inside the cell. Through what process does a white blood cell get bacteria through its plasma membrane?
- Phagocytosis
 - Pinocytosis
 - Facilitated diffusion
 - Receptor-mediated endocytosis
 - Exocytosis
53. Which of the following molecules is considered to be amphipathic?
- Hemoglobin
 - Keratin
 - Glycogen
 - Phospholipid
 - Collagen
54. Which of the following is not found in both prokaryotic and eukaryotic cells?
- Flagella
 - DNA
 - Ribosomes
 - plasma membrane
 - all of the above are found in both
55. All of the following are true regarding both mitochondria and chloroplasts except:
- They can replicate independently of the cell.
 - They contain a molecule of linear DNA.
 - They are surrounded by two membranes.
 - They synthesize ATP by chemiosmosis.
 - They contain a compartment where hydrogen ions are pumped.
56. Which of the following processes occurs in both respiration and photosynthesis?
- Chemiosmosis
 - Calvin Cycle
 - Citric Acid Cycle
 - Krebs Cycle
 - Glycolysis
57. A scientist is studying the salivary glands. He is observing the production of amylase. He notices that cells that produce amylase have a large number of _____:
- Free ribosomes
 - SER
 - RER
 - lysosomes
 - none of the above
58. Oxygen is released in:
- photosystem I
 - photosystem II
 - the Calvin Cycle
 - mitochondrial electron transport system
 - splitting of the 6 carbon sugar

Use the following information for questions: 59-61

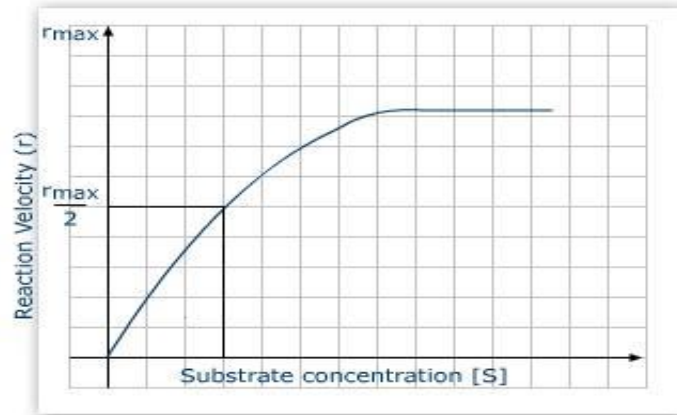
A solid crystal of potassium permanganate was placed on side B of a Petri dish filled with agar, and a solid crystal of methylene blue was placed on side A. The exact same amount of each material was placed on the agar plate at exactly the same time. The plates were covered and then left for 24 hours at room temperature. The results after 24 hours are shown below:



59. The outcome of this experiment as shown above is the result of :
- active transport
 - filtration
 - osmosis
 - diffusion
 - facilitated diffusion
60. What conclusion can be drawn as to the reason the potassium permanganate moved further from its starting location than methylene blue?
- Potassium permanganate is more soluble in water than methylene blue.
 - Potassium permanganate is less soluble in water than methylene blue.
 - Potassium permanganate has lower activation energy than methylene blue.
 - Potassium permanganate has a larger molecular weight than methylene blue.
 - Potassium permanganate has a smaller molecular weight than methylene blue.
61. If you wanted to speed up the reaction seen on the agar plate, you might:
- place the plate in an area 10 degrees cooler.
 - place the plate in an area 10 degrees warmer.
 - leave the plate uncovered.
 - increase the amount of agar in the plate.
 - None of the above will have an effect on the movement
62. Accessory pigments within chloroplasts are responsible for:
- Absorbing photons of different wavelengths of light and passing that energy to P680 and P700.
 - Pumping H^+ across the thylakoid membrane to create a proton-motive force.
 - Anchoring chlorophyll a within the reaction center.
 - Driving the splitting of water molecules.
 - Providing electrons to the reaction-center chlorophyll after photoexcited electrons pass to $NADP^+$.
63. Which of the following types of molecules produce the most energy when oxidized?
- Proteins
 - Carbohydrates
 - Lipids
 - nucleic acids
 - All of the above provide equal amounts when oxidized.

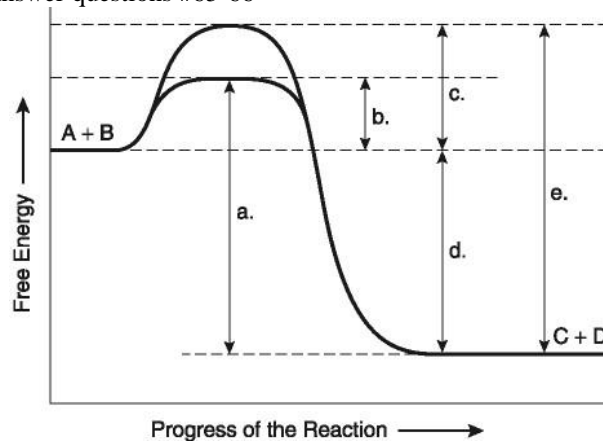
Use the figure below to answer questions #64

The following is the graph of a reaction which involves enzyme XYZ that catalyzed a reaction on a substrate known as ABC.



64. Which of the following would most likely have the greatest chance of increasing the rate of the reaction?
- | | |
|-------------------------------------|----------------------------------|
| a. Increase the amount of substrate | c. Increase the amount of enzyme |
| b. Decrease the amount of substrate | d. Decrease the amount of enzyme |
| | e. Increasing the temperature |

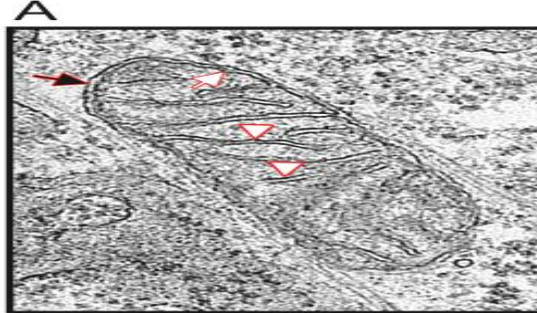
Use the figure below to answer questions #65-66



65. The letter _____ represents the activation energy when no enzyme is present, while the letter _____ represents the activation energy when the enzyme is present.
- | | |
|---------|---------|
| a. b, a | d. c, b |
| b. a, b | e. e, d |
| c. b, c | |
66. Which of the following best describes the reaction?
- positive ΔG , nonspontaneous
 - ΔG of zero, chemical equilibrium
 - positive ΔG , exergonic
 - negative ΔG , endergonic
 - negative ΔG , spontaneous

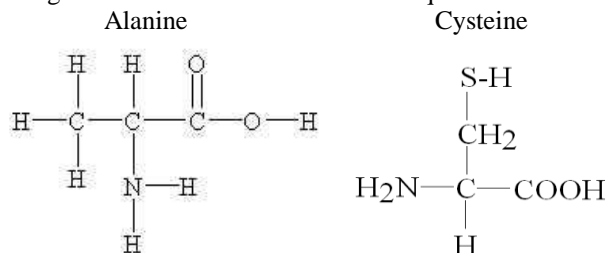
67. Which of the following is an incorrect statement about the Calvin Cycle?
- The main inputs to the reactions are NADPH, ATP, and CO₂
 - More NADPH is used than ATP during the Calvin Cycle
 - The main outputs of the reactions are NADP⁺, ADP, and sugar
 - Carbon fixation is the first step of the process.
 - The reactions occur in the stroma of the chloroplast.

Use the following figure to answer Questions #68-69



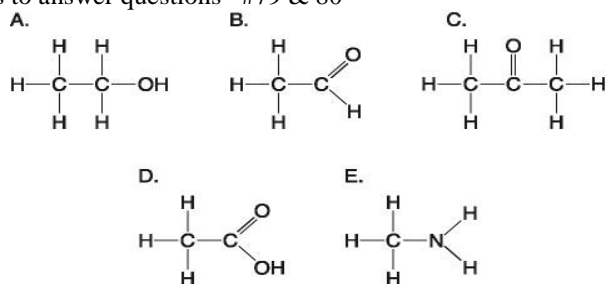
68. The triangles (not arrows) in figure A are pointing at what structures:
- thylakoids
 - matrix
 - stroma
 - cristae
 - grana
69. Which of the following does **not take** place in the organelle shown in figure A?
- Glycolysis
 - Krebs cycle
 - Chemiosmosis
 - None of the above they all take place in the organelle
70. Glycolysis of two molecules of glucose would yield:
- A total of 72 ATPs
 - 4 ATP, 2 NADH, and 4 pyruvate
 - 2 ATP, 2 NADH, and 2 pyruvate
 - 4 ATP, 4 NADH, and 4 pyruvate
 - 2 ATP, 2 NADH, and 4 pyruvate
71. During cellular respiration, most ATP is formed as a direct result of the net movement of:
- Sodium ions diffusing across a membrane
 - Protons flowing through a channel
 - Electrons flowing against a gradient
 - Electrons flowing through a channel
 - Protons flowing against a gradient
72. Which of the following requires ATP?
- Flow of oxygen into cells
 - The facilitated diffusion of glucose into a cell
 - The uptake of cholesterol by a cell
 - The flow of water into a cell
73. A scientist identifies a new organism. The cells of the organism show the presence of a cell wall, nucleus, ribosomes, and a plasma membrane. The organism could be:
- Plant
 - Fungi
 - Animal
 - a & b
 - all of the above

Using the information below to answer questions # 74-75



74. You are to make a dipeptide using the 2 amino acids, alanine and cysteine, listed above. What would be the molecular formula of this dipeptide which you have formed?
- $C_6H_{14}O_4N_2S_1$
 - $C_6H_{10}O_2N_2S_1$
 - $C_6H_{13}O_3N_2S_1$
 - $C_6H_{12}O_3N_2S_1$
 - none of the above
75. Breaking the peptide bond of the dipeptide you made in the previous question would be done by:
- Hydrolysis
 - Dehydration
 - Oxidation
 - Reduction
 - all of the above
76. Which of the following represents the most likely chronology of life on Earth from oldest to most recent?
- Organic molecules, plants fungi, animals, humans
 - Organic molecules, heterotrophs, autotrophs, plants, animals
 - Organic molecules, autotrophs, heterotrophs, animals
 - Organic molecules, heterotrophs, cyanobacteria, plants, fungi, animals
 - Organic molecules, heterotrophs, autotrophs, chloroplasts, animals, plants
77. In an experiment, plants are exposed to radioactively labeled O_2 molecule. In which of the following molecules would the radioactivity be expected?
- NADPH
 - H_2O
 - $C_6H_{12}O_6$
 - ATP
 - Rubisco
78. Which of the following is a membrane-bound molecule responsible for active transport?
- Peripheral protein
 - Integral protein
 - ATP
 - glycolipid
 - phospholipid

Use the following figures to answer questions #79 & 80



79. Which of the above figures has a carbonyl functional group?
- B
 - D
 - C
 - B and C
 - All of the above
80. Which of the above structures is a ketone?
- A
 - B
 - C
 - D
 - E

NEW JERSEY SCIENCE LEAGUE
Biology II Answer Key

January 2012

1	E	17	E	33	C	49	D	65	D
2	B	18	A	34	B	50	B	66	E
3	E	19	C	35	D	51	D	67	B
4	D	20	D	36	A	52	A	68	D
5	B	21	B	37	C	53	D	69	A
6	A	22	B	38	D	54	E	70	D
7	C	23	A	39	E	55	B	71	B
8	D	24	C	40	A	56	A	72	C
9	A	25	D	41	B	57	C	73	D
10	C	26	B	42	D	58	B	74	D
11	B	27	D	43	C	59	D	75	A
12	D	28	C	44	B	60	E	76	C
13	C	29	E	45	A	61	B	77	B
14	B	30	A	46	D	62	A	78	B
15	E	31	B	47	B	63	C	79	D
16	C	32	D	48	E	64	C	80	C

BIOLOGY 11 For all second year and AP level students. **NOTE:** Consistent with a modern approach to biology, principles of evolution will be included in every test as these apply to the topics listed.

JANUARY TEST: evolution, general chemistry, water, chemistry of carbon molecules, structure and function of macromolecules, eukaryotic and prokaryotic cell structure and function including membrane transport, ATP synthesis, photosynthesis and cell respiration, enzymatic regulation of biochemical reactions.

FEBRUARY TEST: evolution, eukaryotic and prokaryotic cell cycles, chromosomes, meiosis and gametogenesis, Mendelian and non-Mendelian patterns of genetic inheritance, molecular genetics and biotechnology, bioinformatics, genetic diseases, genetics of viruses and bacteria, population genetics.

MARCH TEST: evolution, phylogeny and systematics, prokaryotes, protists, fungi, comparative anatomy and physiology of the plant kingdom (from green algae to flowering plants - with emphasis on angiosperm form and function)

APRIL TEST: evolution, comparative anatomy and physiology of the animal kingdom with emphasis on human anatomy and physiology (nutrition and digestion, circulation and gas exchange, immunity and disease, osmoregulation and excretion, hormonal control, reproduction and development, nervous control and sensory mechanisms), ecology (relationships, energy flow, cycling of matter, biomes, ecosystems, populations), behavior.

Testing Dates for 2012

Thursday January 12, 2012, Thursday Feb 9, 2012;

Thursday March 8, 2012; *Thursday April 12, 2012

*The April 2011 exam can be changed based upon the Schools spring break.

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Science League Biology II February 2012 Exam

Choose the answer that best completes the statements or questions below and fill in the appropriate response onto the scan-tron. If you change your answer be sure to completely erase your first choice,

Please PRINT your name, school, area, and which test you are taking onto the scan-tron.

1. To make bacterial cells competent for transformation with plasmid DNA, the cells must be treated with
 - a. Chlorine
 - b. Fluoride ions
 - c. Calcium chloride
 - d. Oxygen gas
 - e. Iron oxide

2. In the early days of PCR one needed to add fresh polymerase enzyme before each round of replication because
 - a. the primers would auto-polymerize into primer dimers
 - b. denaturing the DNA also denatured the enzyme
 - c. the old polymerase enzyme was completely used up in the previous round of replication
 - d. the old polymerase stayed bound to the old DNA and was not available

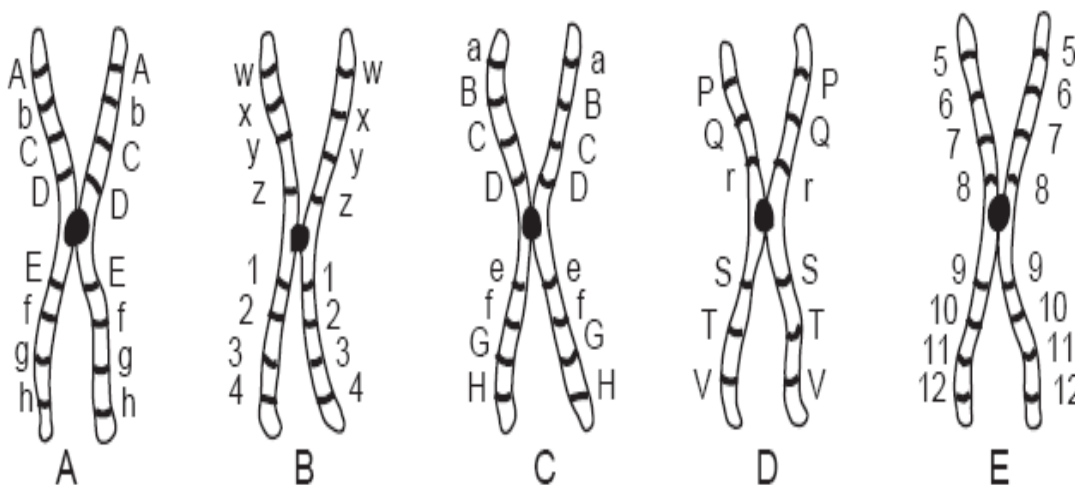
3. In addition to polymerase enzyme, PCR also needs
 - a. dNTP's
 - b. viable RNA molecules
 - c. aminoacyl transferase enzyme
 - d. ribosomes

4. The Western blot technique is used to detect specific _____.
 - a. eukaryotic DNA molecules
 - b. RNA molecules
 - c. chromosomes
 - d. proteins
 - e. plasmids

5. Oligonucleotides are useful in the screening of cDNA libraries because
 - a. they can bind specifically to a gene of interest
 - b. they will act as origins of replication in plasmids
 - c. they can act as catalysts in the PCR process
 - d. they can be used to produce target DNA sequences through the reverse transcriptase method.
 - e. when they are attached to a nitrocellulose membrane they form a very tight network that can filter out other DNA molecules

6. In order to express target DNA in a recombinant plasmid, the DNA must be inserted next to
 - a. a start codon
 - b. a ribosome
 - c. a poly-A sequence
 - d. a regulator sequence
 - e. a promoter

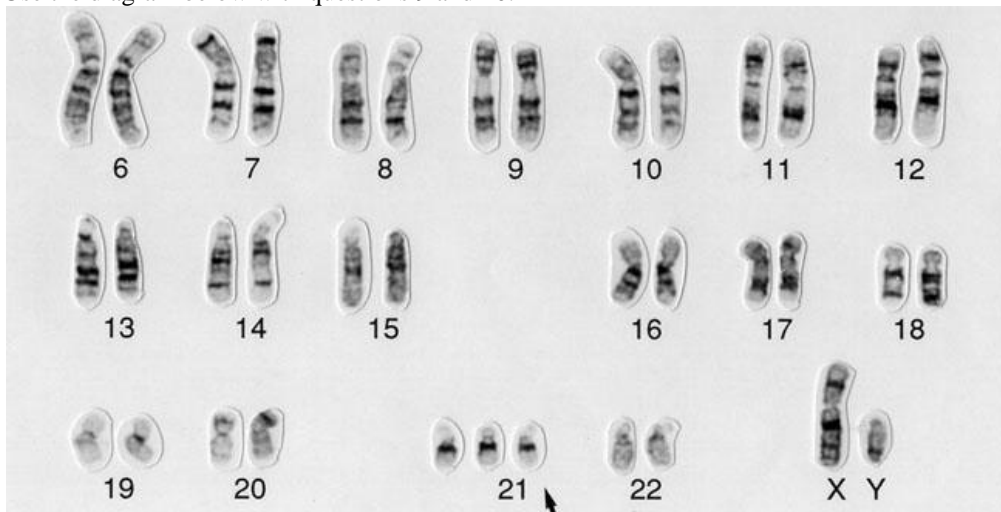
7. Which chromosomes shown in the picture below are homologous to each other?



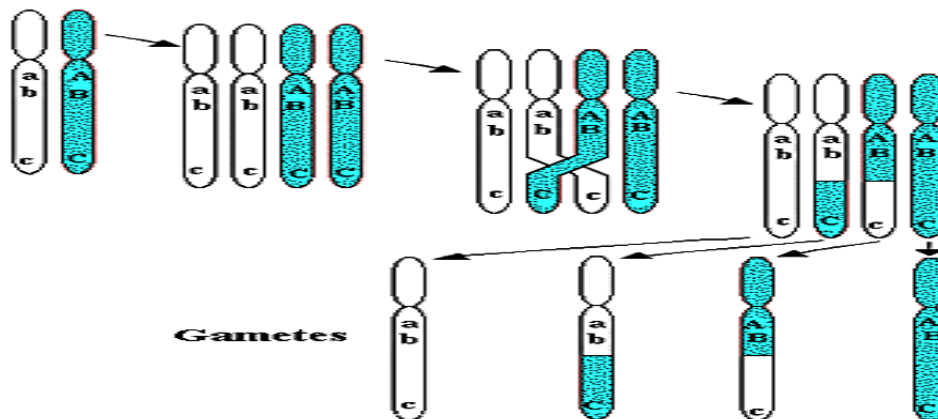
- a. A & B b. A & C c. B & D d. C & E e. B & E

8. The term semiconservative when applied to replication means
- the original DNA strands remain together after they are copied.
 - DNA is broken down into nucleotides when replicated.
 - only certain parts of the DNA molecule are replicated.
 - DNA is only replicated when needed.
 - a template strand becomes part of the new double-stranded DNA

Use the diagram below with questions 9 and 10.



9. What information can one NOT derive from the above diagram?
- the gender of the individual from whose cell it came
 - that the individual has PKU disease
 - the species to which the individual belongs
 - that the individual has Down syndrome
10. Which of the following choices is a REASONABLE source of the genetic material that was used to make the diagram above?
- the egg cell of a mature human woman
 - a cell from a chorionic villus biopsy
 - a HeLa cell
 - a transformed *E. coli* cell
 - a somatic cell from a newborn human baby girl



11. The process shown above would normally take place during
- G1 of the cell cycle
 - meiosis anaphase II
 - meiosis prophase I
 - mitosis prophase
 - interphase

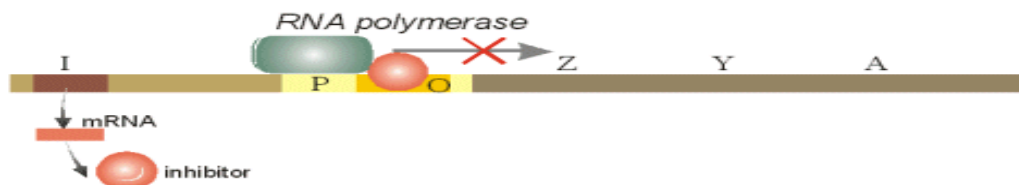
12. A segment of one DNA strand reads 5'ATCGCGAT3'. What is the complementary strand?
- 5'ATCGCGAT3'
 - 3'TAGCGCTA5'
 - 5'TAGCGCTA3'
 - 3'ATCGCGAT5'
 - 3'UAGGGCUA5'
13. A segment of a DNA strand reads 5'ATCGCGAT3'. Assume it serves as the template strand for RNA. What is the complementary RNA sequence?
- 5'AUCGCGAU3'
 - 3'TAGGGCTA5'
 - 5'UAGCGCUA3'
 - 3'ATCGCGAT5'
 - 3'UAGCGCUA5'
14. If radioactive sulfur (S^{35}) is used in the culture medium of bacteria that harbor phage viruses, it will appear in the
- viral DNA
 - bacterial RNA
 - viral coats
 - viral RNA
 - bacterial DNA
15. Fred Griffith was able to determine that
- DNA was the genetic material.
 - replication was semi conservative.
 - genetic capabilities could be transferred between bacteria.
 - DNA could undergo mutations.
 - viruses consist of DNA and protein.
16. Suppose that DNA replication was dispersive rather than semi conservative. If this were the case, then Meselson and Stahl would have noted that after two rounds of replication
- each chromosome would be partially radioactive.
 - all of the radioactive DNA would be in one chromosome only.
 - only two of the four chromosomes would display radioactivity.
 - none of the DNA would be radioactive.
17. Which item below supports the idea that the genetic code is "degenerate" (redundant)?
- There is only one codon for tryptophan.
 - There are four different codon for leucine.
 - Some codons are "stop" codons.
 - Introns must be "edited" out in the preparation of eukaryotic mRNA.
18. Suppose life forms much like those on Earth have been found on another planet. However, on this planet life evolved to incorporate 32 amino acids into proteins. If this extraterrestrial life uses the same DNA-RNA-protein genetic expression system as what is used on Earth, what is the minimum number of bases in a single codon?
- 1
 - 2
 - 3
 - 4
 - 5
19. A molecular biologist used a virus to introduce a gene coding for a certain enzyme into mouse cells. Most of the mouse cells were able to make the enzyme, but others lost the ability to make some other protein - different ones in different cells - and many of these died. Which of the following best explains these results?
- The cells that died were cancer cells.
 - The virus transferred genes from one mouse cell to another.
 - The virus inserted the enzyme gene into mouse cell genes.
 - The virus was too small to carry the entire gene.
 - The enzyme acted as a restriction enzyme, cutting up mouse DNA.

Codons Found in Messenger RNA

		Second Base				
		U	C	A	G	
First Base	U	Phe Phe Leu Leu	Ser Ser Ser Ser	Tyr Tyr Stop Stop	Cys Cys Stop Trp	U C A G
	C	Leu Leu Leu Leu	Pro Pro Pro Pro	His His Gln Gln	Arg Arg Arg Arg	U C A G
	A	Ile Ile Ile Met	Thr Thr Thr Thr	Asn Asn Lys Lys	Ser Ser Arg Arg	U C A G
	G	Val Val Val Val	Ala Ala Ala Ala	Asp Asp Glu Glu	Gly Gly Gly Gly	U C A G
						Third Base

Use the drawing above with questions 20 and 21.

20. A strand of mRNA containing the repeating sequence AAGAAGAAGAAG could code for which amino acid sequence?
 - a. Lysine-Lysine-Lysine-Lysine
 - b. Phenylalanine-Phenylalanine-Phenylalanine-Phenylalanine
 - c. Leucine-Leucine-Leucine-Leucine
 - d. Arginine-Arginine-Arginine-Arginine
 - e. Serine-Serine-Serine-Serine
21. A template DNA strand composed only of adenine-containing nucleotides would produce, after transcription and translation, a polypeptide chain composed of
 - a. all lysines
 - b. all phenylalanines
 - c. a random mix of phenylalanines and lysines
 - d. alternating lysines and phenylalanines
 - e. all uracils
22. Which one of the following is NOT needed for the initiation of translation?
 - a. peptidyl transferase
 - b. mRNA
 - c. large ribosomal subunit
 - d. small ribosomal subunit
 - e. charged methionine tRN
23. An entire eukaryotic gene was inserted into the DNA of a bacterium. The bacterium then transcribed this gene into mRNA and translated the mRNA into protein. However, compared to the native protein the bacterial product contained way too many amino acids. Why?
 - a. Bacteria can't handle introns.
 - b. Eukaryotes and prokaryotes use different genetic codes.
 - c. Repressor proteins interfered with accurate transcription and translation.
 - d. The life span of the bacterial mRNA was too short.
 - e. Bacterial ribosomes cannot recognize eukaryotic mRNA.



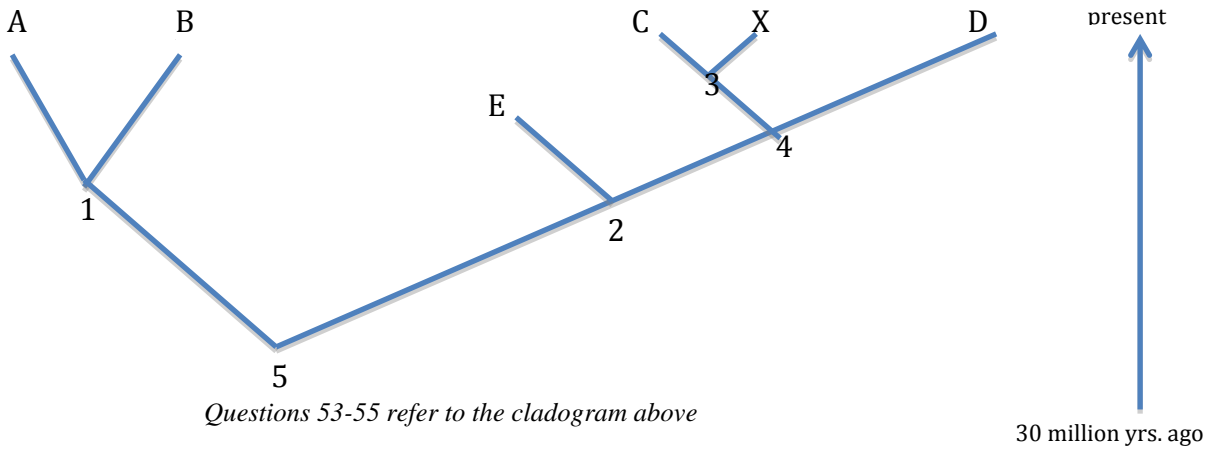
24. The diagram above shows a lac operon in the “off” configuration. When lactose is present the operon turns “on” because
 - a. lactose binds to RNA polymerase and so allows it to bypass the inhibitor
 - b. lactose binds to upstream region “I” and so prevents synthesis of the mRNA that is used to produce the inhibitor
 - c. lactose binds to the mRNA produced from region “I” and prevents its translation
 - d. lactose binds the inhibitor so that it can no longer attach to the operator

25. By contrast to the lac operon, the tryptophan synthase operon (trp operon)
- turns on when tryptophan is present as opposed to when lactose is present
 - is usually on
 - turns off when lactose is present
 - turns on when enough tryptophan has been synthesized
26. The four haploid nuclei found at the end of meiosis usually differ from one another in their exact genetic composition. Some of this difference is due to
- imperfect cytokinesis
 - separation of sister chromatids at anaphase II
 - the lack of crossing-over during prophase I
 - independent assortment
 - selective elimination of nuclei that contain Y chromosomes
27. At the end of meiosis I in humans a daughter cell contains
- only maternal chromosomes.
 - a mixture of maternal and paternal chromosomes.
 - the same number of chromosomes as a diploid cell.
 - a single sister chromatid from each chromosome.
 - one-fourth the amount of DNA in the parent nucleus.
28. At the end of meiosis I, how many chromosomes does a daughter cell have, and how many chromatids are in each chromosome?
- Each chromosome is composed of two sister chromatids and there are N chromosomes.
 - Each chromosome is composed of one chromatid and there are N chromosomes.
 - Each chromosome is composed of two sister chromatids and there are 2N chromosomes.
 - Each chromosome is composed of one chromatid and there are 2N chromosomes.
29. The crossing over or exchange of genetic material between members of a homologous pair of chromosomes results in
- chromosomes that will have a higher than normal rate of mutation
 - a mixing of paternal and maternal genes
 - a pair of identical chromosomes
 - Down's syndrome
 - cell death
30. Which of the following represents a difference between male and female meiosis in humans?
- Oogenesis is completed only after fertilization.
 - New sperm cells are produced throughout the adult life of a male.
 - Oogenesis commences before birth.
 - Mature spermatozoa lack significant cytoplasm.
 - All of the above are differences.
31. Which of the following is characteristic of anaphase II of meiosis?
- Sister chromatids separate.
 - Microtubules elongate.
 - Homologous chromosomes pair up.
 - Crossing over occurs.
 - Tetrads form.
32. In human females, at the end of meiosis how many functional cells are produced?
- | | |
|---------|----------|
| a. One | d. Six |
| b. Two | e. Eight |
| c. Four | |
33. To determine whether a fruit fly with normal wings may harbor the recessive gene for vestigial wings cross it with a fly that is
- | | |
|--------------------------|-----------------|
| a. homozygous normal. | d. like itself. |
| b. homozygous vestigial. | e. dead. |
| c. heterozygous normal. | |

34. If a human child has type AB blood, which blood type is impossible in either of the parents?
- O
 - B
 - A
 - AB
 - None is impossible
35. A man who has type O blood and a woman who has type A blood are expecting a child. What blood type can this child of theirs have?
- only type A
 - only type B
 - only type O
 - either type O or type A
 - any of the ABO blood types is possible
36. Gene A exists as a dominant allele (A) or a recessive allele (a). Gene B also has a dominant (B) or recessive allele (b) but is located on a non-homologous chromosome. An individual with the genotype AaBb can produce four different gametes relative to genes A and B. This genetic diversity in the gametes is due to
- Translocation
 - independent assortment
 - nondisjunction
 - mutation
 - genetic drift
37. What combination of alleles is impossible in any normal gamete produced by the individual described in question #36?
- AB
 - Aa
 - Ab
 - aB
38. A single nondisjunction event during meiosis I in the individual described in #36 could produce a gamete that contains
- aBB
 - AAb
 - AaB
 - ABB
 - Abb
39. Assume we cross AaBb with AaBb, where genes A and B exist independently as described in #36, above. What is the probability that any progeny of this cross would be homozygous recessive for both A and B?
- 50%
 - 25%
 - 6.25%
 - 56.25%
 - 100%
40. In a certain breed of dog there is an autosomal dominant gene for hairlessness. Unfortunately, homozygous dominant pups are stillborn and exhibit multiple physical defects. A dog breeder breeds two hairless dogs (male and female respectively). What phenotypic ratio of hairless to haired dogs could he expect among the litter of whining, wriggling puppies?
- 2:1
 - 1:2:1
 - 1:1
 - 3:1
 - all hairless
41. The frequency with which cross-over occurs between two linked genes is directly proportional to
- the number of genes on the chromosome.
 - the number of chromosomes in a cell.
 - the distance between chromosomes in a cell.
 - the distance between genes on a chromosome.
 - their position in prophase.
42. Polydactyly is caused by a dominant allele. Affected individuals express the gene in their hands and/or feet as having extra digits. Some individuals with this condition may have one or more completely formed extra fingers or toes (the world record, according to London's Daily Mail, is 34 digits, 7 on each hand, 10 on each foot); others may not show any real signs of having this condition. Suppose a normal woman marries a polydactylous man whose mother was normal. If this trait has a 90% penetrance, what percentage of their children will be expected to show this trait phenotypically?
- 22.5%
 - 45%
 - 50%
 - 67.5%
 - 90%

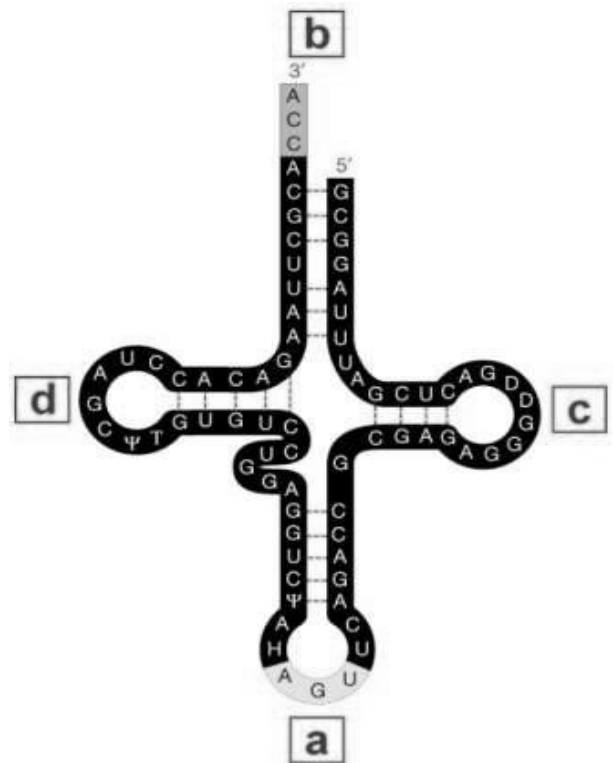
43. A cell that produces anomalous histone proteins would probably have trouble dividing because it could not
- produce tubulin.
 - carry on cytokinesis.
 - organize chromatin into chromosomes.
 - replicate its centrioles.
 - move.
44. Mitosis without cytokinesis may result in
- a cell with 2 nuclei
 - 2 haploid cells
 - 2 cells, each with an unequal share of cytoplasm
 - a cell with no nucleus at all
 - one exceptionally small cell
45. Most terminally differentiated cells remain in the
- G-0 stage
 - S stage
 - G-2 stage
 - M stage
46. Cells that have high telomerase activity
- experience premature senescence
 - over-express genes for chromosome destruction
 - enter meiosis
 - can become immortal
 - experience G-1 arrest
47. Which of the following do Down's syndrome and Klinefelter's syndrome have in common?
- Both involve the sex chromosomes.
 - Both are the result of point mutations.
 - Both are the result of chromosome addition.
 - Both are the result of chromosome deletion.
 - Both are due to reading frame-shift mutations.
48. A group of 5 lizards of the same species colonizes an island where this species previously did not exist. All have a phenotypic crest, a trait controlled by a dominant gene "C," but only one harbors the recessive allele, "c." What are the frequencies of allele C and allele c in the original lizard colony on this island?
- C=0.8 & c=0.2
 - C=0.9 & c=0.1
 - C=0.1 & c=0.9
 - C=0.2 & c=0.8
49. If you assume a Hardy-Weinberg equilibrium for the alleles that control crest formation (admittedly very improbable), about how many crestless lizards would you expect when the island population reaches 20,000?
- 0
 - 20
 - 200
 - 1000
 - 2000
50. No new lizards arrive and none leaves this isolated island. If, when the population reaches 20,000, the number of crestless lizards differs greatly from the answer to the previous question, this could be due to a combination of which factors?
- gene flow and genetic drift.
 - gene flow and natural selection.
 - genetic drift and natural selection.
 - gene flow and nonrandom mating
51. Ellis-van Creveld Syndrome (also called *chondroectodermal dysplasia* or *mesoectodermal dysplasia*) is a rare genetic disorder significantly common among Old Order Amish, small communities whose members do not intermarry with the "outside world." The high frequency of this disorder among Amish is most likely due to
- founder effect
 - natural selection
 - selective mutation
 - gene flow
 - nonrandom mating.

52. Most of the genetic variation observed in a large natural population, such as all the white tail deer in New Jersey, arises from
- new mutations
 - migration of individuals into & out of the population
 - recombination due to sexual reproduction
 - genetic drift
 - differential predation on members of the population.



53. Species X would be expected to share the greatest amount of homologous DNA with species
- A
 - B
 - C
 - D
 - E
54. The common ancestor of A and C is
- 1
 - 2
 - 3
 - 4
 - 5
55. The extinct species is
- A
 - B
 - C
 - D
 - E

56. The molecule to the right
- binds to an amino acid at site B
 - binds to mRNA at site B
 - binds to DNA at sites A and B
 - catalyzes the formation of a peptide bond
 - is one of the bases of a DNA molecule
57. How many different kinds of molecules of the type shown to the right must exist in a given cell?
- 20
 - 4
 - 64
 - 61
 - unlimited



58. The DNA coding sequences TTTCCAAG and TTCCUAAA produce the same tripeptide because
- both contain exactly three codons
 - both are transcribed to yield identical mRNA molecules
 - the genetic code is imperfect
 - some amino acids are represented by more than one codon
 - they are both mutant sequences

Species 1: AATTGCCGGTTATTGCTGA

Species 2: AATTGCCGGTTAATGCTGA

Species 3: AATTGCCGGTTAAAGCTGA

Species 4: AATTGCCGGTTATTGCTGA

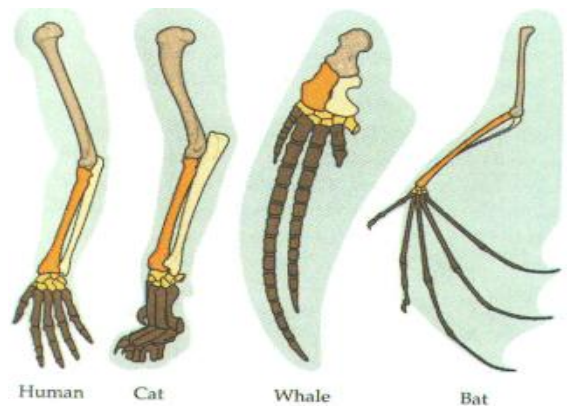
59. The diagram directly above shows DNA base sequences for 4 species. Assume the DNA sequences are part of the same gene in each species. What two species are most closely related based on these data?
- 1&2
 - 1&3
 - 2&3
 - 1&4
 - 3&4
60. Methicillin Resistant *Staphylococcus aureus* is a multiple antibiotic-resistant bacterial species that plagues hospitals. It most likely arose because
- hospitals did not use disinfectants enough
 - antibiotic therapy selected for resistant mutants
 - patients became immune to certain antibiotics
 - many doctors did not wash their hands after treating infected patients
 - the gene for resistance was transmitted from a patient to the bacteria
61. When co-mingled in zoos, African lions and Asian tigers interbreed to produce healthy and viable “tiglons” and “ligers.” What prevents these hybrids from existing in nature?
- A behavioral barrier – tigers and lions in nature would just as soon eat one another rather than mate with one another
 - A geographic barrier – the two species are geographically isolated from one another
 - An ecological barrier – the two species are active at different times of the day; one is diurnal the other nocturnal
 - A gametic barrier – even though they may mate in nature, their respective gametes never fertilize one another because of stress
62. The placental flying squirrel of North America (drawing on the left) and the marsupial sugar glider of Australia look and behave similarly although they are not related. What best explains their existence?



- Coevolution
- Convergent evolution
- Divergent evolution
- Intelligent design
- Batesian mimicry

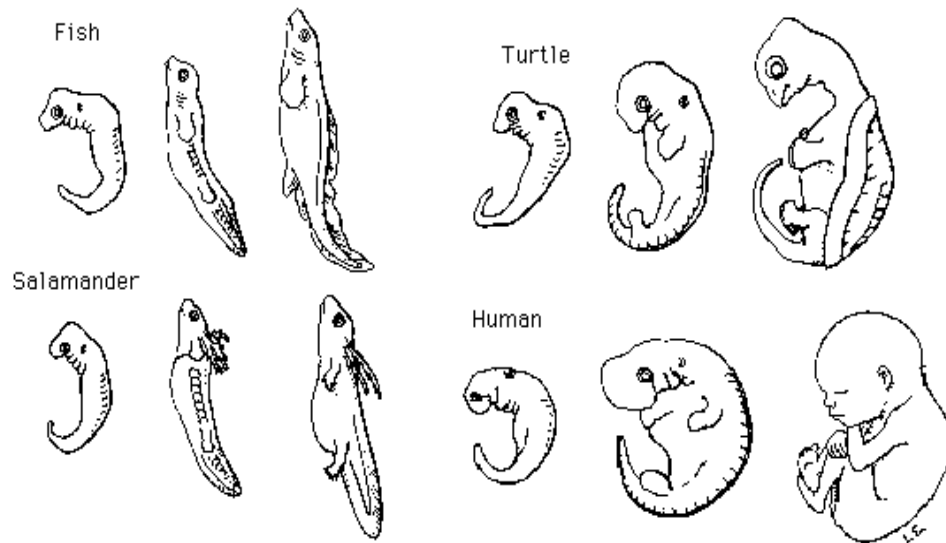
63. The flying squirrel is more closely related to _____ than is the sugar glider
- humans
 - kangaroos
 - duck-billed platypuses
 - ants
64. Which of the following pairs are considered homologous structures?
- leg of a frog and wing of a chicken
 - wing of a bat and wing of a butterfly
 - lobster tail and tail of an opossum
 - petal of a flower and feather of a bird
 - arm of a person and a branch of a tree
65. A new hybrid garden tomato is produced that is very vigorous, producing much fruit. When the seeds of these fruits are planted, however, the resulting plants do not thrive and often perish before yielding any fruit. In evolutionary terms the hybrid line is not sustainable due to
- gametic isolation
 - temporal isolation
 - hybrid sterility
 - hybrid inviability
 - hybrid breakdown
66. Eldredge and Gould suggested a model for evolution that they called Punctuated Equilibrium. Their model helped explain
- the extinction of the dinosaurs
 - the existence of many intermediate species in the evolution of modern humans
 - that, relative to geologic time, the fossil record shows that some species seem to appear suddenly, with very few transitional forms
 - gradual transition of life-forms from aquatic to terrestrial
67. Which of Darwin's ideas is explained by Mendel's work?
- Variability in a natural population
 - Overproduction of offspring
 - Limited resources and the struggle for survival
 - Environmental selection pressure

68. The homologous structures shown in the diagram to the right suggest that
- humans evolved from cats
 - humans, cats, whales and bats share a common ancestor
 - given enough time a whale's flipper could evolve into a structure resembling a bat wing
 - the upper arm bone in a human (the humerus) is analogous to its counterpart in a whale flipper



69. Very large or very small acorns do not survive to produce oak seedlings as often as medium-sized acorns do. In evolutionary terms this is an example of
- directional selection
 - sexual selection
 - artificial selection
 - stabilizing selection
 - disruptive selection

70. What provides the best evidence for the relatedness of species?
- Examining the fossil record
 - Comparing DNA and protein sequences
 - Measuring of shared derived characteristics
 - Examining biogeographical distributions
 - The existence of vestigial structures
71. Convergent evolution of two different species would most likely occur as a result of
- a series of identical mutations in both species.
 - hybridization between the two species.
 - interbreeding by both species with members of a third species.
 - exposure of both species to similar selection pressures.
 - genetic drift between the species.
72. Flowers pollinated by hummingbirds are often red and usually odorless. Hummingbirds see red easily but have a poor sense of smell. This is an example of
- mimicry
 - polymorphism
 - coevolution
 - stabilizing selection
 - convergence



73. The figure above shows that
- fish, salamanders, turtles and humans have embryonic stages that look similar
 - humans evolved from fish
 - over geologic time fish pectoral fins will evolve into legs
 - humans are warm blooded, whereas the other species shown are cold-blooded
 - if you take an early fish embryo and implant it in a human, it will turn into a human baby
74. The diagram above offers evidence for
- convergent evolution
 - directional selection
 - hybrid vigor
 - common ancestry
 - intelligent design

75. In domestic cats a gene for coat color resides on the X-chromosome. This gene has two co-dominant alleles, black and yellow. When both alleles are present the cat has a "tortoise-shell " coat (also known as "calico "). A black male and a yellow female are mated. What are the chances that any of the kittens will be black?
- Zero
 - 50%
 - 25%
 - 75%
 - 100%
76. Suppose the mating described in #75 produces, by chance, only female kittens. What would these kittens look like?
- Half of them would be yellow, half of them would be black
 - All of them would be calico
 - Half would be calico, half yellow
 - Half would be calico, half black
 - There would be mix of calico, black and yellow kittens.
77. If a tortoise shell female is crossed with a yellow male
- None of the female kittens would be yellow
 - None of the kittens would be calico
 - None of the male kittens would be black
 - None of the female kittens would be black
 - None of the male kittens would be yellow
78. Tortoise shell males are exceptionally rare but they do exist? What would be a tortoise-shell male's genotype and to what phenomenon would its existence be most likely attributed? (let B represent the allele for black and G the allele for yellow)
- X^{BY^G} : due to translocation
 - X^BY : co-expression of a hidden gene for yellow
 - X^BX^GY : nondisjunction
 - $X^{BG}Y$: spontaneous mutation and doubling of the coat color gene on the X chromosome
79. Suppose there is another gene locus that governs tail-kinking located on the X-chromosome. This gene has two alleles, where dominant is normal, straight tail and recessive is kinky tail. A normal-tailed, tortoise-shell female is mated with her father, a black cat with a normal tail. The female's mother was kinky and yellow. If no crossing over takes place during oogenesis, what is the probability that any of the kittens will be black and have straight tails?
- 100%
 - 50%
 - 25%
 - 0%
80. Consider that the cross-over frequency between the loci for coat color and tail kinking is about 16%. With crossing over, what are the chances of getting a yellow male kitten with a straight tail?
- 0%
 - 4%
 - 16%
 - 21%
 - 25%

NEW JERSEY SCIENCE LEAGUE
Biology II Answer Key

February 2012

1	C	17	B	33	B	49	C	65	E
2	B	18	C	34	A	50	C	66	C
3	A	19	C	35	D	51	A	67	A
4	D	20	A	36	B	52	C	68	B
5	A	21	B	37	B	53	C	69	D
6	E	22	A	38	C	54	E	70	B
7	B	23	A	39	C	55	E	71	D
8	E	24	D	40	A	56	A	72	C
9	B	25	B	41	D	57	D	73	A
10	B	26	D	42	B	58	D	74	D
11	C	27	B	43	C	59	D	75	A
12	B	28	A	44	A	60	B	76	B
13	E	29	B	45	A	61	B	77	D
14	C	30	E	46	D	62	B	78	C
15	C	31	A	47	C	63	A	79	B
16	A	32	A	48	B	64	A	80	B

BIOLOGY II is for all second year and AP level students. NOTE: Consistent with a modern approach to biology, principles of evolution will be included in every test as these apply to the topics listed.

JANUARY TEST: evolution, general chemistry, water, chemistry of carbon molecules, structure and function of macromolecules, eukaryotic and prokaryotic cell structure and function including membrane transport, ATP synthesis, photosynthesis and cell respiration, enzymatic regulation of biochemical reactions.

FEBRUARY TEST: evolution, eukaryotic and prokaryotic cell cycles, chromosomes, meiosis and gametogenesis, Mendelian and non-Mendelian patterns of genetic inheritance, molecular genetics and biotechnology, bioinformatics, genetic diseases, genetics of viruses and bacteria, population genetics.

MARCH TEST: evolution, phylogeny and systematics, prokaryotes, protists, fungi, comparative anatomy and physiology of the plant kingdom (from green algae to flowering plants - with emphasis on angiosperm form and function)

APRIL TEST: evolution, comparative anatomy and physiology of the animal kingdom with emphasis on human anatomy and physiology (nutrition and digestion, circulation and gas exchange, immunity and disease, osmoregulation and excretion, hormonal control, reproduction and development, nervous control and sensory mechanisms), ecology (relationships, energy flow, cycling of matter, biomes, ecosystems, populations), behavior.

Testing Dates for 2012

Thursday January 12, 2012, Thursday Feb 9, 2012;

Thursday March 8, 2012; *Thursday April 12, 2012

*The April 2011 exam can be changed based upon the Schools spring break.

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New Jersey Science League
Biology II March 2012 Exam

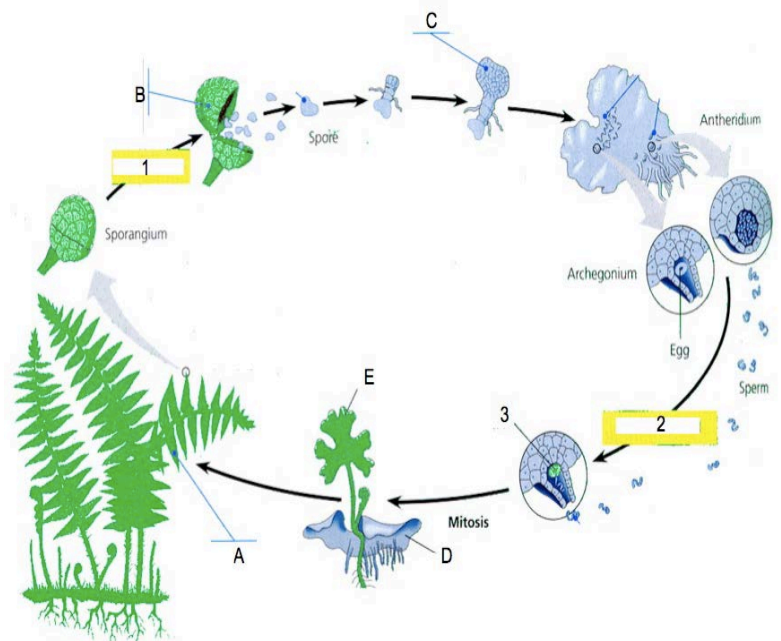
- 1) Which of these illustrates the correct representation of the binomial scientific name for the African lion?
- a. *Panthera leo*
 - b. panthera leo
 - c. Panthera *leo*
 - d. Panthera Leo
 - e. *Panthera leo*
- 2) A phylogenetic tree that is "rooted" is one
- a. that extends back to the origin of life on Earth.
 - b. at whose base is located the common ancestor of all taxa depicted on that tree.
 - c. that illustrates the rampant gene swapping that occurred early in life's history.
 - d. that indicates our uncertainty about the evolutionary relationships of the taxa depicted on the tree.
 - e. with very few branch points.
- 3) If organisms A, B, and C belong to the same class but to different orders and if organisms D, E, and F belong to the same order but to different families, which of the following pairs of organisms would be expected to show the greatest degree of structural homology?
- a. A and B
 - b. A and C
 - c. B and D
 - d. C and F
 - e. D and F
- 4) Some molecular data place the giant panda in the bear family (Ursidae) but place the lesser panda in the raccoon family (Procyonidae). Consequently, the morphological similarities of these two species are probably due to
- a. inheritance of acquired characteristics.
 - b. sexual selection.
 - c. inheritance of shared derived characters.
 - d. possession of analogous structures.
 - e. possession of shared primitive characters.
- 5) Generally, within a lineage, the largest number of shared derived characters should be found among two organisms that are members of the same
- a. kingdom.
 - b. class.
 - c. domain.
 - d. family.
 - e. order.
- 6) When using a cladistic approach to systematics, which of the following is considered most important for classification?
- a. shared primitive characters
 - b. analogous primitive characters
 - c. shared derived characters
 - d. the number of homoplasies
 - e. overall phenotypic similarity
- 7) Phylogenetic hypotheses (such as those represented by phylogenetic trees) are strongest when
- a. they are based on amino acid sequences from homologous proteins, as long as the genes that code for such proteins contain no introns.
 - b. each clade is defined by a single derived character.
 - c. they are supported by more than one kind of evidence, such as when fossil evidence corroborates molecular evidence.
 - d. they are accepted by the foremost authorities in the field, especially if they have won Nobel Prizes.
 - e. they are based on a single DNA sequence that seems to be a shared derived sequence.
- 8) Which kind of DNA should provide the best molecular clock for gauging the evolutionary relatedness of several species whose common ancestor became extinct billions of years ago?
- a. that coding for ribosomal RNA
 - b. intronic DNA belonging to a gene whose product performs a crucial function
 - c. paralogous DNA that has lost its function (i.e., no longer codes for functional gene product)
 - d. mitochondrial DNA
 - e. exonic DNA that codes for a non-crucial part of a polypeptide

- 9) The most important feature that permits a gene to act as a molecular clock is
- having a large number of base pairs.
 - having a larger proportion of exonic DNA than of intronic DNA.
 - having a reliable average rate of mutation.
 - its recent origin by a gene-duplication event.
 - its being acted upon by natural selection.
- 10) You are given an unknown organism to identify. It is unicellular and heterotrophic. It is motile, using many short extensions of the cytoplasm, each featuring the 9+2 filament pattern. It has well-developed organelles and three nuclei, one large and two small. This organism is most likely a member of which group?
- foraminiferans
 - radiolarians
 - ciliates
 - kinetoplastids
 - slime molds
- 11) Suppose the population size of a population of marmots is 300. According to genetic drift theory, what is the probability that a newly arisen mutation will become fixed in this population?
- 1/100
 - 1/300
 - 1/600
 - 1/1200
 - None of the above
- 12) When researchers apply the principles of evolution to produce new molecules that can be used for pharmaceuticals, they are
- bioprospecting.
 - performing *in vitro* evolution.
 - performing concerted evolution.
 - using biomes.
 - ribozyming.
- 13) Catastrophism, meaning the regular occurrence of geological or meteorological disturbances (catastrophes), was Cuvier's attempt to explain the existence of
- evolution.
 - the fossil record.
 - uniformitarianism.
 - the origin of new species.
 - natural selection.
- 14) Natural selection is based on all of the following *except*
- genetic variation exists within populations.
 - the best-adapted individuals tend to leave the most offspring.
 - individuals who survive longer tend to leave more offspring than those who die young.
 - populations tend to produce more individuals than the environment can support.
 - individuals adapt to their environments and, thereby, evolve.
- 15) Over evolutionary time, many cave-dwelling organisms have lost their eyes. Other losses over evolutionary time are tapeworms have lost their digestive systems and whales have lost their hind limbs. How can natural selection account for these losses?
- Natural selection cannot account for losses, only for innovations.
 - Natural selection accounts for these losses by the principle of use and disuse.
 - Under particular circumstances that persisted for long periods, each of these structures presented greater costs than benefits.
 - The ancestors of these organisms experienced harmful mutations that forced them to find new habitats that these species had not previously used.
- 16) Members of two different species possess a similar-looking structure that they use in a similar fashion performing the same function. Which information would best help distinguish between an explanation based on homology versus an explanation based on convergent evolution?
- The two species live at great distance from each other.
 - The two species share many proteins in common, and the nucleotide sequences that code for these proteins are almost identical.
 - The sizes of the structures in adult members of both species are similar in size.
 - Both species are well adapted to their particular environments.
 - Both species reproduce sexually.

- 17) What was the species concept most used by Linnaeus?
- biological
 - morphological
 - ecological
 - phylogenetic
- 18) A defining characteristic of allopatric speciation is
- the appearance of new species in the midst of old ones.
 - asexually reproducing populations.
 - geographic isolation.
 - artificial selection.
 - large populations.
- 19) According to the concept of punctuated equilibrium, the "sudden" appearance of a new species in the fossil record means that
- the species is now extinct.
 - speciation occurred instantaneously.
 - speciation occurred in one generation.
 - speciation occurred rapidly in geologic time.
 - the species will consequently have a relatively short existence, compared with other species.
- 20) Which of the following factors would *not* contribute to allopatric speciation?
- A population becomes geographically isolated from the parent population.
 - The separated population is small, and genetic drift occurs.
 - The isolated population is exposed to different selection pressures than the ancestral population.
 - Different mutations begin to distinguish the gene pools of the separated populations.
 - Gene flow between the two populations is extensive.
- 21) Beginning with a single bacterium, how many cells would be present after four hours of growth if they can double every 20 minutes?
- 12
 - 24
 - 64
 - 4,096
 - 34,217,728

Use the diagram of the life cycle of a fern for #s 22, 23, 24, 25

- 22) What processes are represented by box 1 and box 2 respectively?
- box 1 = mitosis, box 2 = meiosis
 - box 1 = meiosis, box 2 = fertilization
 - box 1 = fertilization, box 2 = mitosis
 - box 1 = mitosis, box 2 = fertilization
 - box 1 = meiosis, box 2 = mitosis
- 23) Which of the labeled structures are diploid?
- Only C and D
 - A, B, C, D and E are all diploid
 - Only A, B and E
 - Only D and E
 - Only B and C
- 24) Structures C and D are part of
- the sporophyte generation
 - the gametophyte generation
 - the haplodiplontic life cycle
 - the juvenile component
 - the macrosporangium



- 25) Contrasting the fern life cycle with the life cycle of a true flowering plant we can say that
- in the fern life cycle the gametophyte generation is more significant than in the flowering plant life cycle.
 - the fern has a more significantly developed vascular system.
 - fern seeds tend to be much larger than flowering plant seeds.
 - in the flowering plant life cycle the sporophyte generation is limited to the megaspore and microspore.
 - there is no true gametophyte generation in the flowering plant life cycle.
- 26) The transfer of genes by uptake of DNA from dead organisms characterizes which type of gene transfer in bacteria?
- Conjugation
 - Transference
 - Transduction
 - Transformation
 - None of the above
- 27) All plasmids
- are integrated into the bacterial chromosome.
 - have an R factor.
 - have a capsid.
 - have an origin of replication.
 - All of the above
- 28) When tryptophan accumulates in a bacterial cell,
- it binds to the operator, preventing transcription of adjacent genes.
 - it binds to the promoter, allowing transcription of adjacent genes.
 - it binds to the repressor, causing it to bind to the operator.
 - it binds to the genes that code for enzymes.
 - it binds to RNA and initiates a negative feedback loop to reduce transcription.
- 29) During prokaryotic cell division, two chromosomes separate from each other and distribute into the daughter cells by
- attachment to microtubules.
 - a mitotic spindle.
 - repellent forces.
 - attachment to separating membrane regions.
 - All of the above.
- 30) In order for a prokaryote cell to divide, which of the following must occur?
- A reproductive signal, replication, segregation of DNA, and cytokinesis
 - DNA replication, crossing over, and segregation of DNA
 - DNA replication and segregation of DNA
 - Cell growth and cytokinesis
 - DNA replication, segregation of DNA, and cytokinesis
- 31) During bacterial cell division, the two DNA molecules are separated by
- centrosomes.
 - spindle fibers.
 - nucleosomes.
 - pinching of the plasma membrane.
 - aneuploidy.
- 32) Fungi may be
- saprobies.
 - parasites.
 - pathogens.
 - mutualists.
 - All of the above
- 33) Lichens are
- a single organism.
 - prevalent in industrialized cities.
 - plant cells in association with fungal cells.
 - rapid growers.
 - most often a unicellular green alga in association with fungal cells.

34) Reproduction in fungi

- a. can occur sexually by the formation of spores.
- b. occurs sexually when hyphae of different mating types fuse and make spores by meiosis.
- c. can occur sexually in unicellular fungi by budding.
- d. occurs sexually when hyphae of different mating types fuse and make spores by mitosis.
- e. occurs sexually by alternation of generations in all fungi.

35) The names of fungal classes are based on important and characteristic structures associated with

- a. sexual reproduction.
- b. nutrition.
- c. ecology.
- d. vegetative growth.
- e. cell division.

36) Which of the following statements is sufficient to identify an unknown organism as belonging to the fungi?

- a. It is multicellular and nonphotosynthetic.
- b. It has cell walls and reproduces by spores.
- c. It has filamentous growth and obtains its food by absorption.
- d. It has prokaryotic cells and cell walls made of chitin.
- e. It is unicellular and eukaryotic.

37) One adaptation that fungi have for absorptive nutrition, in which nutrients are absorbed across the cell surfaces, is

- a. lack of a cell wall.
- b. a low surface area-to-volume ratio.
- c. a high surface area-to-volume ratio.
- d. tolerance of low temperatures.
- e. tolerance of high temperatures.

38) Which of the following characteristics is unique to the fungi?

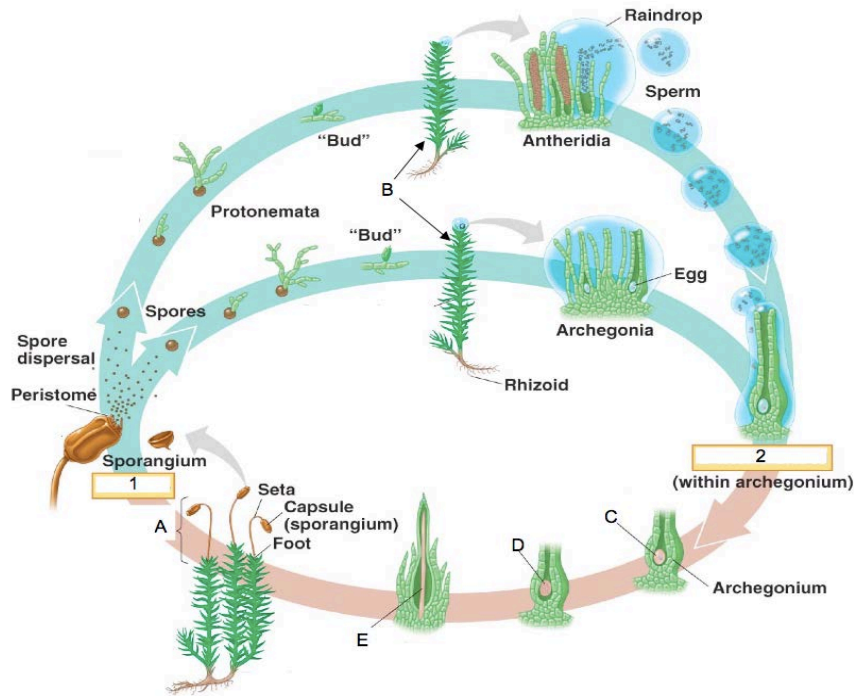
- a. Alternation of generations
- b. Spores
- c. Dikaryotic condition
- d. Fusion of nuclei
- e. Plasmogamy

39) The absorptive nutrition of fungi is aided by

- a. dikaryon formation.
- b. spore formation.
- c. the fact that they are all parasites.
- d. their large surface area-to-volume ratio.
- e. their possession of chloroplasts.

40) Reproductive structures consisting of one or more photosynthetic cells surrounded by fungal hyphae are called

- a. ascospores.
- b. basidiospores.
- c. conidia.
- d. soredia.
- e. gametes.



41) In the moss life cycle, above, what processes are represented by box 1 and box 2 respectively?

- box 1 = mitosis, box 2 = meiosis
- box 1 = meiosis, box 2 = fertilization
- box 1 = fertilization, box 2 = mitosis
- box 1 = mitosis, box 2 = fertilization
- box 1 = meiosis, box 2 = mitosis

42) Letter C in the diagram represents

- | | |
|--|-------------|
| a. the ovum | c. a zygote |
| b. the start of the new gametophyte generation | d. a seed |
| | e. a spore |

43) Of the structures labeled with **letters**, which is (are) diploid?

- All are diploid.
- Only the structures labeled "B" are diploid.
- Only structure "A" is diploid. The other labeled structures are haploid.
- All are diploid except letter "B."
- None is diploid.

44) In contrast to the fern life cycle (question #22), the moss life cycle

- | | |
|--|----------------------|
| a. has a more significant gametophyte generation | c. has motile sperm |
| b. has a more significant sporophyte generation | d. is mostly diploid |
| | e. features a seed |

45) The fruiting structure of a fungus

- attracts predators away from the essential underground parts.
- is an important organ for gas exchange with the atmosphere.
- is an organ of reproduction.
- acts as a hallucinogen for mammals.
- serves as a landing pad for fungal pollinators.

- 46) A major role of saprobic fungi in terrestrial ecosystems is to
- trap atmospheric CO₂.
 - break down carbon compounds.
 - parasitize animals.
 - parasitize plants.
 - form symbiotic mutualist relationships with plants.

- 47) The many organisms designated as “protists” or “microbial eukaryotes” are
- closely related to the bacteria.
 - highly diverse and not necessarily closely related to each other.
 - part of a monophyletic clade.
 - all unicellular.
 - all microscopic.

- 48) In *Plasmodium*, which causes malaria, the gametocytes
- develop into merozoites.
 - inhabit the salivary glands of *Anopheles* mosquitoes.
 - are the infective stage obtained from the insect vector.
 - are found inside red blood cells.
 - give rise to zygotes within the mammalian circulatory system.

- 49) The microbial eukaryotes that are responsible for sleeping sickness and those that are responsible for malaria
- are both alveolates.
 - both have insect vectors for transmission to humans.
 - cause the same symptoms.
 - both have gametocyte life stages.
 - All of the above

- 50) Which of the following is a sexual reproductive process common to organisms in the Protista (microbial eukaryotes) group?
- Binary fission
 - Multiple fission
 - Budding and spore formation
 - Union of gametes
 - All of the above

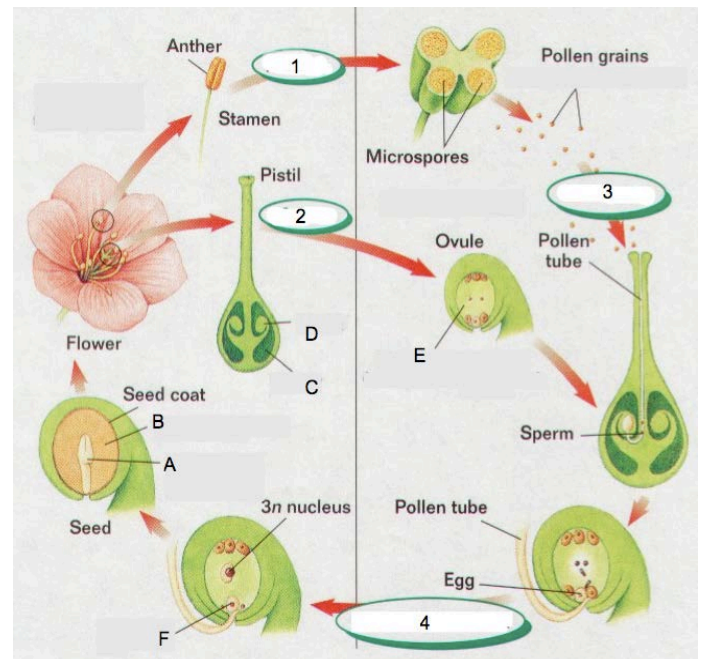
Use the drawing to the right for questions # 51, 52, 53, 54

51) In the life cycle at what step(s) can we expect meiosis to occur?

- at steps 1, 2 and 3 only
- at step 4 only
- at step 3 only
- at steps 1 and 2 only

52) What does the vertical line running down the middle of the picture best represent?

- the separation between male and female, with female on the left and male on the right
- the boundary between the vascular and the non-vascular
- the boundary between gametophyte and sporophyte
- the separation of haploid and diploid, with the diploid on the right and haploid on the left



- 53) In order to produce both the 3N nucleus and a zygote, step 4 must involve
- a. pollination
 - b. double fertilization
 - c. metamorphosis
 - d. multiple meiosis
 - e. significant mitosis

- 54) Which of the labeled components is haploid?
- a. A
 - b. B
 - c. C
 - d. F
 - e. E

- 55) When some autotrophic *Euglena* are placed in the dark, they
- a. stop producing their photosynthetic pigment.
 - b. produce an excess of photosynthetic pigment.
 - c. begin feeding on organic material floating in the surrounding water.
 - d. die.
 - e. Both a and c

- 56) A red belly on a male stickleback fish causes other males to attack. This behavior is called:
- a. operant conditioning
 - b. trial and error learning
 - c. a fixed action pattern
 - d. optimal foraging
 - e. mate selection behavior

- 57) In the alternation of generations, the
- a. haploid generation produces spores.
 - b. diploid generation produces gametes.
 - c. haploid and diploid organisms always resemble each other.
 - d. diploid organism produces spores.
 - e. haploid organism produces gametes by meiosis.

- 58) Red algae
- a. contain the photosynthetic pigment phycoerythrin.
 - b. do not contain chlorophyll.
 - c. can change their pigment concentrations as a function of light intensity.
 - d. have motile gametes.
 - e. Both a and c

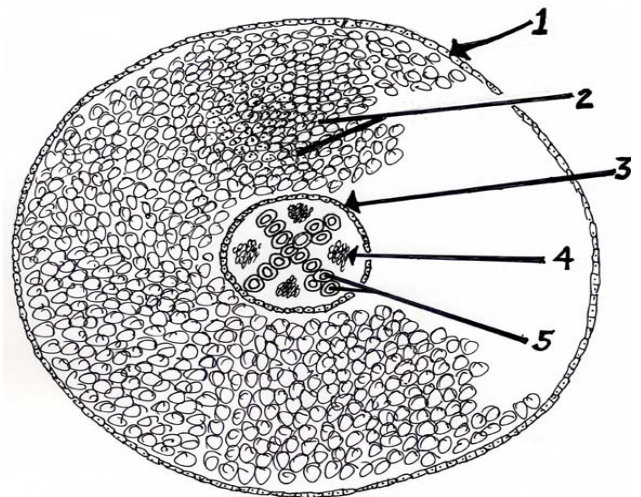
- 59) Grasses and other flowering plants with parallel-veined leaves are examples of
- a. monocots.
 - b. gymnosperms.
 - c. eudicots.
 - d. magnoliids.
 - e. Both b and c

Use the following diagram for questions #60, 61, 62:

- 60) The diagram is of a:
- a. dicot stem
 - b. dicot root
 - c. monocot stem
 - d. monocot root
 - e. gymnosperm stem

- 61) Label 5 points to the:
- a. xylem
 - b. phloem
 - c. pith
 - d. cortex
 - e. endodermis

- 62) Cells that conduct food throughout the plant are indicated by label:
- a. 1 and 2
 - b. 2
 - c. 3
 - d. 4
 - e. 5



- 63) A layer of cells that protects the plant is the
- a. cuticle.
 - b. endoderm.
 - c. epidermis.
 - d. ground tissue.
 - e. pericycle.
- 64) Guard cells
- a. protect the plant from herbivores.
 - b. secrete a waxy cuticle to prevent evaporation.
 - c. contain chemicals that poison insects.
 - d. control gas exchange.
 - e. inhibit germination of fungal spores.
- 65) A benefit of sexual reproduction in plants is
- a. the greater number of progeny that results.
 - b. ease of pollination.
 - c. the improved ability of plants to adapt to new environments.
 - d. that the haploid plant becomes diploid.
 - e. farther dispersal of progeny.
- 66) In a flower, the microsporangia are found in the
- a. anther.
 - b. filament.
 - c. stigma.
 - d. ovule.
 - e. ovary
- 67) Which is the correct order of events for female gametophytes?
- a. Megagametophyte, megasporocyte, megaspore
 - b. Megagametophyte, megaspore, megasporocyte
 - c. Megasporocyte, megaspore, megagametophyte
 - d. Megaspore, megasporocyte, megagametophyte
 - e. Megaspore, megagametophyte, megasporocyte
- 68) A flower that is wind-pollinated would be **least** likely to
- a. have numerous anthers.
 - b. have sticky or feathery stigmas.
 - c. produce large numbers of pollen grains.
 - d. have a colorful corolla.
 - e. have smooth wall sculpturing on its pollen.
- 69) The three nuclei in a mature pollen grain are formed by
- a. one meiotic division and one mitotic division.
 - b. two meiotic divisions and one mitotic division.
 - c. one meiotic division and two mitotic divisions.
 - d. two meiotic divisions and two mitotic divisions.
 - e. one meiotic division in which one of the four cells degenerates.
- 70) The advantage of self-fertilization in plants is
- a. increased genetic recombination.
 - b. that meiosis can occur.
 - c. greater efficiency of pollination.
 - d. that no flowering is needed.
 - e. that only asexual reproduction is necessary.
- 71) What is the fate of the seven cells of the embryo sac?
- a. All but one disintegrates upon fertilization.
 - b. Two become fertilized; the others disintegrate.
 - c. Two become fertilized; the others fuse to form endosperm.
 - d. All are involved in nuclear fusion events.
 - e. They all become part of the seed tissue.

- 72) Which of the following are distinguishing characteristic of all angiosperms?
 a. Seeds with nutrients
 b. Double fertilization
 c. Pollen production
 d. a, b, and c are correct
 e. only a is correct
- 73) After fertilization of the egg, the integument of the megasporangium develops into the
 a. cotyledons.
 b. embryo.
 c. endosperm.
 d. fruit.
 e. seed coat.
- 74) The fruit generally develops from which part of the flower?
 a. Petals
 b. Sepals
 c. Ovary
 d. Stamens
 e. Pedicel
- 75) Sexual reproduction in angiosperms
 a. is by way of apomixis.
 b. requires the presence of petals.
 c. can be accomplished by grafting.
 d. gives rise to genetically diverse offspring.
 e. cannot result from self-pollination.
- 76) The typical angiosperm female gametophyte
 a. is called a megaspore.
 b. has eight nuclei.
 c. has eight cells.
 d. is called a pollen grain.
 e. is carried to the male gametophyte by wind or animals.
- 77) Water tends to move into a cell that has a(n)
 a. high turgor pressure due to cell wall rigidity.
 b. high, positive water potential.
 c. interior solute concentration like that of distilled water.
 d. more negative water potential than its surroundings.
 e. low turgor pressure.
- 78) Which plant hormone slows growth and promotes seed and bud dormancy?
 a. gibberellin
 b. cytokinin
 c. auxin
 d. ethylene
 e. abscissic acid
- 79) The uptake of ions in plant cells is influenced by the
 a. electrical gradient.
 b. concentration gradient.
 c. ionic balance.
 d. pumping of H^+ .
 e. All of the above
- 80) Cell walls impregnated with water-repellent suberin are found in the cells of the
 a. root hairs.
 b. cortex.
 c. endodermis.
 d. pericycle.
 e. tracheids

**New Jersey Science League
Biology II Answer Key
Date: March 2012**

1 E	17 B	33 E	49 B	65 C
2 B	18 C	34 B	50 E	66 A
3 E	19 D	35 A	51 D	67 C
4 D	20 E	36 C	52 C	68 D
5 D	21 D	37 C	53 B	69 C
6 C	22 B	38 C	54 E	70 C
7 C	23 C	39 D	55 E	71 B
8 A	24 B	40 D	56 C	72 D
9 C	25 A	41 B	57 D	73 E
10 C	26 D	42 C	58 D	74 C
11 C	27 D	43 D	59 A	75 D
12 B	28 C	44 A	60 B	76 B
13 B	29 D	45 C	61 A	77 D
14 E	30 A	46 B	62 D	78 E
15 C	31 D	47 B	63 C	79 E
16 B	32 E	48 D	64 D	80 C

BIOLOGY II For all second year and AP level students. NOTE: Consistent with a modern approach to biology, principles of evolution will be included in every test as these apply to the topics listed. 80 multiple choice questions per exam.

JANUARY TEST: evolution, general chemistry, water, chemistry of carbon molecules, structure and function of macromolecules, eukaryotic and prokaryotic cell structure and function including membrane transport, ATP synthesis, photosynthesis and cell respiration, enzymatic regulation of biochemical reactions.

FEBRUARY TEST: evolution, eukaryotic and prokaryotic cell cycles, chromosomes, meiosis and gametogenesis, Mendelian and non-Mendelian patterns of genetic inheritance, molecular genetics and biotechnology, bioinformatics, genetic diseases, genetics of viruses and bacteria, population genetics.

MARCH TEST: evolution, phylogeny and systematics, prokaryotes, protists, fungi, comparative anatomy and physiology of the plant kingdom (from green algae to flowering plants - with emphasis on angiosperm form and function)

APRIL TEST: evolution, comparative anatomy and physiology of the animal kingdom with emphasis on human anatomy and physiology (nutrition and digestion, circulation and gas exchange, immunity and disease, osmoregulation and excretion, hormonal control, reproduction and development, nervous control and sensory mechanisms), ecology (relationships, energy flow, cycling of matter, biomes, ecosystems, populations), behavior.

TESTING DATES FOR THE NEW JERSEY SCIENCE LEAGUE

Thursday March 8, 2012; *Thursday April 12, 2012

The April exam must be completed by April 30th. No area may take the April exam during the first week of April or during the first week of May.

New Jersey Science League

PO Box 65 Stewartsville, NJ 08886-0065

phone # 908-213-8923 fax # 908-213-8924 email newjisl@ptd.net or njscil@enter.net Web address www.enter.net/~njscil

Testing Dates 2013

Thursday January 10, 2013, Thursday Feb 14, 2013;

Thursday March 14, 2013; *Thursday April 11, 2013

*The April 2013 exam can be changed based upon the School's spring break.

**NJSL Biology II Exam
April 2012**

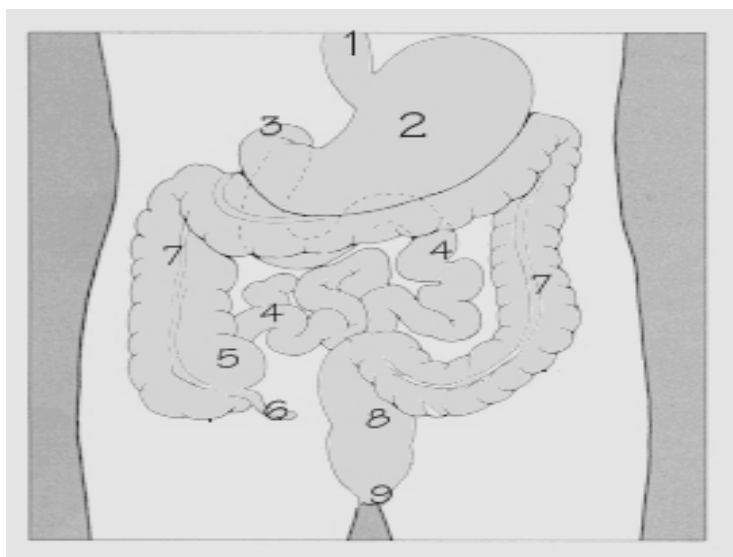
Choose the answer that best completes the statements or questions below and fill in the appropriate response on the form. If you change an answer, be sure to completely erase your first choice.

Please PRINT your name, school, area, and which test you are taking onto the scan-tron.

1. Which of the following could be an example representing convergence between cephalopods and mammals?
 - a. both groups have well-developed internal skeletons, although in cephalopods the skeleton is made of calcium carbonate
 - b. cephalopods have independently evolved a regulating mechanism to maintain constant body temperature
 - c. cephalopods have independently evolved a camera-type eye, much like the that of a mammal
 - d. cephalopods have independently evolved arms, much like mammalian appendages

2. Which of the following is advantageous of a complete digestive system over a gastrovascular cavity?
 - a. the potential for specialized regions
 - b. extracellular digestion is not required
 - c. intracellular digestion is simplified
 - d. digestive enzymes are more specific

Questions 3 and 4 refer to the diagram to the below of the human digestive system. Match the correct letter of the structure to the description provided.



3. Where does the digestion of fats occur?
 - a. 2
 - b. 2 and 4
 - c. 4
 - d. 8

4. Where are the enzymes maltase, sucrase, and lactase produced?
 - a. 2
 - b. 4
 - c. 7
 - d. 8

5. Blood returning to a mammalian heart through a pulmonary vein will drain into which of the following first?
 - a. right atrium
 - b. left atrium
 - c. right ventricle
 - d. left ventricle
 - e. vena cava

6. Which of the following is NOT a reason why gas exchange is more difficult for aquatic animals compared to terrestrial animals?

- a. air is less dense than water
- b. air contains more oxygen than water per unit volume
- c. water takes more energy to pump than air
- d. gills have less surface area than lungs

7. Capillary beds are associated with all of the following surfaces **EXCEPT**

- a. epidermis of frog
- b. trachea of insects
- c. gills of fish
- d. alveoli of lungs

Match the appropriate description in questions 8, 9, 10 to the following answers.

- a. Cirrhosis
- b. Crohn's disease
- c. Mesothelioma
- d. Angina
- e. Atherosclerosis

8. In most cases of this disease, the cause is heavy exposure to asbestos

9. This disease is characterized by the replacement of healthy liver tissue by fibrosis or scar tissue.

10. Condition where blood vessels narrow and harden due to plaque build-up.

11. Which of the following is NOT considered a disorder of the immune system?

- a. Aids
- b. Crohn's
- c. Leukemia
- d. Type one Diabetes

12. The digestion and use of which of the following creates the greatest need for osmoregulation by the kidneys?

- a. starch
- b. lipid
- c. protein
- d. cellulose

Use the following diagram to answer questions 13-15.

13. The filtering of blood occurs at

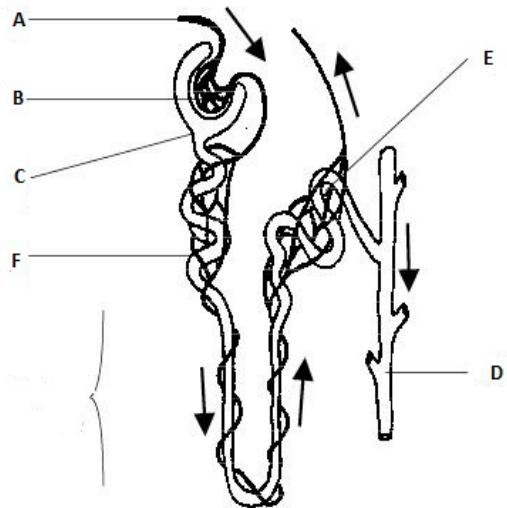
- a. B and C
- b. C and F
- c. D
- d. D and F

14. Where does urine become most concentrated?

- a. E
- b. F
- c. C
- d. D

15. The specialized cells called podocytes are located in which choice below?

- a. A
- b. B
- c. C
- d. D



16. In contrast to an earthworm's metanephridia, a mammalian nephron

- a. is notably associated with a network of capillaries
- b. processes blood as opposed to coelomic fluid
- c. functions in osmoregulation AND the excretion of nitrogenous wastes.
- d. forms urine by changing the fluid make-up inside the tubule.

17. Brain hormone in insects is most similar

- a. insulin from pancreas
- b. ADH from the posterior pituitary
- c. parathyroid hormone from the parathyroid gland
- d. releasing hormones from the hypothalamus

18. Which of the following is an endocrine gland?

- a. salivary gland
- b. sweat gland
- c. parathyroid gland
- d. sebaceous gland

Use the following list of hormones to answer questions 19, 20, 21.

- a. estrogen
- b. testosterone
- c. cortisone
- d. insulin
- e. oxytocin

19. Which of the above hormones is **NOT** a steroid?

20. Which of the above hormones is a protein?

21. Which of the above hormones stimulates the contraction of uterine muscles?

22. Which of the following is the best explanation for why sexual reproduction is important?

- a. Animals do not have to deplete conserved resources to do it.
- b. The resulting range of phenotypes may enhance survival of a population in a changing environment.
- c. It allows geographically isolated animals to colonize a habitat quickly.
- d. It can result in many offspring in a short amount of time.

23. Oxytocin and vasopressin are both manufactured in the hypothalamus but are stored and released from the

- a. thalamus
- b. adenohypophysis
- c. thyroid
- d. neurohypophysis

24. The five hormones that regulate the human menstrual and ovarian cycle originate from

- a. the ovary
- b. the hypothalamus
- c. the pituitary
- d. all three of these

25. Human semen is made up of

- a. approximately 250 to 400 million sperm, and nothing else
- b. sperm plus secretions from the prostate, bulbourethral glands and seminal vesicles
- c. sperm and secretions from only the prostate gland
- d. sperm and various enzymes, but no other secretions

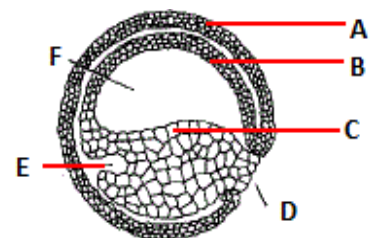
26. Which of the following describes parthenogenesis?

- a. an organism is born with male reproductive parts that develop into female reproductive parts
- b. an egg develops without being fertilized
- c. an organism is born with both male and female reproductive parts
- d. an egg needs to be fertilized twice in order to develop

Use the late gastrula diagram to answer questions 27-29.

27. The embryo above most likely develops into a(n)

- a. frog
- b. dog
- c. chick
- d. human



**Late
gastrula**

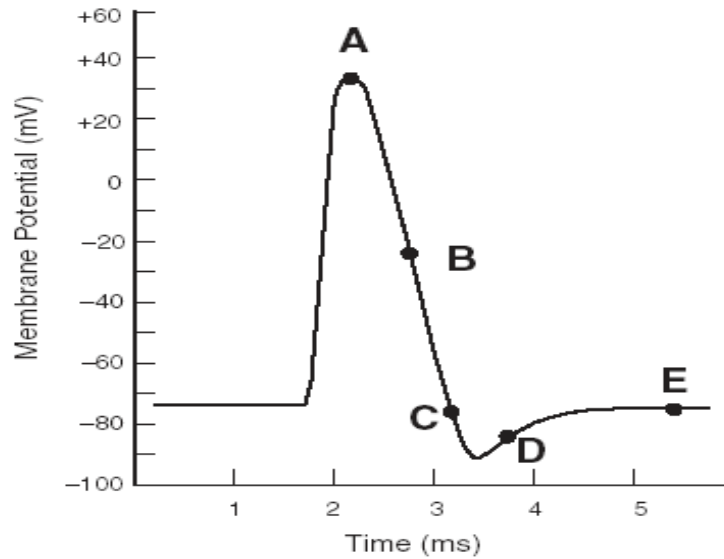
28. A nervous system would not exist without the formation of

- a. A
- b. B
- c. C
- d. D

29. In the above embryo, the notochord will develop from

- a. A
- b. B
- c. C
- d. D

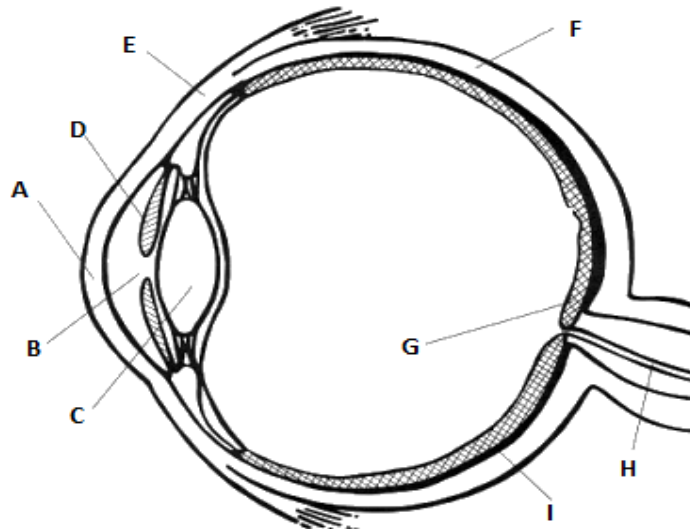
30. What do nerves, muscles and glands have in common?
- They are referenced as postsynaptic cells
 - They are target cells
 - They can synapse with neurons
 - a, b and c are correct



Use the graph plotting action potential curve above to answer questions 31-32.

31. Which letter in the diagram represents repolarization (sodium gates are closed, and potassium gates are open)?
32. The situation at point A is most accurately described by
- permeability of the cell membrane to K^+ is greater than its permeability to Na^+
 - most of the voltage regulated Na^+ channels are open
 - the intracellular concentration of Na^+ is greater than its extracellular concentration
 - activity of the Na^+/K^+ pump has ceased
33. Centralization of the nervous system is most likely associated with the evolution of
- radial symmetry
 - bilateral symmetry
 - closed circulatory system
 - respiratory units
34. Into which of the following can the motor part of the Peripheral Nervous System be separated?
- brain & spinal cord
 - sympathetic & parasympathetic system
 - somatic & autonomic systems
 - central nervous & sensory systems
35. The parasympathetic division of the nervous system is associated with
- fight or flight response
 - resting and digesting
 - increase in metabolic rate
 - release of epinephrine

36. Which of the following refers to the ability of a receptor to absorb the energy of a stimulus?
- amplification
 - transmission
 - reception
 - transduction



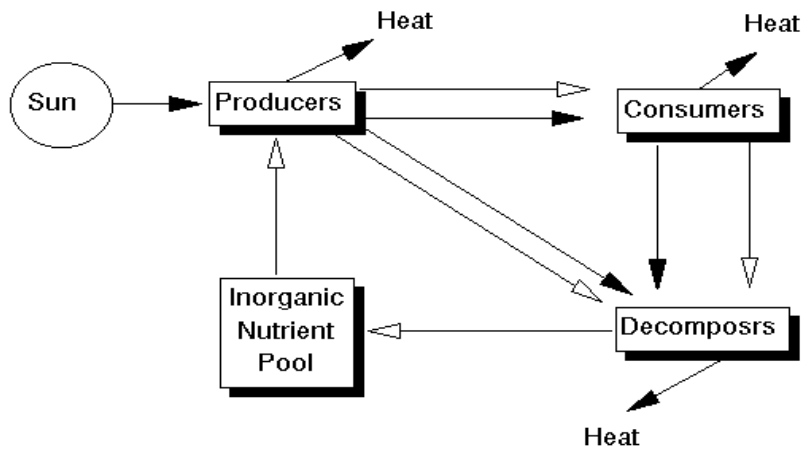
The following two questions refer to the above diagram of the anatomy of the eye.

37. Which of the following contains the muscles that regulate the size of the pupil?
- A
 - G
 - C
 - D
38. The eye's photoreceptors are located on which of the following structures?
- A
 - B
 - C
 - G
39. The common ancestor of all animals most likely resembled a
- protist
 - fungus
 - plant
 - bacteria
40. The swim bladder of modern bony fish was probably modified from
- simple lungs of freshwater fish
 - stomach of a shark
 - crop of an arthropod
 - stomach of a reptile
41. The amniotic egg first evolved in which of the following groups?
- fish
 - birds
 - reptiles
 - amphibians
42. In the history of evolution, why is the amniotic egg considered an important evolutionary breakthrough?
- The shell provides the perfect medium for gas exchange
 - The shell provides insulation to conserve heat energy
 - It allowed for the incubation of eggs on land
 - It allows for more time for embryo to develop

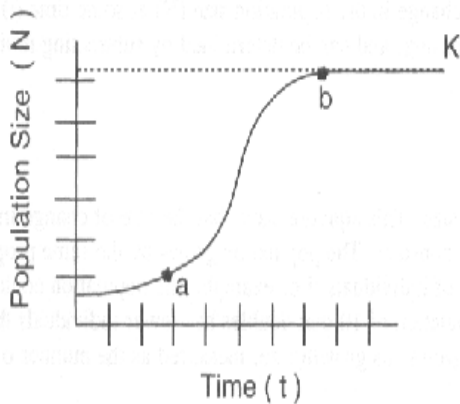
43. Which of the following are possibly the only known modern animals to likely have descended directly from dinosaurs?
a. lizards b. crocodiles c. snakes d. birds
44. Which of the following evolutionary sequences is consistent with fossil records?
a. fishes → amphibians → reptiles → birds
b. fishes → birds → reptiles → amphibians
c. reptiles → amphibians → birds → fishes
d. reptiles → birds → amphibians → fishes
45. Which of the following levels of classification is NOT shared by humans and apes?
a. Phylum b. order c. class d. genus
46. Which of the following best supports the statement that mitochondria are descendants of endosymbiotic bacteria-like cells?
a. Mitochondria and bacteria possess similar ribosomes and DNA.
b. Mitochondria and bacteria possess similar nuclei.
c. Glycolysis occurs in both mitochondria and bacteria.
d. Both mitochondria and bacteria have microtubules.
e. Neither mitochondria nor bacteria possess chloroplasts.
47. The study of ecology includes all of the following categories of organization EXCEPT
a. cell
b. organism
c. population
d. community
48. A species newly introduced to a geographic location where it previously did not exist
a. is often unable to colonize new region
b. may thrive and become invasive
c. can disrupt the endemic species and the balance of the ecosystem
d. All of the above are correct.
49. Which of the following biomes would most likely have the shortest growing season?
a. Deciduous forest b. temperate grassland c. tropical rain forest d. taiga e. savanna
50. Which of the following is **NOT** recycled in the biosphere?
a. water b. nitrogen c. carbon d. energy
51. Which statement best contrasts the difference between the movement of nutrients and the movement of energy through the living world?
a. energy flows in one direction and nutrients recycle
b. energy is limited in the biosphere and nutrients are always available
c. nutrients flow in one direction and energy recycles
d. energy forms chemical bonds and nutrients are lost as heat
52. The sympatric existence of hawks and owls seems to defy the competitive exclusion principle, especially since they feed on the same prey. What best explains the coexistence of these carnivorous birds in the same geographic region?
a. Owls are not as successful hunters as hawks and so pose no competition
b. Hawks hunt in forests whereas owls hunt in open fields
c. They are active at different times of the 24-hour day
d. Owls scavenge the kills of hawks

53. Carbon cycles through the biosphere in all of the following processes EXCEPT
- photosynthesis
 - transpiration
 - Burning of fossil fuels
 - decomposition of plants and animals
54. As DDT moves up the trophic levels in food webs, its concentration within individual organisms
- stays the same
 - increases
 - decreases
 - is eliminated
55. If the rates of immigration and emigration of a population are the same, what would cause the population to grow?
- The population could not increase
 - if the mortality and natality are equal
 - if the mortality is greater than the natality
 - if the natality is greater than the mortality
56. The relationship between a tree orchid and the tree in which it resides can be best categorized as
- Mutualism
 - commensalism
 - parasitism
 - divisionism
57. Which of the following should be classified as a “community?”
- a wetland marsh
 - a flock of sea gulls
 - a pack of grey wolves
 - a school of dolphins
58. Which of the following biomes supports the greatest number of large animals despite moderate rainfall?
- taiga
 - temperate rainforest
 - savanna
 - polar
59. In which of the following communities would organisms most likely have evolved to adapt to different photoperiods?
- Tropical forest
 - temperate forest
 - coral reef
 - savanna
60. Introduced by ballast water from boats from foreign geographic areas, Zebra mussel populations in the Mississippi river are increasing at an uncontrollable rate. Which of the following can best explain the reason for the uncontrolled growth rate?
- They disrupt the river water with mud so that predators can not see them
 - Predator species are too few to slow down the mussel population growth
 - The Zebra mussels are not as well adapted to the environment as are the endemic species
 - The mussels are feeding on a source of food previously under utilized

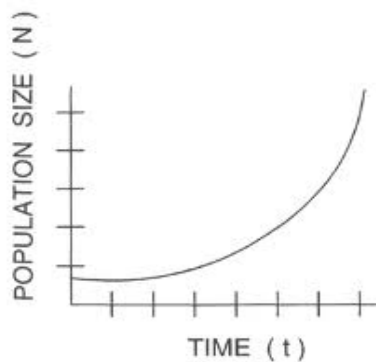
Use the diagram to the below for question #61.



61. The diagram above shows the cycling of carbon in a system. What would occur if the decomposers were removed from system?
- the amount of carbon dioxide in the atmosphere will increase
 - the amount of carbon dioxide in the atmosphere will decrease
 - the amount of carbon dioxide used by producers will increase
 - the amount of carbon dioxide needed by consumers will decrease



A



B.

Use the graphs above to answer questions 62-64.

62. Which graph represents the maximum carrying capacity of a population?
- Graph A
 - Graph B
63. Which of the graphs most closely resembles human population growth?
- Graph A
 - Graph B
64. Which of the graphs reflects exponential growth?
- Graph A
 - Graph B
 - not enough information is given to choose
 - both graphs A and B

65. Which of the following can contribute to density-dependent regulation of populations?
- Toxic waste accumulation
 - intraspecific competition for nutrients
 - predation
 - all of the above
66. Which of the following is the unit of evolution, meaning it can survive in the Darwinian sense?
- gene
 - chromosome
 - individual
 - population
67. Natural selection is most closely related to?
- gene flow
 - genetic drift
 - differential reproductive success
 - diploidy
68. What accounts for the differences between the skulls of adult humans and adult chimpanzees?
- large range of genetic differences
 - the two do not share a common ancestor
 - variations in allometric growth patterns
 - similar developmental timeables

Use the following terms to answer questions 69-73. Match the term which best fits the following descriptions of behavior.

a. classical conditioning b. operant conditioning c. imprinting d. habituation e. classical & operant conditioning

69. A pet dog, knowing he usually gets a chip, comes running when his owner moves a bag of potato chips in the kitchen.
70. A salmon returns to its own home stream to spawn.
71. Male insects try to mate with orchids but eventually discontinue their attempts.
72. A dog learns it will get a treat when it barks.
73. A sea slug normally responds to being poked by curling up. After being poked repeatedly, the slug no longer curls up.
74. Killer bees are more deadly than other bees because
- Their venom is stronger
 - their stingers are longer
 - their reception threshold for alarm pheromone is lower
 - They can sting multiple times
75. Two poisonous species of moths that live in overlapping habitats have similar coloration. This is an example of
- Mullerian mimicry
 - Batesian mimicry
 - Imitation
 - Habituation

76. Consider the following list of factors

- I dispersal
- II rainfall
- III mineral deposits
- IV competition
- V temperature

Which of the factors listed above are most significant in determining the fact that belts of vegetation at successively higher altitudes often correspond to those at successively higher latitudes?

- a . I and III
- b . III and V
- c . II and IV
- d . II and V
- e . I and V

77. The NJ pinelands can be considered an edaphic climax community because

a. most of the surrounding regions are characterized by a beech/maple hardwood forest climax community

- b. they are located close to the coast
- c. there is a parallel pine community in the Carolinas
- d. the community is easily disturbed by fire

78. The coastal wetlands of NJ are dominated by *Spartina* grasses. What trait or traits must *Spartina* grasses display that enables them to thrive in this ecosystem, and that distinguishes them from grass species further inland?

- a. they reproduce asexually
- b. they fix CO₂ at night
- c. they actively secrete salt out of their leaves
- d. they must be able to tolerate high grazing pressure from large animals

79. Social behavior of insects on an evolutionary basis was studied by ?

- a. E.O. Wilson
- b. Jane Goodall
- c. Karl Von Frisch
- d. B. F. Skinner

80. Karl von Frisch studied honeybee communication and the honeybee waggle dance? The purpose of the waggle dance was to:

- a. inform other bees of nearby danger
- b. direct the queen bee to begin fertilization of eggs
- c. inform other bees of nearby food.
- d. inform other bees of a change in the weather.

NEW JERSEY SCIENCE LEAGUE

Biology II Answer Key

ANSWER SHEET

April 2012

1	C	17	D	33	B	49	D	65	D
2	A	18	C	34	C	50	D	66	D
3	C	19	D	35	B	51	A	67	C
4	B	20	D	36	C	52	C	68	C
5	B	21	E	37	D	53	B	69	E
6	D	22	B	38	D	54	B	70	C all full credit
7	B	23	D	39	A	55	D	71	D
8	C	24	D	40	A	56	B	72	B
9	A	25	B	41	C	57	A	73	D
10	E	26	B	42	C	58	C	74	C
11	B	27	A	43	D	59	B	75	A
12	C	28	A	44	A	60	B	76	D
13	A	29	B	45	D	61	B	77	A
14	D	30	D	46	A	62	A	78	C
15	C	31	B	47	A	63	B	79	A
16	B	32	C	48	D	64	D	80	C

APRIL TEST: evolution, comparative anatomy and physiology of the animal kingdom with emphasis on human anatomy and physiology (nutrition and digestion, circulation and gas exchange, immunity and disease, osmoregulation and excretion, hormonal control, reproduction and development, nervous control and sensory mechanisms), ecology (relationships, energy flow, cycling of matter, biomes, ecosystems, populations), behavior.

Testing Dates 2013

Thursday January 10, 2013, Thursday Feb 14, 2013;

Thursday March 14, 2013; *Thursday April 11, 2013

*The April 2013 exam can be changed based upon the School's spring break.

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