

New Jersey Science League – Biology II Exam
January 14, 2016 White TEST (No Corrections)

SCANTRON INSTRUCTIONS: Please PRINT your NAME, SCHOOL, AREA and which exam (i.e., Bio II – Jan '16) you are taking onto the scan-tron. State if you are an alternate or regular member of your team.

TEST INSTRUCTIONS: 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.

1. Researchers studying the effects of toxic wastes knew animals were poisoned by the heavy metal cadmium, but they wanted to know where cadmium accumulated in the body. How could they find out?
 - a. tracing the movement of cadmium isotopes in test animals
 - b. measuring the size of cadmium atoms
 - c. determining if cadmium is acidic in water
 - d. determining the number of molecules cadmium can covalently bond with.

2. Glucose and hexanoic acid each contain six carbon atoms, but have completely different properties. Glucose is necessary in food, while hexanoic acid is poisonous. What would be responsible for their different properties?
 - a. Monomers that compose these molecules are different
 - b. Their arrangement of the quaternary structure is different
 - c. Each molecule contains different functional groups.
 - d. How each molecule undergoes hydrolysis differentiates each molecule.

3. Where in a potato plant would we expect to find the greatest concentration of sucrose?
 - a. in the cell membrane
 - b. in the nuclei of potato cells
 - c. in the sap of the potato cells
 - d. in the walls of the potato cells

4. A particular protein produce by the rough ER is eventually used to build the cell's plasma membrane. The protein in the membrane is actually slightly different from the protein made in the ER. Where did the probable changes in the protein occur?
 - a. lysosome
 - b. Golgi apparatus
 - c. nucleolus
 - d. ribosome

5. What cell structure would allow a dye injected into one cell to pass into an adjacent cell?
 - a. microtubule
 - b. plasmodesmata
 - c. tight junction
 - d. vacuole

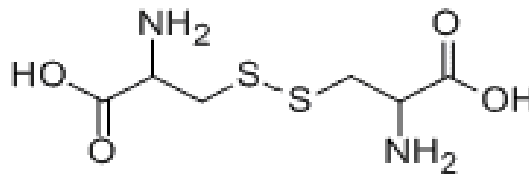
6. Which of the following would be least likely to diffuse through a cell membrane without the help of a transport protein?
 - a. a large polar molecule
 - b. a large non polar molecule
 - c. a small polar molecule
 - d. a small nonpolar molecule

7. If mice were allowed to breathe radioactive oxygen where would radioactive oxygen atoms be found most immediately?
 - a. CO₂
 - b. H₂O
 - c. NADH₂
 - d. C₆H₆O₆

8. Children can suffer from a protein deficiency known as Kwashiorkor. This deficiency occurs when a child's diet is changed from high-protein breast milk to watery cereal. Even though the calories remain the same, the child becomes sick, less active and growth ceases. What is the probable cause of these symptoms?
 - a. too many nucleic acids in the diet
 - b. an overconsumption of complex proteins
 - c. lack of carbohydrates in the diet.
 - d. lack of essential amino acids in the diet.

9. Trypsin and elastase are both enzymes that catalyze hydrolysis of peptide bonds. Trypsin only cuts next to lysine, while elastase cuts next to alanine. Why would the enzymes cut in two different places on the same protein?
- Trypsin is not a protein-based enzyme.
 - ΔG for the two reactions is different.
 - The shape of the active site for two enzymes is different.
 - One reaction is endergonic and the other is exergonic.
10. What determines whether lactic acid or ethanol + CO₂ are produced when oxygen is absent from the respiration pathway?
- oxygen's affinity to the substrate
 - the presence of Acetyl CoA
 - the type of membrane present
 - the type of organism

11. What macromolecule would contain the structure below?

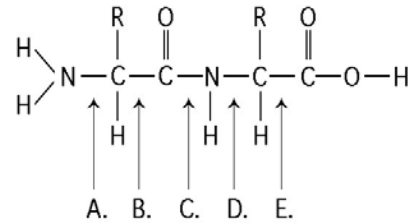


- carbohydrates
 - lipid
 - protein
 - nucleic acid
12. A wilting plant is watered and firms up minutes after receiving water. What has occurred?
- a flaccid reaction caused straightening
 - the active transport of water
 - an isometric response
 - an increase in turgor pressure
13. What would be the likely result, if too many lysosomes were active in a cell at once?
- cell division
 - death
 - movement
 - growth
14. Which cell type would most likely have the highest concentration of mitochondria?
- adipose cells
 - epithelial cells
 - muscle cells
 - red blood cells
15. If product molecules bind allosterically to molecules of the first enzyme in a metabolic pathway in which the product is made, what is the most likely outcome of this binding process?
- A continued rise in product concentration
 - A drop in concentration of available substrate
 - An increase in enzyme activity
 - Feedback inhibition
16. How can the rate of photosynthesis per wavelength of light be measured effectively?
- by change in temperature
 - by the liberation of carbon dioxide
 - by the production of oxygen
 - by the use of sugar
17. A deficiency of dietary niacin results in NAD⁺ deficiency. What impact might this have at the cell level?
- Metabolic reactions accelerate
 - An increase in synthesis of glucose and oxygen
 - Water molecules are degraded
 - Inability to transport hydrogen

18. What best explains why crabgrass, a C₄ plant, can outcompete Kentucky bluegrass, a C₃ plant, in the average lawn?
- Crabgrass is better adapted to cool weather than bluegrass.
 - Crabgrass conducts photosynthesis more efficiently than bluegrass in the given environment.
 - Crabgrass reflects light and heat better than bluegrass.
 - Crabgrass tolerates floods better than bluegrass.
19. Which is an example of protein denaturation?
- Curdling of milk
 - Dehydration synthesis of amino acids
 - Hydrolysis of proteins into amino acids
 - Conversion of alanine to phenylalanine
20. Consider a typical potted houseplant. Water in the soil moves into the plant because...
- root cells contain no water.
 - root cells actively pump water into the plant.
 - root cells have a higher concentration of water than does the soil.
 - root cells have a higher solute concentration than does the soil.
21. A cell is two units in length, width and depth in each dimension. If these dimensions double, what is the new relative surface area?
- 6
 - 24
 - 48
 - 96

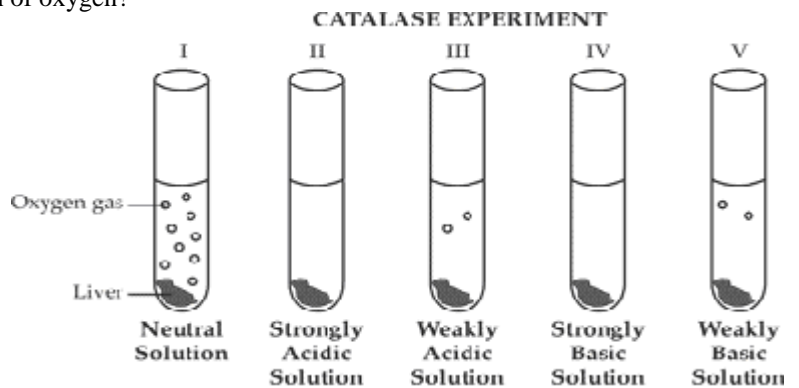
22. In the diagram below, where would a protease be able to break a peptide bond?

- A only
- B and E
- C only
- A and D

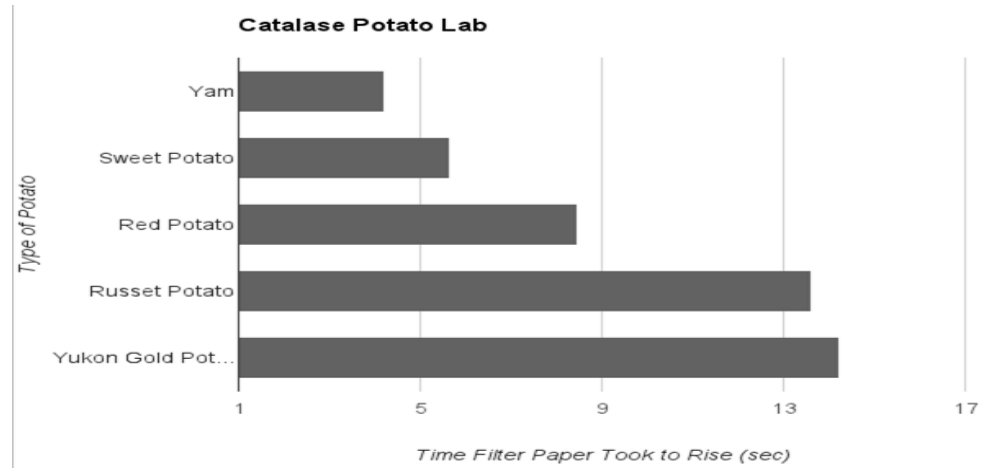


23. Use the information and the diagram below to answer the following item. Catalase helps prevent a toxic buildup of hydrogen peroxide in cells by breaking it down into water and oxygen gas. An experiment is designed to test the effects of pH on the activity of catalase. Each test tube contains a solution of hydrogen peroxide and water at various pH levels. The liver tissue is a source of catalase. The diagram below represents the results of their experiment. What pH is best for the production of oxygen?

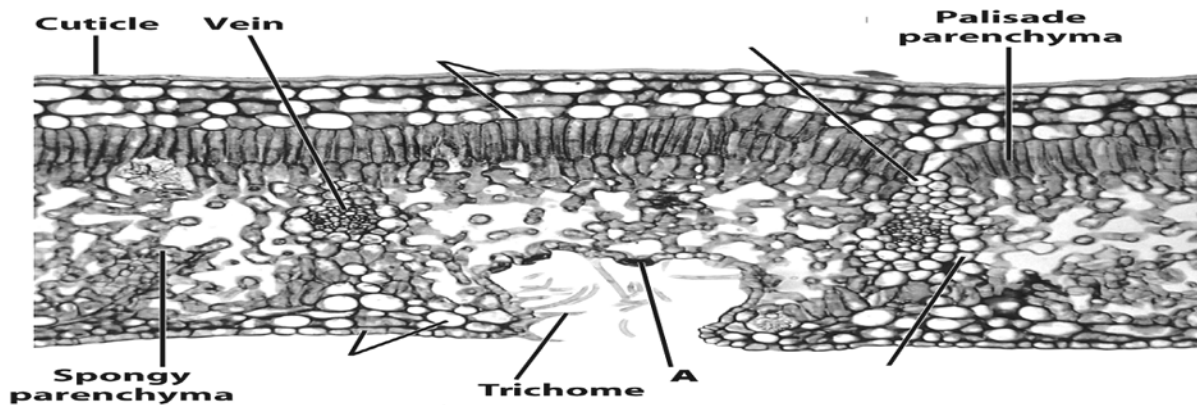
- 1
- 4
- 7
- 10



24. An experiment tested the amount of catalase in different types of potatoes. A slip of paper was soaked in each potato solution using the same extraction method. Then the paper was submerged in hydrogen peroxide, and timed how long it would take to float to the top. Analyze the graph below. Which statement is best supported by the data?

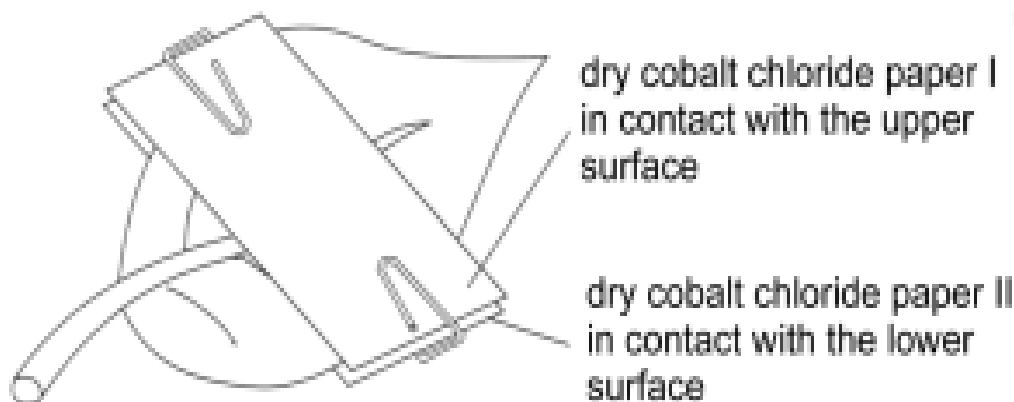


- Yam had the highest concentration of catalase
 - Yam had the lowest concentration of catalase
 - Yukon Gold had the highest concentration of catalase
 - Russet gold and Yukon Gold had equal catalase activity
25. The micrograph below shows a cross-section of a leaf. Assume that letter “A” points to a stomate. What can we infer about this leaf?

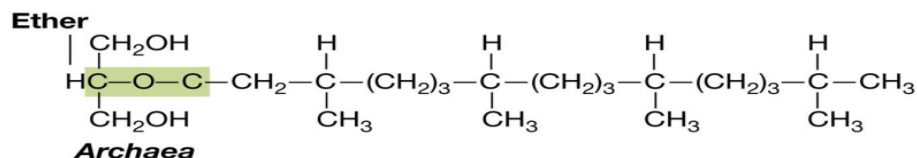
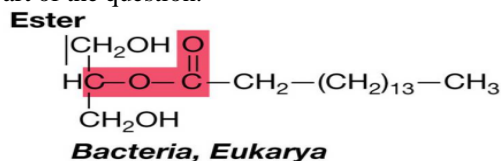


- The plant from which this leaf was taken is adapted to a climate where water availability may be an issue.
 - This is the leaf of a water lily.
 - This leaf shows structure associated with a C_3 plant.
 - The plant from which this leaf was taken shows adaptations for performing photosynthesis in conditions of limited light.
26. Guard cells open in response to light. What would happen if you kept a plant in a dark room until two hours after dawn?
- The stomata would open anyway.
 - Stomata would stay closed until they received light.
 - Chlorophyll would degrade.
 - Stomata would remain closed until the next day.

27. Assume a culture of skeletal muscle cells is grown on a nutrient medium that contains glucose as well as a poison that blocks the electron transport chain. Assume also that these cells grow at the same rate as cells grown on the same medium but without the toxin. If we compare the two cell cultures, we can say that
- The cells in the medium with the toxin will not produce any ATP.
 - Glucose consumption will be higher in the cells grown in the medium that contains the toxin.
 - Oxygen consumption will be the same in both cultures.
 - Ethanol production will be higher in the cells grown in the medium that contains the toxin.
28. Two brothers were under medical treatment for infertility. Microscopic examination of their semen shows that their sperm looked normal but did not move properly. The brothers suffered from chronic bronchitis. The doctor decided that the brothers had a problem with a cell organelle. Which organelle could be a problem in both the sperm cells and bronchial cells?
- Golgi bodies
 - ribosomes
 - microtubules
 - mitochondria
29. Cobalt chloride strips turn from blue to pink in the presence of water. Examine the diagram below. What question is the set-up solving?



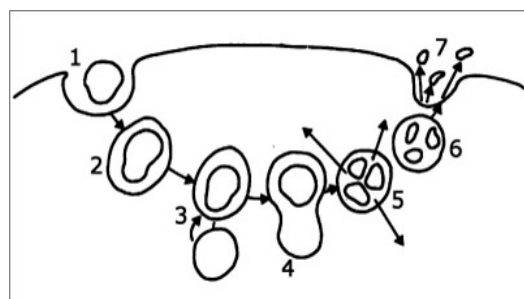
- Does photosynthesis occur in a leaf?
 - What is the density of stomata on each surface of the leaf?
 - What is the role of the stomata?
 - Does paper stop transpiration from occurring?
30. Study the figures below of membrane lipids from two groups of organisms, bacteria and eukarya versus archaea. How do these molecules differ? The shaded areas show the structural form of an ester and an ether. The colored areas are not part of the question.



- In the manner by which fatty acids are linked to glycerol
- In the number of carbons in the glycerol backbone
- In that archaea do not bind phosphates to the glycerol backbone
- In that bacteria and eukarya incorporate fatty acid chains that are significantly shorter than those in archaea

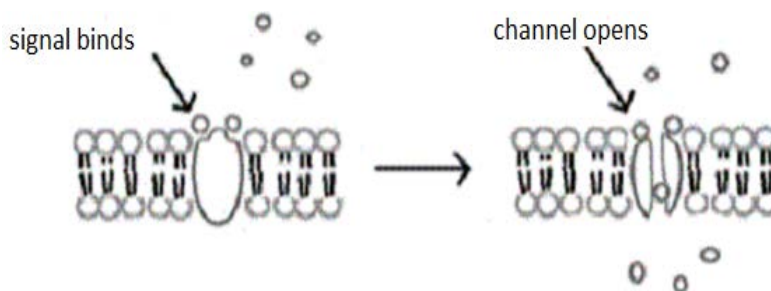
31. Assume that converting substance A to substance B ($A \rightarrow B$) is a thermodynamically unfavorable reaction. How does coupling this reaction to ATP hydrolysis ($ATP \rightarrow ADP + P_i$) make possible an otherwise unfavorable reaction ($A + ATP + H_2O \rightarrow B + ADP + H^+$)?
- ΔG for $ATP \rightarrow ADP + P_i$ must be significantly greater than ΔG for $A \rightarrow B$.
 - ΔG for $ATP \rightarrow ADP + P_i$ must equal ΔG for $A \rightarrow B$.
 - $\Sigma \Delta G$ of both reactions ($A \rightarrow B$ and $ATP \rightarrow ADP + P_i$) must be negative
 - $\Sigma \Delta G$ of both reactions ($A \rightarrow B$ and $ATP \rightarrow ADP + P_i$) must be positive

32. In the diagram below, at what point would a hydrolytic enzyme be acting on the contents of the endocytic vesicle?



- 2
- 3
- 5
- 7

33. The diagrams show the action of a gated channel. When the channel opens what is allowed to pass through?



- steroids
- ions
- small lipids
- phospholipids

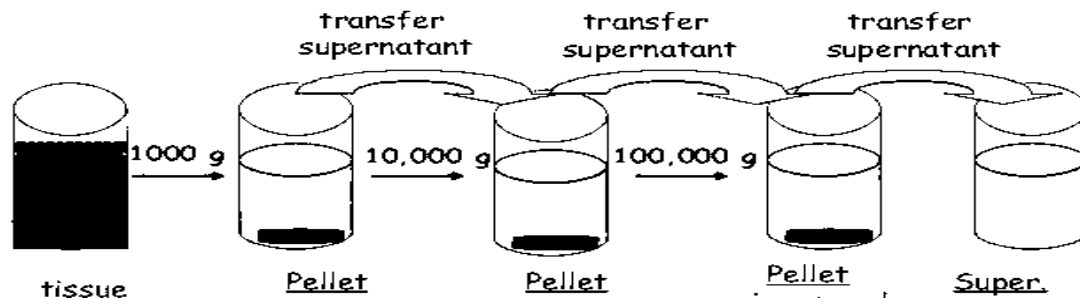
34. Which cannot readily move through biological membranes by simple diffusion?
- small lipids
 - gases such as O_2 and CO_2
 - small uncharged polar molecules
 - charged ions such as Na^+
35. Which overall shape or structural configuration does a membrane transport protein tend to possess?
- integral
 - linear
 - alpha-helical
 - globular
36. Assume a muscle protein undergoes a change in shape due to energy input from the hydrolysis of an ATP molecule. How does the protein store the energy it has received from ATP?
- electrical potential energy
 - ionic potential energy
 - mechanical potential energy
 - random kinetic energy

37. For living organisms, which of the following is an important consequence of the first law of thermodynamics?
- The energy content of a living organism is constant
 - The organism ultimately must obtain all of the necessary energy for life from the environment
 - The entropy of an organism increases with time as the organism grows in complexity
 - Life does not obey the first law of thermodynamics.
38. In the inner unit membranes of the chloroplasts and mitochondria, what supplies the energy needed to move and concentrate hydrogen ions on one side of the membrane?
- the breakdown of water into hydrogen ion and hydroxyl ion
 - the energy in the chemical bonds of molecular oxygen
 - the flow of electrons through a series of redox reactions
 - the flow of sodium ions from the inside to the outside of the membrane
39. Five beakers were used in an osmosis experiment. Each beaker contained 50 ml of a sucrose solution of varying concentrations, as shown in the chart below. Fresh 10.0 g potato cubes were placed into each beaker. After 12 hours, each potato cube was weighed again. Given the results in the table below, what is the most likely molarity of the potato cell cytosol?

Beaker	1	2	3	4	5
Sucrose Concentration	1.0 M	0.8 M	0.6 M	0.4 M	0.2 M
Mass of Potato After 12 hours	8.2 g	9.4 g	9.8 g	11.6 g	13.6 g

- less than 0.2 M
 - less than 0.4 M but greater than 0.2 M
 - less than 0.6 M but greater than 0.4 M
 - less than 0.8 M but greater than 0.6 M
40. Animal tissue was homogenized in a blender to form a liquid homogenate. This was spun in an ultracentrifuge to separate it into layers based on differences in density. The densest organelles settled to the bottom of the tube forming a pellet. The supernatant, the liquid above the pellet, was poured off and re-spun, as shown in the diagram below. If you analyzed the first pellet, what would you expect to find?

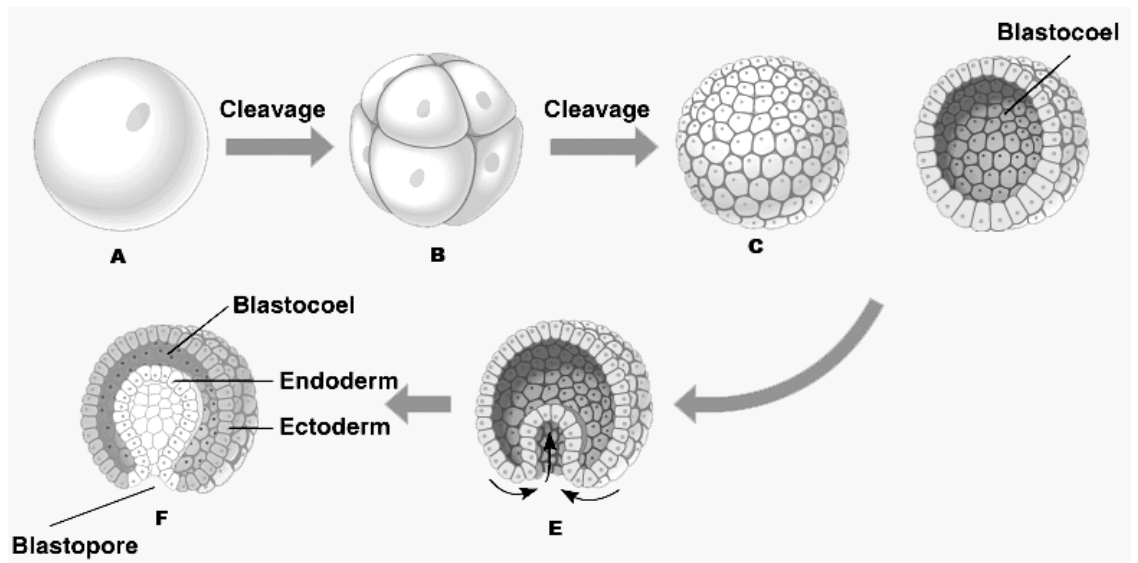
Differential Centrifugation



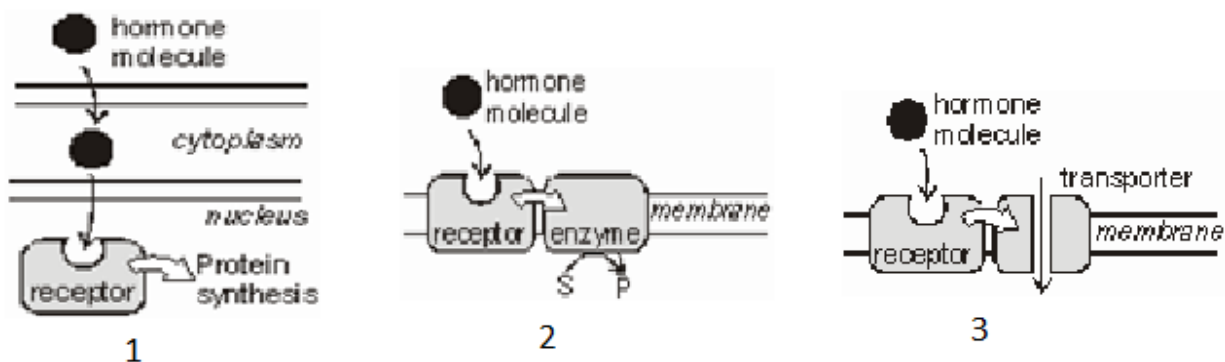
- Golgi Bodies
 - nuclei
 - mitochondria
 - ribosomes
41. In the diagram above(#40) (Differential Centrifugation), what would you expect to be present in the last pellet?
- Golgi bodies
 - mitochondria
 - ribosomes
 - vacuoles

42. The diagram below is of early frog embryological development. Which stage is germ layer differentiation initiated?

- a. Stage A
- b. Stage B
- c. Stage C
- d. Stage E

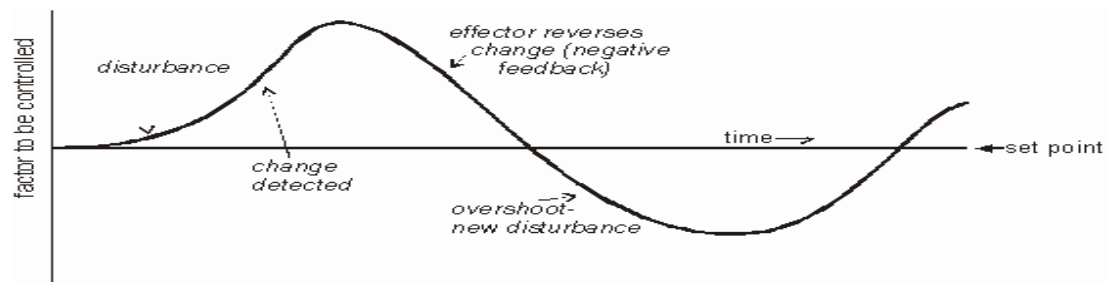


43. A hormone can enter a cell in different ways, as shown in the diagrams below. How would a steroid hormone, such as testosterone enter a cell to stimulate the onset of spermatogenesis?



- a. 1 only
- b. 2 only
- c. 3 only
- d. 2 and 3

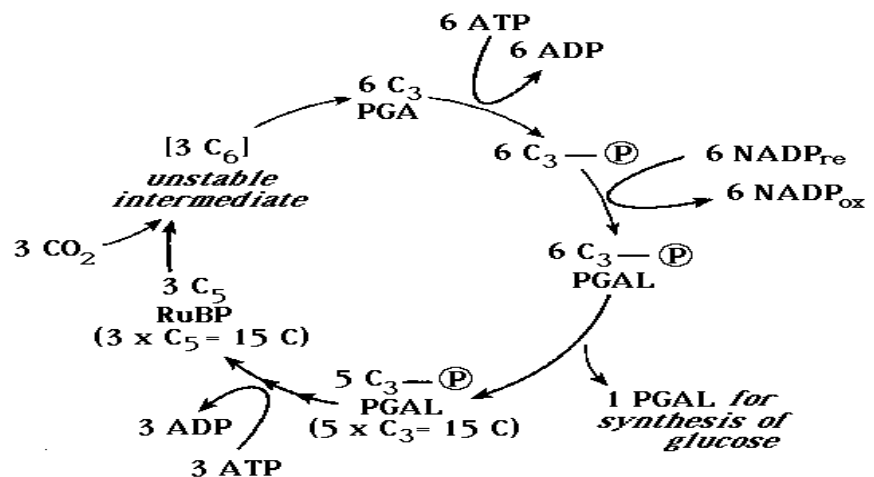
44. Homeostatic systems controlled by a negative feedback system are generalized in the graph below. What would be important to make this system efficient?



- a. Oscillations should remain constant
- b. Oscillations should be more frequent
- c. Oscillations should be minimal in size
- d. Oscillations never occur

45. Which organelles in eukaryotic cells are hypothetically thought to evolve from prokaryotic cells?
- nucleolus and plastids
 - mitochondria and plastids
 - plastids and lysosomes
 - mitochondria and nucleolus
46. Where do noncompetitive inhibitors bind?
- bind to and destroy the substrate
 - bind to the enzymes at the active site
 - bind to the substrate causing a reaction
 - bind to the enzyme at a site other than the active site
47. Fat provides twice as much energy per gram as compared to a carbohydrate or a protein. What in the structure is the difference found in fats from the carbohydrates or proteins that provide the increased energy?
- Fats have a higher carbon to oxygen ratio
 - Fats have a higher hydrogen to oxygen ratio
 - Fats have more oxygen atoms
 - Fats have more carbon atoms
48. What is the function of epithelial cells whose apical surfaces are covered with microvilli?
- locomotion and attachment
 - fighting foreign substances
 - absorption and secretion
 - cell division
49. Which tissue has the fewest cells per unit volume?
- connective tissue
 - smooth muscle tissue
 - simple columnar epithelium
 - nervous tissue
50. What plays the greatest role in restricting the size a cell can attain?
- the surface area to volume ratio
 - the number of phospholipid molecules in the membrane
 - the number of mitochondria
 - the nucleus determines the size by the number of chromosomes that are present
51. Which molecule is generated during the Calvin cycle and serves as a precursor for RuBP, carbohydrates, fats, proteins and nucleic acids?

- CO₂
- PGA
- NADP
- PGAL



52. The light-independent reactions of photosynthesis are dependent upon the light-dependent reactions to provide which of the following?
- CO₂
 - H₂
 - O₂
 - ATP, NADP_{re}

53. What must occur before amino acids can be broken down in cell respiration?
- deamination
 - decarboxylation
 - dehydration
 - phosphorylation
54. A cell physiologist treats a cell so that it cannot make use of ATP. She finds the cell is unable to take up glucose from its environment. What best explains this observation?
- Glucose is necessary for ATP production
 - Glucose enters cells by passive diffusion.
 - Glucose enters by active transport.
 - Glucose enters cells by facilitated diffusion.
55. The chemiosmotic theory is dependent on which one of the following?
- decrease in entropy
 - increase in free energy
 - the absence of an electrochemical gradient
 - a H⁺ gradient that stores potential energy in molecules within the membrane

Matching

Below are some chemical and physical properties of water and a list of possible benefits to organisms. Match each of the lettered properties to the numbered list of benefits.

- | | |
|----------------------------|--------------------------------|
| a. High heat capacity | d. High heat of vaporization |
| b. Higher density than ice | e. Polarity of water molecules |
| c. High heat of fusion | |

56. Temperature changes in organisms are minimized.
57. Membranes composed of low molecular weight, and noncovalently bonded lipids are thermodynamically stable in water.
58. Organisms are protected from freezing at low temperatures.
59. Land animals can cool themselves by evaporating water from body surfaces with a minimum expenditure of body fluids .
60. Ice forms on the surface of a pond first, not on the bottom.

NEW JERSEY SCIENCE LEAGUE
Biology II Exam: White paper test
Biology II Answer Key
JANUARY 14, 2016 (No Corrections)

1	A	16	C	31	C	46	D
2	C	17	D	32	C	47	B
3	C	18	B	33	B	48	C
4	B	19	A	34	D	49	D
5	B	20	D	35	D	50	A
6	A	21	D	36	C	51	D
7	B	22	C	37	B	52	D
8	D	23	C	38	C	53	A
9	C	24	A	39	C	54	C
10	D	25	A	40	B	55	D
11	C	26	B	41	C	56	A
12	D	27	B	42	D	57	E
13	B	28	C	43	A	58	C
14	C	29	B	44	C	59	D
15	D	30	A	45	B	60	B

A complete topic list can be found on [www:entnet.com/~personal/njscil/html](http://www.entnet.com/~personal/njscil/html)

BIOLOGY 11 For AP and second year biology students. 60 Multiple Choice

Question topics for each test will include questions which relate to the Big Ideas I–IV listed below taken from the Advanced Placement Curriculum designed by The College Board. Questions will involve science practices such as analysis of data and evidence to support biological principles. All levels of life (molecules through ecosystems) will be explored on each exam. In addition, for each exam the identified content (e.g. osmoregulation) is linked to the excretory system. For example students should be able to answer, how does osmoregulation occur in the nephron in the excretory system.

Big Idea 1: The process of evolution drives diversity and unity of life

Big Idea 2: Biological Systems utilize free energy and molecular building blocks to grow, reproduce, and to maintain dynamic homeostasis

Big Idea 3: Living Systems store, retrieve, transmit and respond to information essential to life processes.

Big Idea 4: Biological Systems interact, and these systems and their interactions possess complex properties.

EXAM 1 January: Structure and function of Biological Molecules, Protein Folding, Bonding in Polymers, Enzymes, Coenzymes, Cofactors, Lipid and their Properties, Carbohydrates. Structure and function of Cells, Organelles and subcellular structures. Cell and tissue types, Germ layers and development. Free Energy and Gibbs Reactions, Enthalpy in Biological Systems, Biological Applications to the Laws of Thermodynamics, Endothermic/Exothermic Reactions, Coupled Reactions, Photosynthesis, Cellular Respiration, Endotherm/Exotherm in Body Temperature Regulation, Cell Types, Surface Area/Volume Ratios, Fluid Mosaic Model of the Membrane, Properties of Water, Osmoregulation, Membrane Transport, Cellular Feedback Mechanisms, Metabolic Processes and Metabolism, Communication; signaling, reception, transduction and response. Systems in plants and animals include Nervous, Endocrine, Immune and Excretory

EXAM 2 February DNA and replication, RNA and Protein Production, RNA Types, Cell Cycle and Controls, Mitosis, Meiosis, Application of Mendel's Laws, Mendelian and NonMendelian Genetics, Genetic Disorders, Cancer, Genetic Engineering Techniques, Nonnuclear Inheritance, Transposons, Crossover, Gene Regulation, Apoptosis, Developmental Genes, Mutations, Biotechnology, Embryonic Development in Plants and Animals, Signaling Mechanisms, Transmission and Transduction Pathways, Polyploidy, Sex Inheritance, Mutation Effects, Viral Replication, Genetic Variation Processes, Mating Types, Behaviors and Parenting, Bacteria and Yeast Reproduction and use in Biotech. Systems in plants and animals include Reproduction and Development

EXAM 3 March Evolution, Natural Selection, Artificial Selection, Mechanisms for Evolution, Hardy Weinberg Principles, Genetic Drift, Gene flow, Evidences for Evolution, Blast Genomic Analysis, Cladogram, Evolutionary Trees, Evolution of the Domains, Adaptive Radiation, Island Biogeography Theory, Speciation, Prezygotic and Postzygotic Mechanisms, Energy in Reproductive Strategies Hypothesis on Origins of Life, Virus and Bacteria types and adaptations. Evolution of systems in plants and animals include Respiration, Excretion, Digestion, Circulation, Senses

EXAM 4 April Ecosystem Energy Pyramid Structure, Food Web Alterations, Organ and System Specialization, Interactions and Coordination in Plants and Animals, Organism Responses Adaptation to Environment, Ecosystem Transformations, Components of a community, Transpiration, Population: Variation, Growth, Dynamics and Distribution, Exponential and Logistic Population Growth Models, Population Density, Limiting Factors, Species Richness, Species Diversity, Competition, Bacteria, Fungi, Symbiotic Relationships, Food Webs, Productivity, Energy Dynamics, Keystone species, Exotic and Alien Species Biogeochemical Cycles, Energy of Reproductive Strategies, Behavioral and Physiological Response to Environmental Stress, Taxis and Kinesis, Tropisms, Biological Rhythms, Behavioral Biology.

Dates for 2016 Season

Thursday January 14, 2016 Thursday February 11, 2016

Thursday March 10, 2016 Thursday April 14, 2016

New Jersey Science League

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PLEASE RETURN THE AREA RECORD AND ALL TEAM MEMBER SCANTRONS(ALL STUDENTS PLACING 1ST, 2ND, 3RD, AND 4TH).

If you return scantrons of alternates, then label them as ALTERNATES.

Dates for 2017 Season

Thursday January 12, 2017 Thursday February 9, 2017

Thursday March 9, 2017 Thursday April 13, 2017

New Jersey Science League – Biology II Exam
Feb 11, 2016 White TEST (Corrections)

SCANTRON INSTRUCTIONS: Please PRINT your NAME, SCHOOL, AREA and which exam you are taking onto the scan-tron. State if you are an alternate or regular member of your team.

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

1. What contributed most to Mendel’s success in formulating the basic principles of inheritance?
 - a. the comparing of the number of offspring in the F₁ and F₂ generations
 - b. the determining of the genotype of each gamete
 - c. the analysis of the number and types of F₂ progeny
 - d. easy access to a garden

2. Which of the following is an example of a testcross involving two independent traits?
 - a. AaBb X aabb
 - b. AABb X aaBB
 - c. AaBb X AaBb
 - d. AABb X AaBB

3. In human females, how many eggs are normally produced for every primary oocyte that enters meiosis?
 - a. one
 - b. two
 - c. three
 - d. four

4. Not considering crossing-over or spontaneous mutations, how many genetically unique sperm cells can a human male produce?
 - a. 46²
 - b. 23²
 - c. 2²³
 - d. 2⁴⁶

5. Analyze the chromosome map below. Which pair of genes exhibits the highest recombination rate, and which pair the lowest recombination rate?

X _____ Y _____ Z

	HIGHEST	LOWEST
a.	X-Z	Y-Z
b.	X-Y	Y-Z
c.	X-Z	X-Y
d.	Y-Z	X-Y

6. Which of the following skills could not be improved through practice?
 - a. swimming 50 meters
 - b. running 400 meters
 - c. reading music
 - d. hearing high frequency sounds

7. Which of the following best exemplifies an epigenetic influence on gene expression?
 - a. A bodybuilder develops spectacular muscles through weight training.
 - b. As winter sets in, the fur of the snowshoe hare changes from brown to white.
 - c. Malaria favors the survival of individuals that are heterozygous for sickle cell anemia.
 - d. The grilling of hot dogs at high heat converts nitrates to carcinogenic nitrosamines.

8. Which best describes how cytokinesis occurs in human cells?
 - a. Actin and myosin filaments pinch the cell in half
 - b. Small membranous vesicles lay down new cell membrane
 - c. New cell membrane is constructed from the center of the cell to the periphery
 - d. Nuclear membrane induces a new cell membrane to form and to divide to cell evenly

9. What is the consequence of mitosis unaccompanied by cytokinesis?
 - a. cancer
 - b. dead cells
 - c. multinucleated cells
 - d. mutations

10. The principle of independent assortment is somewhat like
 - a. picking only the best apples to eat
 - b. buying a package of Skittles
 - c. packing luggage for vacation
 - d. choosing sides in a baseball game

11. Human height is highly variable. The average male height is about 5'11" and the average female height is about 5'4", but heights generally range from 4'10 to 6'5" and beyond. What does this observation indicate?
 - a. pleiotropy
 - b. polygenic inheritance
 - c. multiple alleles
 - d. epistatic effects

12. What is a reasonable explanation for the high frequency of sickle-cell anemia allele in black Africans ?
 - a. The sickle-cell gene is dominant and thus can spread through a population.
 - b. The sickle-cell gene has been around longer than most mutated genes.
 - c. Those who are carriers are protected from malaria.
 - d. Those with anemia can reach reproductive age to pass on the gene.

13. When offspring never express a mutant phenotype unless one of the parents also expresses the phenotype, what type of inheritance does the mutant allele express?
 - a. sex-linked recessive
 - b. autosomal recessive
 - c. autosomal dominant
 - d. incompletely dominant

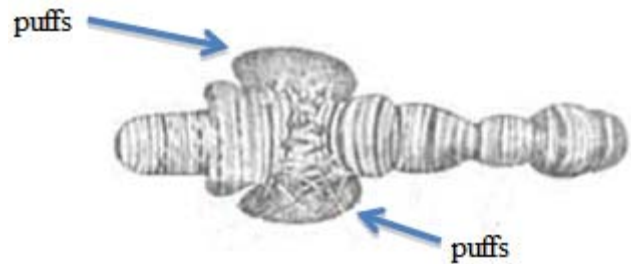
14. An ornithologist studied a novel bird species which displays a variation in feathers; blue, green, purple and teal. Crosses were started with pure breeding males and females from each phenotypic class. Results from various crosses are shown for two generations. What is the relative dominance of alleles that control this trait?

Parents	F1	F2
Teal X green	Teal	3/4 teal, 1/4 green
Green X blue	Green	3/4 green, 1/4 blue
Teal X purple	Teal	3/4 teal, 1/4 purple
Green X purple	Green	3/4 green, 1/4 purple
Blue X purple	Purple	3/4 purple, 1/4 blue

- a. blue < green < purple < teal
- b. blue < purple < green < teal
- c. blue < teal < green < purple
- d. teal < green < purple < blue

15. A genetic cross wherein a 2:1:1 ratio is expected yields four sets of data, each with 100 offspring. Which set of data will yield the highest P value in Chi-square analysis?
 a. 37: 37: 36 b. 40: 30: 30 c. 45: 28: 27 d. 51: 25: 24
16. What does the discovery of Okazaki fragments indicate about DNA synthesis?
 a. It is semiconservative
 b. It is discontinuous
 c. It is continuous
 d. It is synthesis occurs in a 3' to 5' direction.
17. What is the purpose of DNA gyrase during synthesis?
 a. To synthesize the new complementary strands
 b. To unwind the double helix
 c. To stabilize the unwound helix
 d. To release the tension created as the helix unwinds
18. Polytene chromosomes from *Drosophila* salivary glands show “puffs” (indicated by arrows). These puffs most likely demonstrate

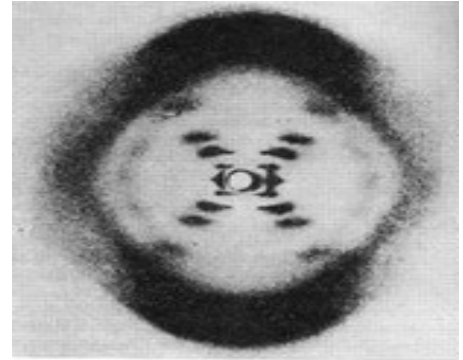
- a. areas of intense protein synthesis
 b. areas of intense RNA synthesis
 c. areas of intense DNA synthesis
 d. areas of intense Okazaki fragments



19. If proteins were composed of 15 different amino acids and the average protein is composed of 20 amino acids long, how many different amino acid sequences would be possible?
 a. 15^{20} b. 20^{15} c. 15×20 d. $15 + 20^2$
20. In which part of the cell cycle is DNA most susceptible to radiation effects?
 a. G1 b. S c. G2 d. M
21. Two genes, OCA2 and HerC2, which behave epistatically, control the expression of eye color. The alleles are O and H respectively. In order for an individual to express “blue eyes”, BOTH dominant alleles O and H must be present. Suppose blue-eyed parents have a brown-eyed child. What is a possible genotype for the brown-eyed child?
 a. OOHh b. OoHH c. Oohh d. OoHh
22. How does the generation of antibody diversity in vertebrate animals take place?
 a. the presence of many genes in the germ line as there are types of antibodies possible
 b. through an infection with bacteria carrying antibody genes
 c. polyploidy occurs in antibody-forming cells
 d. rearrangement of DNA in tissues that go on to produce antibodies

23. Differential distribution of transcription factors in an egg may result in...
- differences in gene expression that may establish embryonic development patterns
 - an accumulation of deleterious mutations in the embryo
 - development of polyploid tissues
 - loss of specific genes during development
24. Below appears an X-ray crystallograph taken by Rosalind Franklin. What information did Watson & Crick glean from this image below to help them build a correct model of DNA?

- DNA replicates semiconservatively.
- That A pairs with T and G pairs with C.
- The molecule is shaped like a helix.
- The molecule is composed of three intertwined strands.



25. If a typical DNA molecule contains 28% cytosine, then what percent of thymine should be expected?
- 14%
 - 22%
 - 44%
 - 56%
26. The data table below indicates the growth results of a mutant strain of *Neurospora* on different media. What can be inferred from the data about this mutant strain?

Medium Type	Minimal	Minimal minus purines & pyrimidines	Minimal minus amino acids	Minimal minus tyrosine only	Minimal minus leucine only	Minimal minus cysteine only
Growth Results	+	+	0	0	+	+

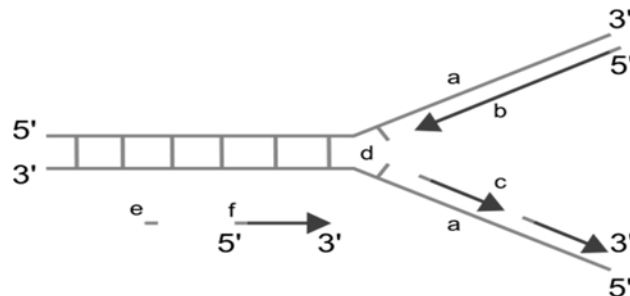
- The cells of this strain most likely need to grow in medium that provides all amino acids.
 - The strain may harbor a mutation in a gene that regulates tyrosine synthesis.
 - The strain may harbor a mutation in a gene that regulates DNA synthesis.
 - The cells of this strain most likely need to grow in medium that provides tryptophan.
27. Suppose scientists successfully transplanted nuclei from adult frog gut cells into enucleated frog egg cells, and that these altered egg cells developed into viable tadpoles. What can we infer from these results?
- Genes are not necessary for development.
 - Monoploid frog ova can develop by parthenogenesis into tadpoles.
 - Nuclei of terminally differentiated cells can be totipotent.
 - Development is predetermined.

28. What can we conclude from the data table below? The data table shows the results of a transformation mapping experiment involving genes “a” and “b”? **(No choices for letters c and d)**

Plate #	Donor/DNA	Recipient	% a ⁺ b ⁺ recombinants
1	a ⁺ b ⁺	a ⁻ b ⁻	0.0015
2	a ⁺ b ⁻ and a ⁻ b ⁺	a ⁻ b ⁻	0.0013

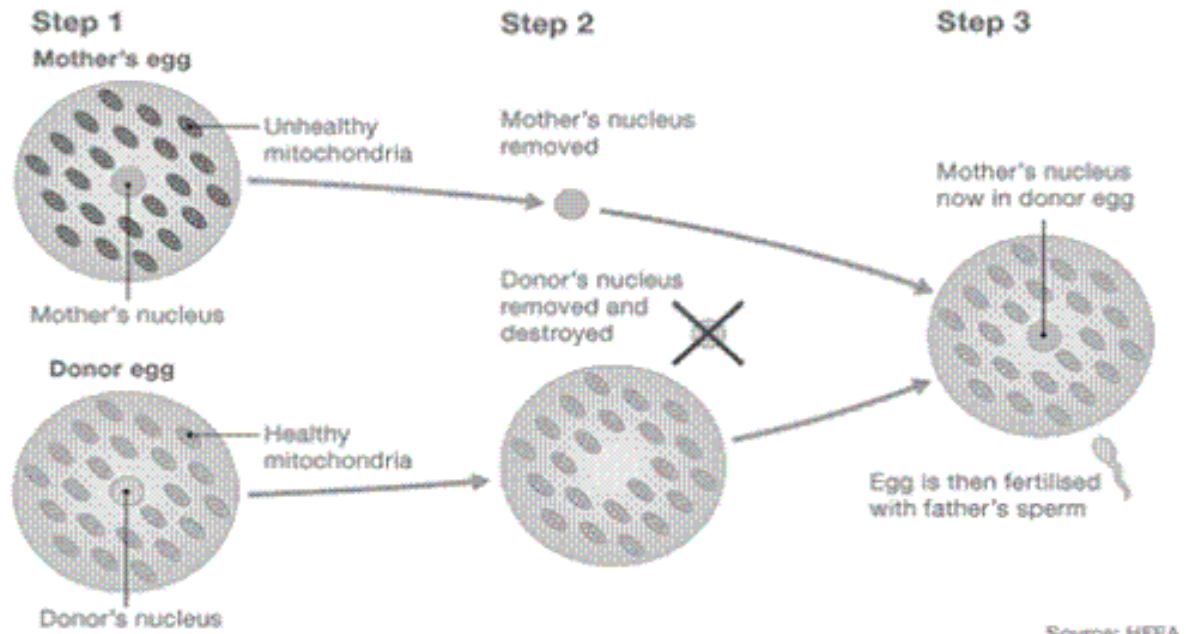
- a. genes a and b are linked b. genes a and b are not linked
29. In foxes, PP is a lethal genotype, pp produces a silver coat, and the heterozygote produces a platinum coat. Suppose two platinum foxes (male and female respectively) mate. Of their living offspring, what are the chances that any one kit will have a silver coat?
- a. 25% b. 33% c. 50% d. 75%
30. In twin studies involving cleft palate, monozygotic twins show a 72% concordance, while dizygotic twins show a 19% concordance. Based on this data, what can be concluded concerning cleft palates?
- a. occurs only in twins
 b. is inherited with no environmental effect
 c. occurs due to a genetic predisposition, but the fetal environment has some effect
 d. is due to completely random developmental error
31. Which letter in the diagram below indicates where helicase acts on DNA ?

- a. a
 b. b
 c. c
 d. d



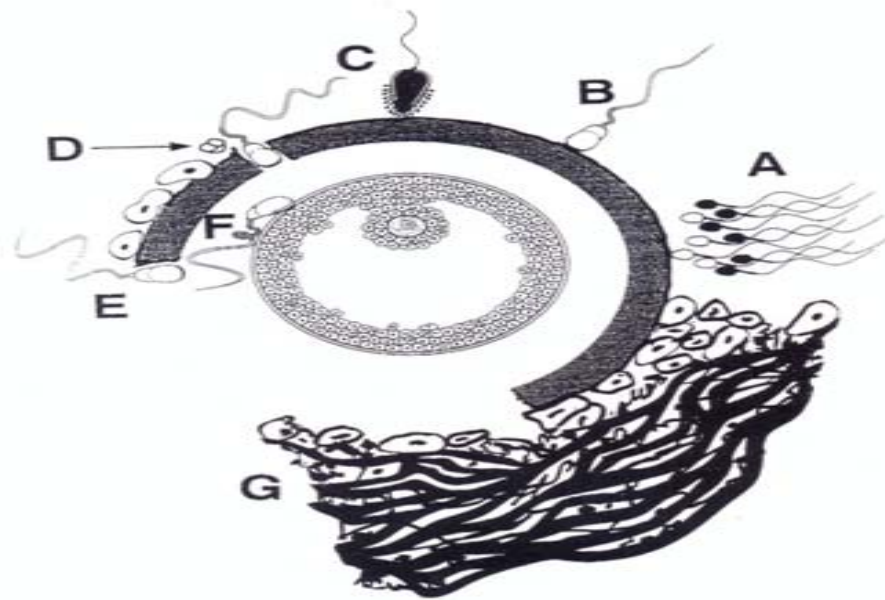
32. 0.1% of a child's genetic code comes from the mitochondrial donor. Mitochondrial DNA has the potential to carry genetic disorders. Also mitochondrial degradation is one reason fertilized eggs from older women are less likely to implant in the uterus wall. Below is one method to solve this situation. What biotech process is involved?

Method one: Egg repair



- a. *In vitro* fertilization
 b. Gene splicing
 c. Chimeric engineering
 d. Gene-specific mutagenesis
33. What molecule is 'spliced' as a step in protein synthesis?
 a. DNA b. mRNA c. rRNA d. proteins
34. What process occurs when RNA is synthesized on a DNA template?
 a. transformation b. transinfection c. translation d. transcription

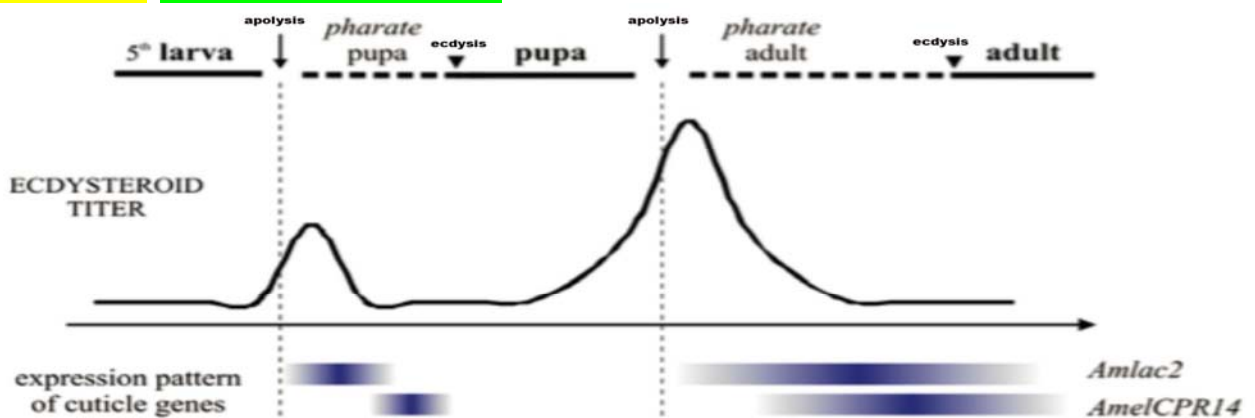
35. Fertilization in humans involves a receptor, ZP3, on the *zona pellucida* that binds the spermatozoa and brings about a series of changes in the ovum. At what point does binding occur and the acrosomal reaction begin in the diagram below?



- a. G, A and B b. A and B only c. B and C only d. C, D, and F
36. Which pairs of RNA strands would be expected to most successfully undergo molecular hybridization?
- a. UAGUCG and AUCAGC c. GCAUAU and GCAUAU
b. AUGCUG and GAAUUG d. GCAUAU and CGAUCA
37. What kind of gene can move around the genome and sometimes inactivate other genes?
- a. activator b. repressor c. replicon d. transposon
38. Which of the following can replicate independently of the host chromosome?
- a. episomes b. plasmids c. transposons d. tumor virus
39. How do potential host cells prevent restriction enzymes from digesting their own DNA?
- a. by coating their DNA with proteins c. by adding methyl groups to the DNA
b. by sequencing their DNA in a specific order d. by inactivating their restriction enzymes
40. Which of the following evidence most directly contradicts the hypothesis that viruses are some kind of cell?
- a. Viruses can crystallize. c. Viruses cause disease.
b. Viruses contain proteins. d. Viruses can cause tumor development.

41. Why can the genes for resistance to antibiotics spread rapidly through a bacterial population?
- carried by bacteriophages
 - carried on plasmids
 - carried by tumor viruses
 - carried by DNA molecules released into growth medium
42. The mustard cress, *Arabidopsis thaliana*, is sometimes called the *Drosophila* of plant genetics. Which of the following traits distinguishes the mustard plant from the fruit fly?
- ability to self-fertilize
 - easily grown in large numbers
 - rapidly reproducing
 - morphology determined by homeotic genes
43. How many nuclei does a mature pollen grain contain and what is the respective ploidy?
- one 1N
 - three 1N
 - two 1N
 - two 2N
44. Which problem below can be solved most easily through genetic engineering?
- Curing someone who has sickle cell disease
 - Reducing methane production and dairy cattle
 - Eradicating malaria
 - Creating a strain of rice that produces beta-carotene
45. How does paracrine signaling differ from endocrine signals?
- Paracrine signals are delivered in ducts while endocrine signals are not.
 - Paracrine signals are steroids while endocrine signals may be steroids or proteins.
 - Paracrine signals are carried in the blood stream while endocrine are not.
 - Paracrine affect targets near the site of production while endocrine signals affect distant targets.

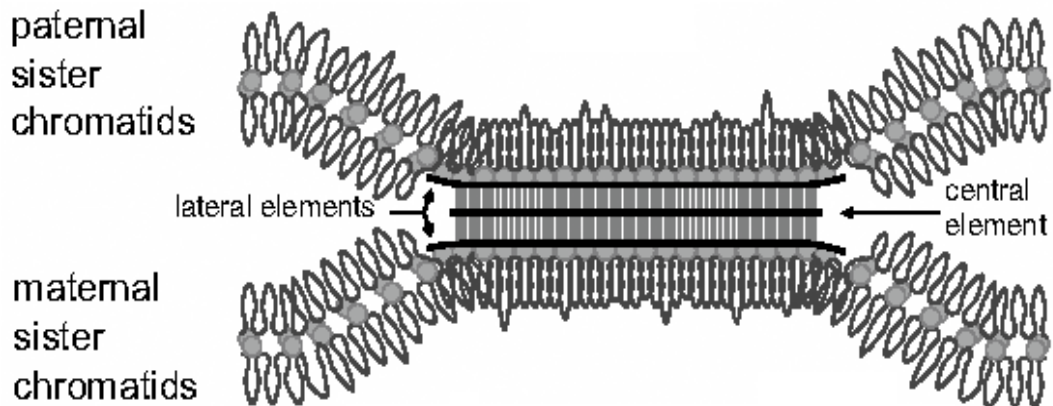
46. An investigation of honey bee development traces the expression of two genes (*Amlac2* and *Amel/CPR14*) involved in cuticle renewal during stages of molting. The amount of ecdysteroid was measured throughout the developmental stages. Insects have two classes of molting cycles a pupation metamorphic molt and an adult differentiation imaginal molt. The graph below demonstrates the molting class relationship between the genes and the hormone during development. Apolysis (separating cuticle from epidermis) is indicated by arrows, and ecdysis (casting cuticle off) is indicated by arrowheads only (see diagram). According to the data collected in the graph, what gene(s) initiates an increase in ecdysteroid to give rise to new lead differentiated adult cuticle? **Correction D is correct not B.**



- Amlac2*
- Amel/CPR14*
- Amlac2* and *Amel/CPR14*
- neither

47. Complete this analogy; chromatin is to chromosomes as DNA is to
- a. daughter cells
 - b. mitosis
 - c. genes
 - d. RNA

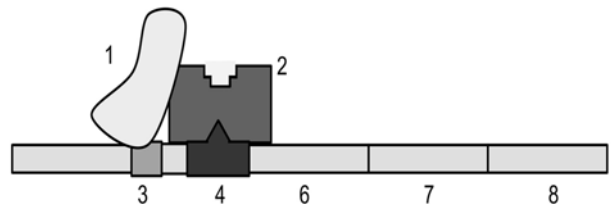
48. Below is a picture of a part of a chromosome in Prophase I. What does the diagram illustrate?



- a. centromere
- b. chromatin material
- c. hydrogen bonds holding genes
- d. synaptonemal complex

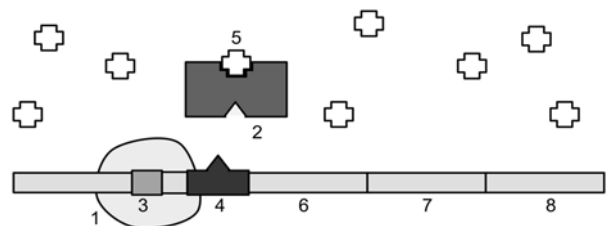
49. Below is a diagram of a **repressed lac operon**. Where is the inducer?

- a. Structure 1 can act as the inducer when needed.
- b. The inducer is not shown in this diagram.
- c. Structure 4 will become the inducer once structure 2 disconnects from it.
- d. Structure 3 was the inducer until structure 1 attached to it.



50. Below is a diagram of the **lac operon**. Identify structure 5.

- a. lactase
- b. lactose
- c. repressor
- d. operator

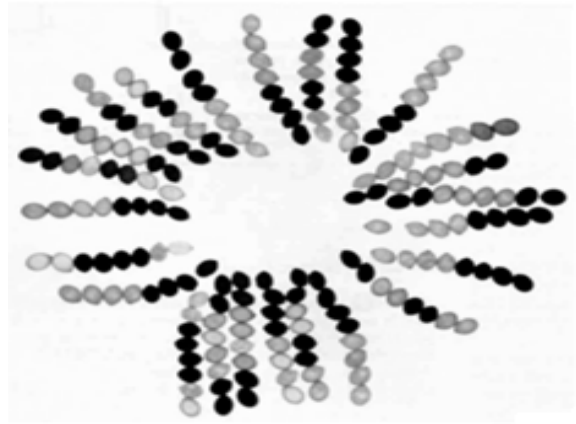


51. Using the information from the last two questions on the lac operon, what type of gene control is demonstrated?

- a. negative inducible operon
- b. negative repressible operon
- c. positive inducible operon
- d. positive repressible operon

52. The fungus *Sordari* exchanges genetic material when two mycelia meet fuse. The resulting zygote undergoes meiosis and then mitosis to produce asci. Each ascus contains 8 ascospores. A single gene controls spore color. A cross was made between a black strain and a tan strain. The resulting asci are shown in the picture below. What is the approximate crossover value for the results shown? All full credit

- a. 10%
- b. 20%
- c. 30%
- d. 60%



53. In honeybees the queen is the only one who lays eggs, which are cared for by the workers (all female). Unfertilized eggs become male drones, whereas eggs fertilized by drones become workers. Kin selection theory predicts that the workers will show the least altruistic behavior towards...
- a. the queen
 - b. their mother
 - c. each other
 - d. the drones
54. What type of RNA is an intermediate precursor for other types of RNA?
- a. siRNA
 - b. snoRNA
 - c. miRNA
 - d. hnRNA

Match the processes to the reproductive descriptions. A choice may be used more than once.

- a. Selection
 - b. Inbreeding
 - c. Hybridization
 - d. Mutations
 - e. Vegetative propagation
55. A nursery sells an apple tree that bears five varieties of apples.
56. A seedless orange was discovered on a tree that normally bears oranges with seeds.
57. Texas cattle have been crossed with Brahman cattle from India.
58. A farmer saves his best ears of corn for planting.
59. Burbank developed the Shasta daisy by crossing the American, English, and Japanese daisies.
60. Prized dogs are mated with members of the same litter B not D

**New Jersey Science League
Biology II Answer Key White Exam**

Date: Feb 11, 2016

Record onto the area record the # correct (Corrections)

1	C	16	B	31	D	46	D not B
2	A	17	D	32	A	47	C
3	A	18	B	33	B	48	D
4	C	19	A	34	D	49	B
5	A	20	D	35	C	50	B
6	D	21	C	36	A	51	A
7	D	22	D	37	D	52	All full credit (A)
8	A	23	A	38	B	53	D
9	C	24	C	39	C	54	D
10	D	25	B	40	A	55	E
11	B	26	B	41	B	56	D
12	C	27	C	42	A	57	C
13	C	28	B	43	C	58	A
14	B	29	B	44	D	59	C
15	D	30	C	45	D	60	B not D

A complete topic list can be found on www.entnet.com/~personal/njscil/html

BIOLOGY 11 For AP and second year biology students. 60 Multiple Choice

Question topics for each test will include questions which relate to the Big Ideas I–IV listed below taken from the Advanced Placement Curriculum designed by The College Board. Questions will involve science practices such as analysis of data and evidence to support biological principles. All levels of life (molecules through ecosystems) will be explored on each exam. In addition, for each exam the identified content (e.g. osmoregulation) is linked to the excretory system. For example students should be able to answer, how does osmoregulation occur in the nephron in the excretory system. Students would not be asked to identify the nephron or to identify its location in the kidney.

Big Idea 1: The process of evolution drives diversity and unity of life

Big Idea 2: Biological Systems utilize free energy and molecular building blocks to grow, reproduce, and to maintain dynamic homeostasis

Big Idea 3: Living Systems store, retrieve, transmit and respond to information essential to life processes.

Big Idea 4: Biological Systems interact, and these systems and their interactions possess complex properties.

EXAM 1 January: Structure and function of Biological Molecules, Protein Folding, Bonding in Polymers, Enzymes, Coenzymes, Cofactors, Lipid and their Properties, Carbohydrates. Structure and function of Cells, Organelles and subcellular structures. Cell and tissue types, Germ layers and development. Free Energy and Gibbs Reactions, Enthalpy in Biological Systems, Biological Applications to the Laws of Thermodynamics, Endothermic/Exothermic Reactions, Coupled Reactions, Photosynthesis, Cellular Respiration, Endotherm/Exotherm in Body Temperature Regulation, Cell Types, Surface Area/Volume Ratios, Fluid Mosaic Model of the Membrane, Properties of Water, Osmoregulation, Membrane Transport, Cellular Feedback Mechanisms, Metabolic Processes and Metabolism, Communication; signaling, reception, transduction and response. Systems in plants and animals include Nervous, Endocrine, Immune and Excretory

EXAM 2 February DNA and replication, RNA and Protein Production, RNA Types, Cell Cycle and Controls, Mitosis, Meiosis, Application of Mendel's Laws, Mendelian and NonMendelian Genetics, Genetic Disorders, Cancer, Genetic Engineering Techniques, Nonnuclear Inheritance, Transposons, Crossover, Gene Regulation, Apoptosis, Developmental Genes, Mutations, Biotechnology, Embryonic Development in Plants and Animals, Signaling Mechanisms, Transmission and Transduction Pathways, Polyploidy, Sex Inheritance, Mutation Effects, Viral Replication, Genetic Variation Processes, Mating Types, Behaviors and Parenting, Bacteria and Yeast Reproduction and use in Biotech. Systems in plants and animals include Reproduction and Development

EXAM 3 March Evolution, Natural Selection, Artificial Selection, Mechanisms for Evolution, Hardy Weinberg Principles, Genetic Drift, Gene flow, Evidences for Evolution, Blast Genomic Analysis, Cladogram, Evolutionary Trees, Evolution of the Domains, Adaptive Radiation, Island Biogeography Theory, Speciation, Prezygotic and Postzygotic Mechanisms, Energy in Reproductive Strategies Hypothesis on Origins of Life, Virus and Bacteria types and adaptations. Evolution of systems in plants and animals include Respiration, Excretion, Digestion, Circulation, Senses

EXAM 4 April Ecosystem Energy Pyramid Structure, Food Web Alterations, Organ and System Specialization, Interactions and Coordination in Plants and Animals, Organism Responses Adaptation to Environment, Ecosystem Transformations, Components of a community, Transpiration, Population: Variation, Growth, Dynamics and Distribution, Exponential and Logistic Population Growth Models, Population Density, Limiting Factors, Species Richness, Species Diversity, Competition, Bacteria, Fungi, Symbiotic Relationships, Food Webs, Productivity, Energy Dynamics, Keystone species, Exotic and Alien Species Biogeochemical Cycles, Energy of Reproductive Strategies, Behavioral and Physiological Response to Environmental Stress, Taxis and Kinesis, Tropisms, Biological Rhythms, Behavioral Biology.

Dates for 2016 Season

Thursday February 11, 2016

Thursday March 10, 2016 Thursday April 14, 2016

New Jersey Science League

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PLEASE RETURN THE AREA RECORD AND ALL TEAM MEMBER SCANTRONS(ALL STUDENTS PLACING 1ST, 2ND, 3RD, AND 4TH).

If you return scantrons of alternates, then label them as ALTERNATES.

Dates for 2017 Season

Thursday January 12, 2017 Thursday February 9, 2017
Thursday March 9, 2017 Thursday April 13, 2017

New Jersey Science League – Biology II Exam
March 10, 2016 White TEST (Corrections)

SCANTRON INSTRUCTIONS: Please PRINT your NAME, SCHOOL, AREA and which exam (i.e., Bio II – Mar '16) you are taking onto the scan-tron. State if you are an alternate or regular member of your team.

TEST INSTRUCTIONS: 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.

1. Which statement could be considered a scientific theory?
 - a. The stomach secretes HCl to aid in digestion.
 - b. Radioactive isotopes of the same element behave the same way chemically.
 - c. Leaves bend towards the light because they know they need the light to grow.
 - d. Students are becoming smarter.

2. Which of the following organisms would you expect to find preserved in a fossil record?
 - a. sea organism, such as a jellyfish
 - b. a shelled arthropod, such as a trilobite
 - c. a protistan, such as amoeba
 - d. a parasitic organism, such as nematode

3. What major characteristics are shared by members of the kingdom Animalia?
 - a. mode of nutrition
 - b. inhabitation of a terrestrial environment
 - c. mode of locomotion
 - d. inhabitation of an aquatic environment

4. What is the most important characteristic of a pre-cell?
 - a. Precells were the simplest form of an inorganic molecule.
 - b. Precells easily fused together into one cell.
 - c. Precells had the ability to multiply their membranes.
 - d. Precells had an interior region that was separate from the external environment.

5. Ostriches are found in Africa and Emus are found in Australia. Although they look similar, why are they classified in different animal families?



- a. Because they share analogous structures
 - b. Because they share morphological convergence
 - c. Because they share a common ancestry
 - d. Because one flies and the other doesn't.
-
6. Which of the following reproductive strategies would allow the most adaptations to a changing environment?
 - a. Binary fission in *Paramecia*
 - b. Multiple inseminations of a female dog by several males
 - c. Auto-insemination in *C. elegans*
 - d. Vegetative reproduction in strawberry plants

7. When a male lion becomes the new alpha male of a pride, he kills all the cubs. How is this killing an example of an evolutionary adaptation?
- It keeps the juvenile males subservient to him.
 - The other lions eat the dead cubs thereby providing immediate nutrition.
 - He increases the chances that his genes will be transmitted to future generations.
 - The mourning female lions will be more likely to stay with the pride.
8. What has occurred when the courtship song of hybrid offspring is not recognized by either parent?
- speciation
 - balanced polymorphism
 - post zygotic isolation
 - behavioral isolation
9. What characteristic is most effective to promote speciation when a geographic barrier is present?
- the size of the barrier
 - the ability of the organism to overcome the barrier
 - the speed at which the barrier forms
 - the size of the population it separates
10. Which of the following contribute to greatest success for adaptive radiation within a lineage?
- extinction of competitors
 - new phenotypic characteristic
 - genetic uniformity
 - extinction of competitors and key innovations of traits
11. A plant population is found in an area that is becoming more arid. The average surface area of leaves has been decreasing over generations. What is occurring in this plant population?
- a cline is forming
 - direction selection
 - stabilizing selection
 - genetic drift
12. If an allele is recessive and lethal in homozygotes, what would happen to the allele?
- the allele is present in the population at a frequency of 0.0001
 - the allele will be removed from the population in 1000 years
 - the allele will most likely remain in the population at a low frequency because it cannot be selected against when in a heterozygote
 - the allele will most likely remain in the population at a low frequency because it cannot be selected against when in a homozygote
13. Which of the following conditions would be conducive to the evolution of sexual reproduction and recombination?
- small population size
 - steady temperatures
 - an efficient DNA repair enzymes
 - a rapidly changing environment
14. In a population of ruddy ducks, 45% of individuals with a zeta-1 mutation survive from hatchling to the first year, while ducks without the mutation have a survival rate of 33%. This mutation does not affect any other component of fitness. What type of mutation is zeta-1 evaluated to be?
- beneficial
 - harmful
 - deleterious
 - nonessential
15. If the frequency of one allele is 0.7 and the frequency of the other allele is 0.3 for a particular trait, what is the percentage of heterozygotes in this population?
- 4.5%
 - 21%
 - 42%
 - 50%

16. Why is it unwise to say that an organism's complexity is directly related to large body size or large cell number?
- A large organism can have a very small and simple genome
 - A simple organism, such as a bacterium or protist, can have a large genome.
 - A single celled organism, such as a bacterium or protist, does conduct all the complex functions of life as a larger multicellular organism.
 - A very large organism may consist of very few cells or cell types.

17. Pigs are vulnerable to infection by bird flu virus and human flu virus, both of which can be present in an individual pig at the same time. When this occurs it is possible for the genes from both flu types to combine, therefore making a genetically distinct virus that. What phenomenon is described? All full credit

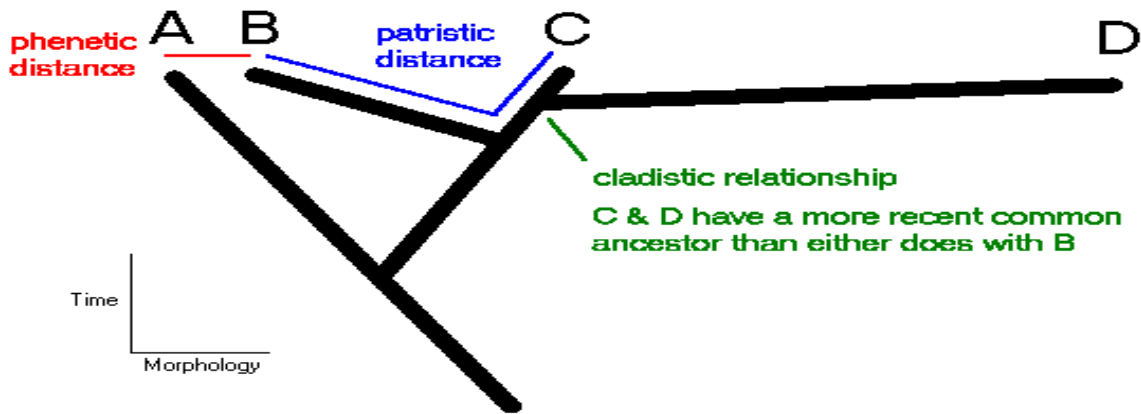
- bottle neck effect
 - founder effect
 - gene flow
 - natural selection
18. Consider the information in the question #17. If the human flu virus contributes a gene for Tamiflu-resistance (Tamiflu is an antiviral drug) to the new virus, and the new virus is introduced to an environment lacking Tamiflu, then what is most likely to occur?
- The Tamiflu-resistance will undergo mutations that convert into a gene that has a useful function in this environment.
 - If the Tamiflu-resistance gene involves a cost, it will experience directional selection leading to a reduction in its frequency
 - If the Tamiflu-resistance gene confers no benefit in the current environment, and has no cost, the virus will become permanently dormant.
 - The Tamiflu-resistance gene will replicate in the genome becoming more potent.
19. Fragments of DNA extracted from the remnants of extinct woolly mammoths have amplified and sequenced. Which task can best take advantage of the data from these processes?
- Studying relationships among woolly mammoths and other wool-producers
 - Understanding the possible relationships among members of related taxa
 - Introducing mammoth DNA fragments into relatives of the woolly mammoths
 - Discovering the reasons why mammoths went extinct
20. Why might the cricket genome have 11 times as many base pairs as that of *Drosophila melanogaster*?
- Crickets must have more noncoding DNA
 - The two insect species evolved in different geologic eras
 - Drosophila* are more complex organisms
 - Drosophila* must make more useful proteins

21. A genetically variable population is subject to natural selection. In what sequence would the following apply?
- Well-adapted individuals have more offspring than do poorly adapted individuals.
 - A change occurs in the environment.
 - Genetic frequencies within the population change.
 - Poorly adapted individuals have decreased survivorship.
- 1-2-3-4
 - 2-1-3-4
 - 2-4-1-3
 - 4-1-3-2

22. What best accounts for the evolution of blind cave-dwelling salamander, tapeworms that lack digestive systems, and whales with vestigial leg bones?
- Divine intervention
 - Natural selection accounts for these losses by the principle of use and disuse.
 - The ancestors of these species experienced mutations that forced them to find new habitats.
 - Natural selection favored forms that did not waste energy to make unneeded structures.
23. What criteria are most useful in beginning the classifying of a collection of previously unknown grasshopper species?
- Behavioral traits
 - Morphological features
 - Ecological location
 - Degree of embryological development
24. Beetle pollinators of a particular plant are attracted to the plant's bright orange color flowers. The beetles not only pollinate the flowers, but they mate while inside of the flowers. A mutant version of the plant with red flowers becomes more common with the passage of time. A particular variant of the beetle prefers the red flowers to the orange flowers. Over time, these two beetle variants diverge from each other to such an extent that interbreeding is no longer possible. What kind of speciation has occurred in this example, and what has driven it?
- sympatric speciation; allopolyploidy
 - allopatric speciation; ecological isolation
 - sympatric speciation; habitat differentiation
 - allopatric speciation; behavioral isolation
25. In a hypothetical situation, a certain species of flea feeds only on pronghorn antelopes. In rangelands of the western United States, pronghorns and cattle often associate with one another. If some of these fleas develop a strong preference for cattle blood and mate only with other fleas that prefer cattle blood, then over time which of these should occur, if the host mammal can be considered as the fleas' habitat?
- reproductive isolation
 - sympatric speciation
 - habitat isolation
 - prezygotic barriers
- 1,2,3 only
 - 2,3,4 only
 - 1,3,4 only
 - 1,2,3,4
26. Gould coined the term exaptation, which is defined as a feature produced by natural selection for a function other than the one for which it was originally adapted. Which example best illustrates this idea?
- Snakes display vestigial leg pelvic bones.
 - Fins in dolphins evolved from fins in fish.
 - Flowering plants developed colorful petals to attract insects, which later evolved into symbols of love for Valentine's Day.
 - Originally serving as insulation for flightless ancestral birds, feathers provide aerodynamics for modern descendants.
27. A swim bladder is a gas-filled sac that helps fish maintain buoyancy. The swim bladder evolved from lungs of an ancestral fish. What has occurred?
- an evolutionary trend
 - exaptation
 - changes in a *Hox* gene expression
 - adaptive radiation

28. Males of different species of the fruit fly *Drosophila* that live in the same parts of the Hawaiian Islands have different elaborate courtship rituals. These rituals involve fighting other males and making stylized movements that attract females. What type of reproductive isolation does this represent?
- gametic isolation
 - behavioral isolation
 - habitat isolation
 - postzygotic barriers
29. Plant species A has a diploid number of 12. Plant species B has a diploid number of 16. A new species, C, arises as an allopolyploid from A and B. What would be the probable diploid number for species C?
- 12
 - 14
 - 16
 - 28
30. The respiratory system of birds is extremely efficient because of a network of air sacs connected to the lungs. Upon inhalation, air first flows into posterior air sacs, then into the lungs, and then into anterior air sacs on the way to being exhaled. Thus, there is one-way flow of air through the lungs, along thousands of tubules called parabronchi. Birds generate a lot of heat, especially during flight. Yet the adipose tissue under their skin and the feathers atop their skin make it difficult to eliminate excess heat across the skin. Which of the following alternatives can absorb body heat and eliminate it from the bird most effectively?
- lymph in the lymphatic vessels
 - air in the air sacs
 - blood in the heart
 - blood in the vessels
31. Nucleotide analysis of rRNA divides the living world into which 3 domains listed below?
- bacteria, archaea, eukarya
 - virus, archaea, eukarya
 - procarya, archaea, eukarya
 - bacteria, archaea, cyanobacteria
32. The DNA of species A consists of 65% C-G base pairs, while species B has 35% G-C base pairs. What can be inferred these data?
- The two species are closely related.
 - The two species will successfully hybridize.
 - The two species are not closely related.
 - The two species belong to same genus.
33. Suppose in a given population there are two independent DNA markers (let's call them A & B). Suppose also that a given allele for A and one for B is EACH present in the population with a frequency of 0.2. What is the probability that any individual in the population possesses BOTH alleles? All full credit
- 0.02
 - 0.08
 - 0.4
 - 0.16
34. If the frequency of males affected with an X-linked recessive condition in a human population is 0.10 (one in ten), what will be the expected frequency of affected females?
- 0.001
 - 0.01
 - 0.05
 - 0.20
35. Why is mitochondrial DNA advantageous in evolutionary studies?
- it is inserted into the X chromosome
 - it first appeared in humans and is not found in other animals
 - it evolves slower than genes in the nucleus
 - it is inherited only through the female parent and thus evolves in a way that allows trees of relationship to be easily constructed

36. Suppose the diagram below shows that dinosaurs and birds have the most recent common ancestor in the Cretaceous Period. Considering the adaptations associated with the evolution of flight, birds are morphologically distinctive. If dinosaurs are represented by C, which letter would be the best position for birds on the tree?

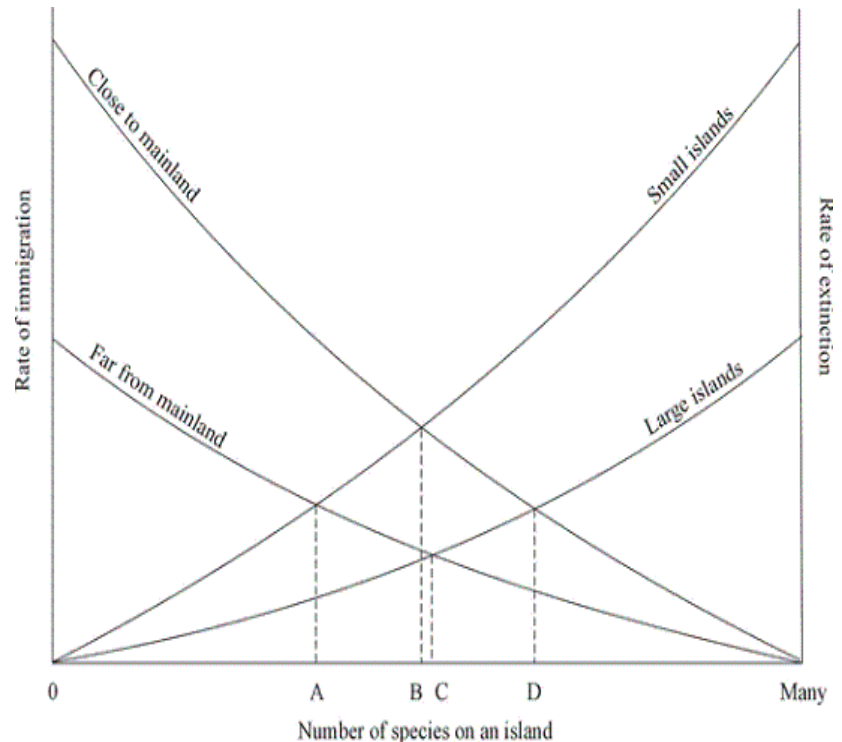


- a. A b. B c. C d. D
37. What is the most probable route for the evolution of multicellular organisms?
- a. series of endosymbiosis c. parasitism
b. colonial aggregates in which cells began to specialize d. the alternation of generations
38. How did the evolution of plants on land lead to the cooling of the earth?
- a. Plants provided shade, which blocked sunlight from the ground.
b. The evaporative cooling from plants was sufficient to lower the overall temperature of Earth.
c. Plants released minerals from the soil. These mineral particles absorbed heat and carried it to the ocean.
d. Plants absorbed CO₂ from the atmosphere and locked carbon into polymers. The reduced CO₂ in the atmosphere allowed more heat to radiate from Earth back to space.
39. Which is the best example of coevolution?
- a. wind pollination in conifers as an adaptation to living at high altitudes
b. nectar guides in flowers that direct bees towards nectaries and facilitate pollination
c. the synchronization of nutrient development and fertilization to allow a fetus to grow
d. the clumping of moss plants to support each other and create an absorbent mat
40. When would divergent evolution occur?
- a. as one lineage of a species dies out
b. as two species become dependent upon each other
c. every time two separate species mate
d. as populations of the same species in the same environment adapt to different niches

41. What determines a female's evolutionary success?
- how many males she is able to mate with
 - how many of her fertilized eggs survive to become the next breeding population
 - how much energy she is able to pack into the eggs she produces
 - how much time she allows her offspring to develop before they are independent

42. Analyze the graph below on the Island Biogeography theory. Where would the least species diversity be located?

- small island, far from the mainland
- small island, close to mainland
- large island, far from mainland
- large island, close to mainland



43. Suppose in an original population the frequency of a dominant autosomal allele A is at one point determined to be 0.7. In a later generation, in a sample of 300 individuals, 12 showed the recessive trait. Was the population in equilibrium? Only two choices for this question.
- Yes
 - No
44. In the question above, if in future samples the frequency of individuals showing the recessive trait does not change drastically, what type of selection has occurred relative to the original population?
- stabilizing
 - disruptive
 - directional
 - cannot be determined from the data
45. Which of the following pathways for the transformations of cellular energy most likely evolved first?
- Calvin cycle
 - C₄ cycle
 - glycolysis
 - citric acid cycle

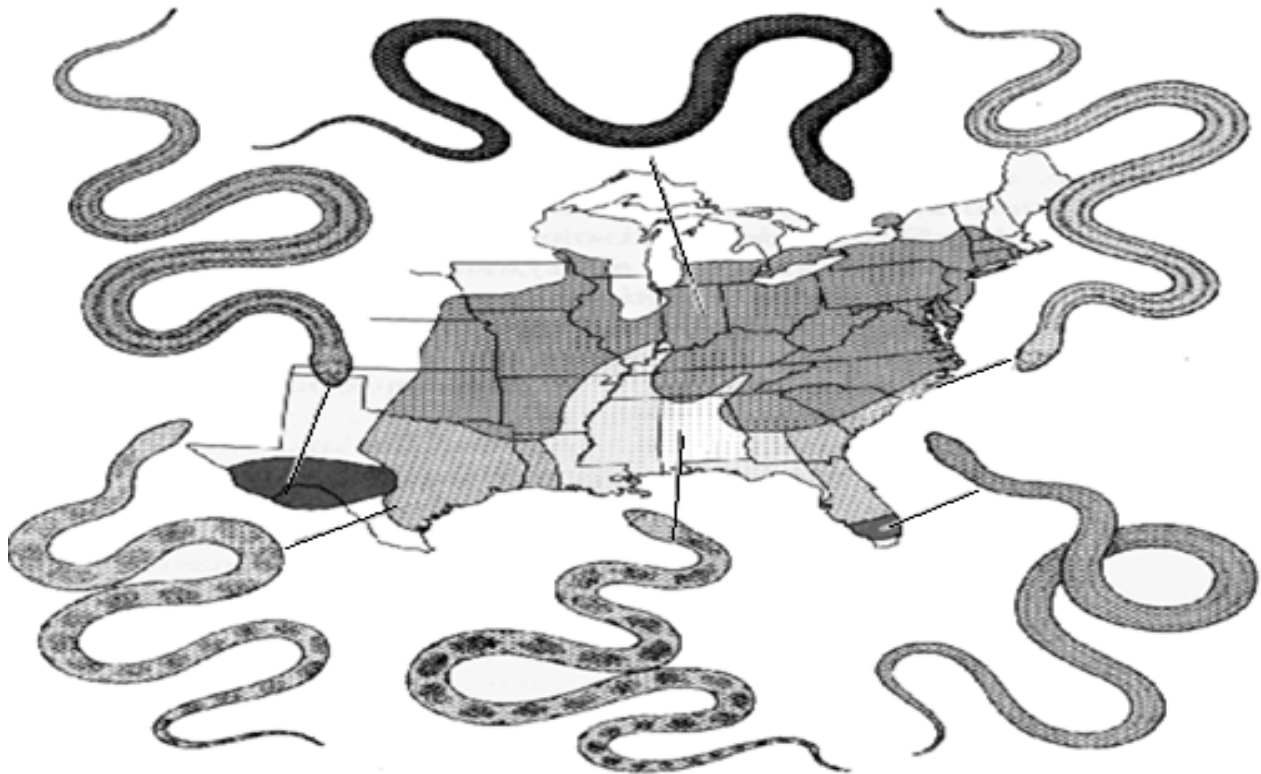
46. Biochemical analysis of respiratory protein cytochrome C, contains between 100 and 104 amino acids. The chart show how many amino acid differences exist between two species. Which two organisms seem to be least related to each other?

- a. man and tuna
- b. tuna and moth
- c. monkey and moth
- d. man and monkey

		Turtle	Man	Tuna	Chicken	Moth	Monkey	Dog
		A	B	C	D	E	F	G
Turtle	A							
Man	B	19						
Tuna	C	27	31					
Chicken	D	8	18	26				
Moth	E	33	36	41	31			
Monkey	F	18	1	32	17	35		
Dog	G	13	13	29	14	28	12	

47. In rat snakes, *Elapha obsoleta*, genetic flow occurs between subspecies as seen in the image below. What is a possible explanation of the cline?

- a. a population with chromosomes inversion
- b. a uniform set of environmental conditions
- c. the geographic limits of a species
- d. a gradient of phenotypic characteristics



48. A paleontologist recovered a bit of tissue from a 400 year old preserved skin of an extinct Dodo bird. In order to compare a specific region of the Dodo DNA to a DNA sample of living birds, which of the following would be more useful than the other choices for increasing the amount of Dodo DNA sample available for testing?
- gel electrophoresis
 - RFLP analysis
 - PCR (polymerase chain reaction)
 - Southern blotting
49. What can be inferred from the results of a comparative genomic analysis using Blast?
- A species' complete phylogenetic profile.
 - The time, in the past, when the species diverged from a common ancestor.
 - The relative relatedness of the species involved.
 - How long will pass before one of the species goes extinct.
50. Two different animals live in the same location and eat the same kind of food. What adaptation would decrease the competition?
- Both animals eat at the same time.
 - One eats during the day and the other eats at night
 - Both animals breed at the same time.
 - One animal has hair and the other has feathers.
51. When ionizing radiation or chemical mutagens cause somatic cell mutations, these mutations will most likely be passed on to...
- sex cells only
 - other somatic cells only
 - offspring only
 - gametes only
52. In one large, randomly mating population of beetles, a spotted variant form is found. The variant is caused by homozygous recessive. Data were recorded for the population as shown in the chart below. What is the frequency of the mutant allele?

Genotype	Frequency	# of progeny
<i>MM</i>	64%	200
<i>Mm</i>	32%	200
<i>mm</i>	4%	160

- 0.16
 - 0.20
 - 0.4
 - 0.80
53. To which kingdom would a species belong that displayed the following traits:
- eukaryotic cells with cell walls
 - enzymes that digest food outside the body
 - nutrients absorbed from the environment
- Animalia
 - Fungi
 - Plantae
 - Protista

54. The rate of evolution varies greatly depending upon the trait and species involved. The coloration of the peppered moth changed rapidly over 200 years beginning with the Industrial Revolution, whereas the increase in size and color of the peacock tail took longer (over 1000's of years). Why was the evolution of peppered moth coloration more rapid than the evolution of size and color of the peacock's tail feathers?
- The more rapid selection in the case of peppered moths compared to that of the peacocks can be attributed to strong selection pressure from predators.
 - There was a selective disadvantage to increasing the size of peacock's tail feathers due to sexual selection, which limits evolution.
 - There are fewer peppered moths than peacocks, thus the changes in allelic frequency occurred more rapidly.
 - The peacocks were in Hardy Weinberg equilibrium and the peppered moths were not.
55. Based on multiple forms of evidence, we can say that the earth was formed approximately 4.6 billion years ago. The fossil record shows the first evidence of life in rocks dated to 3.5 billion years ago. Which of the following best explains why life cannot be detected in rocks that come from the first billion years?
- We can't date rocks that are that old.
 - The early Earth's environment was too hostile for life to exist.
 - Life was RNA-based. Because RNA is less stable than DNA, early life left no fossil record.
 - Before 3.5 billion years ago the planet had no water to speak of, and life needs water.
56. What best describes the role of the population in the process of evolution?
- A population is the level at which natural selection occurs.
 - A population is the only level at which genetic changes can occur.
 - Populations are the only groups in which a gene pool always remains constant over time.
 - Populations are the groups in which evolution occurs over generations.

Matching: Each choice is used only once

- mutation
 - gene flow
 - genetic drift
 - natural selection
57. Which process is most likely to lead a reduction of genetic variation in a small population?
58. Which process produces new genetic variation within a species?
59. Which process rapidly offset the effects of genetic isolation when two populations come into secondary contact?
60. Which process occurs is responsible for the reduced contribution of one genotype in comparison to another genotype in each successive generation

**New Jersey Science League
Biology II Answer Key White Exam
Date: March 10, 2016 (Corrections)**

Record onto the area record the # correct

1	B	16	C	31	A	46	B
2	B	17	All full credit C	32	C	47	D
3	A	18	B	33	All full credit B	48	C
4	D	19	B	34	B	49	C
5	C	20	A	35	D	50	B
6	B	21	C	36	D	51	B
7	C	22	D	37	B	52	B
8	D	23	B	38	D	53	B
9	D	24	C	39	B	54	A
10	D	25	D	40	D	55	B
11	B	26	D	41	B	56	D
12	C	27	C	42	A	57	C
13	D	28	B	43	B	58	A
14	A	29	D	44	C	59	B
15	C	30	B	45	C	60	D

A complete topic list can be found on www.entnet.com/~personal/njscil/html

BIOLOGY 11 For AP and second year biology students. 60 Multiple Choice

Question topics for each test will include questions which relate to the Big Ideas I–IV listed below taken from the Advanced Placement Curriculum designed by The College Board. Questions will involve science practices such as analysis of data and evidence to support biological principles. All levels of life (molecules through ecosystems) will be explored on each exam. In addition, for each exam the identified content (e.g. osmoregulation) is linked to the excretory system. For example students should be able to answer, how does osmoregulation occur in the nephron in the excretory system.

Big Idea 1: The process of evolution drives diversity and unity of life

Big Idea 2: Biological Systems utilize free energy and molecular building blocks to grow, reproduce, and to maintain dynamic homeostasis

Big Idea 3: Living Systems store, retrieve, transmit and respond to information essential to life processes.

Big Idea 4: Biological Systems interact, and these systems and their interactions possess complex properties.

EXAM 1 January: Structure and function of Biological Molecules, Protein Folding, Bonding in Polymers, Enzymes, Coenzymes, Cofactors, Lipid and their Properties, Carbohydrates. Structure and function of Cells, Organelles and subcellular structures. Cell and tissue types, Germ layers and development. Free Energy and Gibbs Reactions, Enthalpy in Biological Systems, Biological Applications to the Laws of Thermodynamics, Endothermic/Exothermic Reactions, Coupled Reactions, Photosynthesis, Cellular Respiration, Endotherm/Exotherm in Body Temperature Regulation, Cell Types, Surface Area/Volume Ratios, Fluid Mosaic Model of the Membrane, Properties of Water, Osmoregulation, Membrane Transport, Cellular Feedback Mechanisms, Metabolic Processes and Metabolism, Communication; signaling, reception, transduction and response. Systems in plants and animals include Nervous, Endocrine, Immune and Excretory

EXAM 2 February DNA and replication, RNA and Protein Production, RNA Types, Cell Cycle and Controls, Mitosis, Meiosis, Application of Mendel's Laws, Mendelian and NonMendelian Genetics, Genetic Disorders, Cancer, Genetic Engineering Techniques, Nonnuclear Inheritance, Transposons, Crossover, Gene Regulation, Apoptosis, Developmental Genes, Mutations, Biotechnology, Embryonic Development in Plants and Animals, Signaling Mechanisms, Transmission and Transduction Pathways, Polyploidy, Sex Inheritance, Mutation Effects, Viral Replication, Genetic Variation Processes, Mating Types, Behaviors and Parenting, Bacteria and Yeast Reproduction and use in Biotech. Systems in plants and animals include Reproduction and Development

EXAM 3 March Evolution, Natural Selection, Artificial Selection, Mechanisms for Evolution, Hardy Weinberg Principles, Genetic Drift, Gene flow, Evidences for Evolution, Blast Genomic Analysis, Cladogram, Evolutionary Trees, Evolution of the Domains, Adaptive Radiation, Island Biogeography Theory, Speciation, Prezygotic and Postzygotic Mechanisms, Energy in Reproductive Strategies Hypothesis on Origins of Life, Virus and Bacteria types and adaptations. Evolution of systems in plants and animals include Respiration, Excretion, Digestion, Circulation, Senses

EXAM 4 April Ecosystem Energy Pyramid Structure, Food Web Alterations, Organ and System Specialization, Interactions and Coordination in Plants and Animals, Organism Responses Adaptation to Environment, Ecosystem Transformations, Components of a community, Transpiration, Population: Variation, Growth, Dynamics and Distribution, Exponential and Logistic Population Growth Models, Population Density, Limiting Factors, Species Richness, Species Diversity, Competition, Bacteria, Fungi, Symbiotic Relationships, Food Webs, Productivity, Energy Dynamics, Keystone species, Exotic and Alien Species Biogeochemical Cycles, Energy of Reproductive Strategies, Behavioral and Physiological Response to Environmental Stress, Taxis and Kinesis, Tropisms, Biological Rhythms, Behavioral Biology.

Dates for 2016 Season

Thursday March 10, 2016 Thursday April 14, 2016

All areas and schools must complete the April exam and mail in the results by April 28th, 2016

New Jersey Science League

PO Box 65 Stewartsville, NJ 08886-0065

phone # 908-213-8923 fax # 908-213-9391 email newjssl@ptd.net Web address: www.entnet.com/~personal/njscil/html

PLEASE RETURN THE AREA RECORD AND ALL TEAM MEMBER SCANTRONS(ALL STUDENTS PLACING 1ST, 2ND, 3RD, AND 4TH).

If you return scantrons of alternates, then label them as ALTERNATES.

New Jersey Science League – Biology II Exam
April 14, 2016 White TEST (Corrections)

SCANTRON INSTRUCTIONS: Please PRINT your NAME, SCHOOL, AREA and which exam (i.e., Bio II – April '16) you are taking onto the scan-tron. State if you are an alternate or regular member of your team.

TEST INSTRUCTIONS: 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

1. An oceanographer suggested a method to slow the rate of greenhouse warming by fertilizing the ocean to increase the growth of algae. How might this reduce the greenhouse effect?
 - a. It would repair the hole in Earth's ozone layer.
 - b. It would produce oxygen, which would reflect the sunlight from the atmosphere.
 - c. It would use up CO₂, which traps heat in the atmosphere.
 - d. It would change the color of the ocean, reflecting the sun's heat.

 2. Which of the following is typical characteristic of biodiversity hot spots?
 - a. a large land or aquatic area
 - b. a large proportion of endemic species in the population
 - c. a high rate of habitat degradation
 - d. a large population of migratory birds

 3. Among honeybees the location of nectar is communicated by waggle dances. The duration and vertical dance on the honey comb indicates the location of the food source relative to the horizontal angle to the sun. Even after several hours have elapsed, and the sun's position relative to the earth has changed, bees can still fly directly to a food source. What best accounts for this?
 - a. The waggle dance provided direction only to the position of the hive.
 - b. The bees have visited the food source previously so the sun position is not relevant.
 - c. The bees have an internal clock that compensates for the movement of the sun when time has elapsed.
 - d. The bees are directed more by olfactory cues than by directional cues.

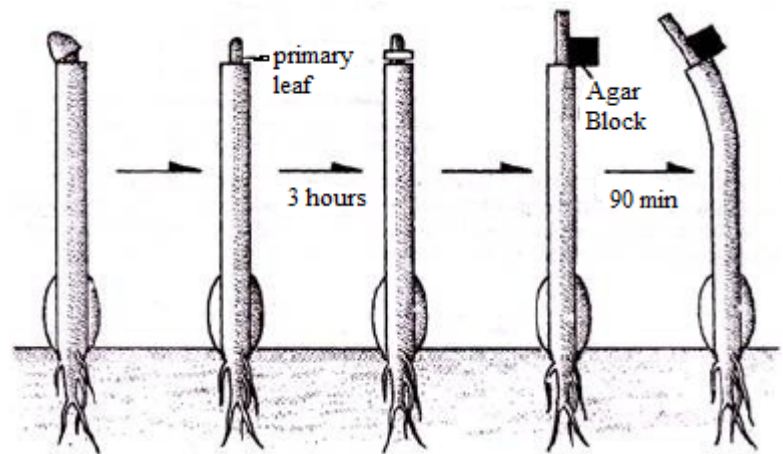
 4. What type of intraspecies communication signal would be best suited to a nocturnal species, such as this owl?
 - a. auditory
 - b. chemical
 - c. tactile
 - d. visual
-
5. What type of behavior is exhibited when animals maximize their energy intake to expenditure ratio?
 - a. maturation
 - b. territoriality
 - c. Avoidance learning
 - d. optimal foraging

 6. Where would you expect to find aposematic coloring?
 - a. predators who are able to sequester toxic plant compounds in their bodies
 - b. prey species that have chemical defenses
 - c. good tasting prey that evolve to look like each other
 - d. prey species that are camouflaged to match their environment

 7. Two species A and B occupy adjoining environmental patches that differ in several abiotic factors. When species A is experimentally removed from a portion of its patch, species B colonizes the vacated area and thrives. When species B is experimentally removed from a portion of its patch, species A does not colonize the area. What can you conclude?
 - a. Both species A and B are limited to their range of abiotic factors.
 - b. Species A is limited to its range by competition, and species B is limited by abiotic factors.
 - c. Species A is limited to its range by abiotic factors and species B is limited to its range because it cannot compete with species A.
 - d. Both species are limited to their range by competition.

8. Why do track coaches recommend their Olympic athletes train at high altitudes for months?
- to take advantage of better weather
 - to adapt physiologically and morphologically to cold and wind
 - to get used to running hills
 - to acclimate the body by increasing red blood cells and hemoglobin
9. Diurnal species of *Aedes aegypti* spread Zika virus that can cause flu-like symptoms and has been implicated in microcephaly in newborns from infected mothers. The mosquito has a life span of 10 days and the symptoms appear within 10 days of the bite. In August, the Olympics are scheduled for Brazil, an area that has been impacted by Zika. Which strategy is biologically most effective in reducing the spread of the virus at the Olympics?
- Spray all water sources with insecticide.
 - Hold events in the dark.
 - Release genetically modified male mosquitos that transmit a gene lethal to larvae.
 - Spray insecticide aerially on event sites during the events.
10. Auxin is a hormone that stimulates growth. In a plant experiment, an auxin/gelatin block is applied to the right half edge of a cut stem tip, causing the plant to grow and bend in the opposite direction. Which explains this observation

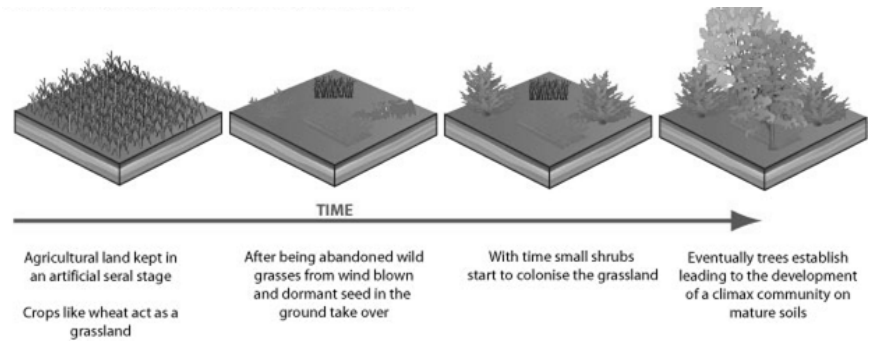
- Sunlight caused the plant to bend.
- The plant exhibited gravitropism
- Auxin stopped cell division on the left side of the plant's tip
- Auxin stimulated elongation on the right side of the plant's tip



11. A taxis is the directional movement of an organism toward or away from a stimulus. What controls a taxis response?
- the strength and quality of the stimulus and the age or condition of the organism
 - the skill and accuracy of the organism
 - insight learning
 - a series of complex behaviors
12. The cuckoo bee and the yellow jacket both have a toxic sting and mimic each other in appearance. This adaptation of the two species allows them to avoid predators. What type of mimicry do they display?
- neutral
 - mutualistic
 - Batesian
 - Mullerian
13. Goldfish require long periods of time to acclimate themselves to changing water temperatures. What quality of water facilitates this long-term adjustment?
- Salt water is generally much warmer than fresh water
 - The larger the body of water, the more the temperature remains constant.
 - Water has a high heat capacity and changes temperature slowly
 - Aquatic organism cannot utilize the sun as a heat source.
14. Which of the following are likely to result in increased levels of PO_4^{3-} available to primary producers?
- Carrion beetles colonize a mouse carcass.
 - An elk is killed and partially eaten by wolves.
 - Thick moss mats develop on bare rock to serve as anchorage for larger plants.
- I and II
 - I and III
 - II and III
 - none of these

15. What process does the diagram below demonstrate?

- a. eutrophication
- b. primary succession
- c. secondary succession
- d. apotopsis



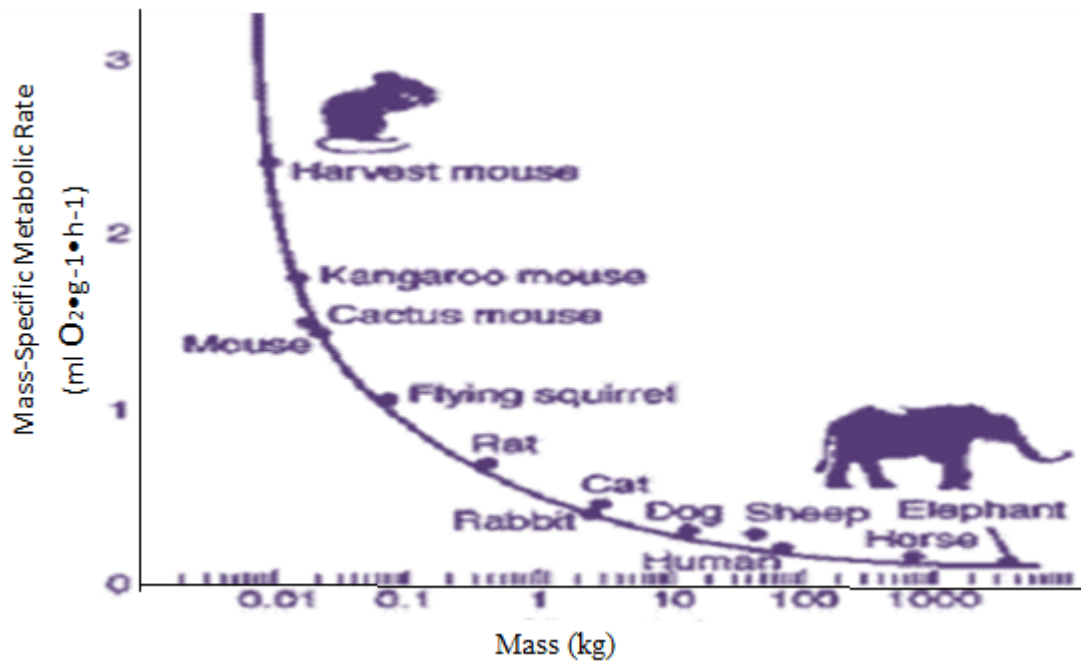
16. Which best illustrates a prairie ecosystem in which there are more grass plants than there are bison, prairie dogs and herbivorous insects?

- a. a pyramid of numbers
- b. a chart of primary gross productivity
- c. an energy pyramid
- d. a food chain

17. How does an electric fence help a dog learn to stay in its own yard?

- a. by imprinting
- b. through insight
- c. by classical conditioning
- d. through operant conditioning

18. Analyze the figure below. Based on the pattern, which of the animals listed in the **choices** is most likely to have the highest metabolic rate per unit body mass?



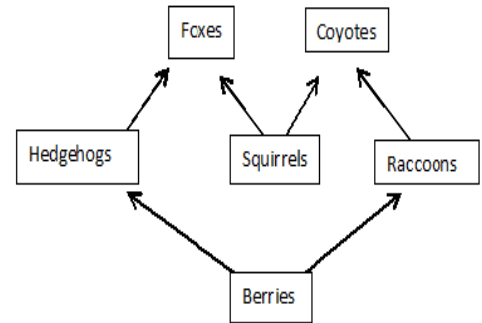
- a. hamster
- b. raccoon
- c. monkey
- d. elephant

19. Which of the following accurately describes the ways in which energy and matter move within an ecosystem?

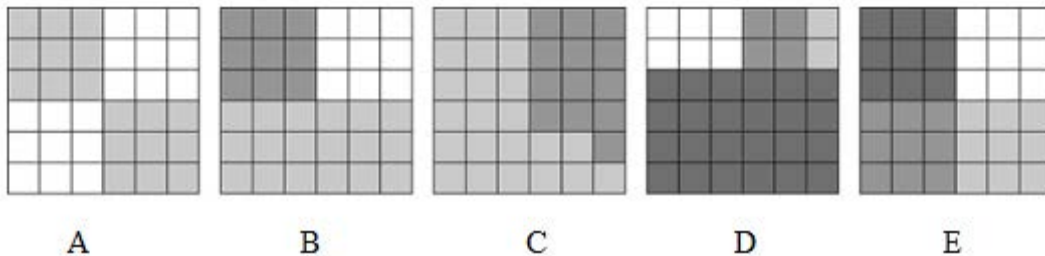
- a. energy flows, while matter is recycled
- b. energy is recycled, while matter flows
- c. energy and matter both flow
- d. energy and matter are both recycled

20. A food web for a forest habitat that spans 30 km² is shown below. The biomass of the primary producers is consistently distributed throughout the forest and totals 1,250 kg/km². A new housing development is being built which will permanently reduce the biomass of the primary producers by 75% and will remove all hedgehogs and squirrels. Which of the following will most likely result from completion of the housing development?

- The biomass of foxes will be significantly reduced.
- The biomass of the raccoons will be 12kg and biomass of the coyotes will be 24kg
- The biomass of the coyotes will be significantly increased.
- The number of raccoons will decrease by 75%, and the number of coyotes will decrease by 85%



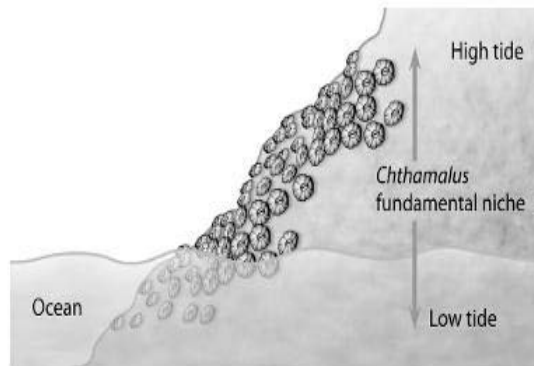
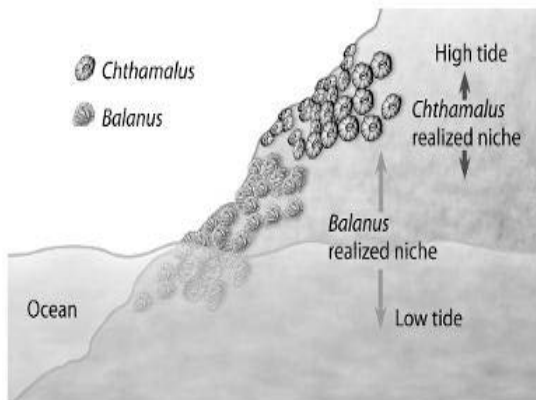
- How might an ecologist test whether a species is occupying its realized or its fundamental niche?
 - Remove a competitor species to see if the species expands its range.
 - Measure the change in reproductive success when the species is subjected to environmental stress.
 - Observe if the niche size changes after the addition of nutritional resources to the habitat.
 - Study the temperature range and humidity requirements of the species.
- Approximately how many kg. of **carnivore** biomass can be supported by a field plot containing 1,000 kg. of plant material?
 - 10,000
 - 100
 - 10
 - 1
- Why is a pathogen generally more virulent in a new habitat?
 - More pathogens tend to immigrate into newer habitats.
 - Pathogens evolve more efficient forms of reproduction in new environments.
 - Intermediate host species are more motile and transport pathogens to new areas.
 - Hosts in new environments have not had a chance to become resistant to the pathogen through natural selection
- During the course of the formation of a parasite/host relationship, what could be a critical first step in this evolution?
 - Developing asexual reproduction.
 - Deriving nourishment without killing the host.
 - Starting as an ectoparasite and then later becoming an endoparasite.
 - Changing the behavior of the host or intermediate host.
- According to the Shannon Diversity Index, which block(s) (A-E) of the shaded areas plotting different species, represents the greatest diversity?



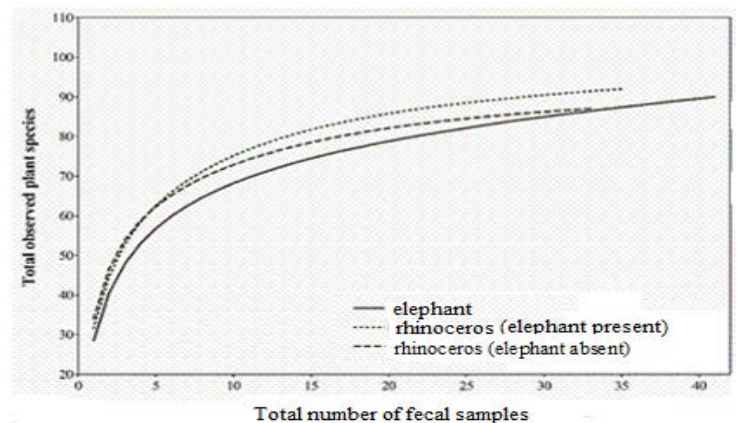
26. Why are some food chains short?
- local extinction of a species causes extinction of the other species in its food chain
 - only a single species of herbivore feeds on each plant species
 - most of the energy in a trophic level is lost as it passes to the next higher level
 - predator species tend to be less diverse and less abundant than prey species
27. Which food chain includes organism that would most immediately be affected by acid rain?
- grass > rabbit > fox > bacteria
 - algae > aquatic insect > trout > otter
 - Shrub > mouse > snake > hawk
 - tree > caterpillar > bird > cat
28. Which of the following statements is a valid conclusion of the experiment shown below?

EXPERIMENT Ecologist Joseph Connell studied two barnacle species—*Chthamalus stellatus* and *Balanus balanoides*—that have a stratified distribution on rocks along the coast of Scotland.

RESULTS *Chthamalus* spread into the region formerly occupied by *Balanus*.



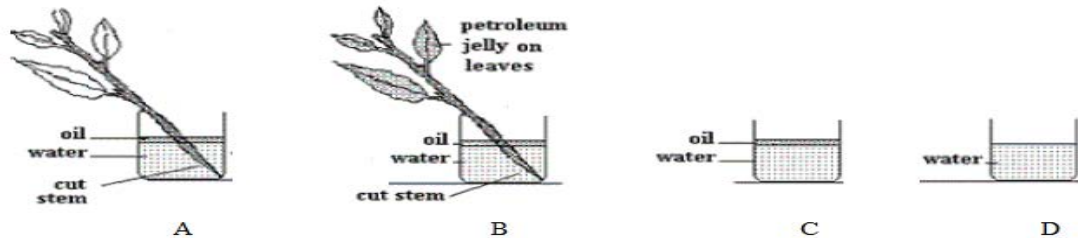
- When *Balanus* is removed, it can be observed that the realized niche of *Chthamalus* is smaller than its fundamental niche.
 - The two species of barnacles do not compete with each other because they feed at different times of day.
 - Balanus* is inferior to *Chthamalus* in competing for space on intertidal zone rocks.
 - Balanus* can only survive in the lower intertidal zone, because it is unable to resist desiccation.
29. What is an example of a successful practice that increases the number of bald eagles in the United States?
- increasing the use of pesticides
 - transfer hawk survival genes into the eagle genome
 - protecting their natural habitats
 - importing food into their nest for their young
30. Using the data organized in the graph below, what conclusion can be formed with regard to competition for food between elephants and rhinoceroses?
- Elephant and rhinos eat the same food.
 - Rhinos eat more food as measured in mass than elephants.
 - Without rhinos around, elephants eat more diverse plants.
 - With elephants around, rhinos eat more diverse plants.



31. If the sun were to stop providing energy to the earth, most ecosystems would vanish. Which of the following ecosystems would survive the longest? **C is correct not letter D.**
a. desert b. grassland c. deep ocean d. tundra
32. When determining the species richness index for the number of fish in a coral reef, what is the best way to take a sample for averaging the trials?
a. count the fish in the entire reef c. count the number of fish in a small section
b. count the number of fish only if you see them within 10 minutes d. count one type of fish in one square meter and multiply it by the total area.
33. How does predation impact prey?
a. Predation affects all prey the same.
b. Predation does not have any long-term effect on the population of the prey.
c. Predation will make prey organisms wait longer to reproduce
d. Predation is a strong selective force for prey organisms within a population.
34. What is a significant difference between a predator and a parasite?
a. Parasites do not cause immediate death, while predators do.
b. Parasites are always microscopic, while predators can be any size
c. Parasites feed on any organism; predators are not specific to their prey.
d. A parasite has a complete digestive tract, while a predator must have multiple stomachs for digestion of their kill.
35. When starling birds fly over a field where army ants are on the march, other insects jump up to get out of the army's way, and starlings feed on these jumping insects. What is the relationship between the army ants and starlings?
a. mutualism b. commensalism c. competition d. parasitism
36. At what point would a population exhibit a negative growth rate?
a. population is mostly young c. no diseases are in the population
b. birth rate is higher than the death rate d. death rate is higher than the birth rate
37. Which of the following is a consequence of biological magnification?
a. Only a small portion of energy is captured by producers is transferred to consumers
b. Populations of top-level predators are generally larger than populations of primary consumers
c. Toxic chemicals in the environment pose a greater risk to top-level predators than to primary consumers.
d. The amount of toxic chemicals passed from producers to top-level predators decreases to the point that only trace amounts of the chemical can be found
38. Stable K-strategist organisms have few offspring and give parental care, procreate later in life with a long life expectancy. In which of the following habitats would you expect to find the **largest number** of K-strategist individuals?
a. a climax beech/maple forest
b. a sand dune community on Oregon beach
c. a recently abandoned agricultural field in Iowa
d. on a newly formed volcanic island
39. Which density-dependent factor controls the **size** of a population?
a. light intensity b. wind velocity c. nutrient supply d. rainfall
40. A termite can detect the scent of an invading ant. Scientists do not consider this a form of communication between termite and the ant. Why not?
a. The scent is not sufficient to cause a response in the termite.
b. The ant does realize it is giving off a scent.
c. The termite does not return a scent.
d. Communication must benefit both the signaler and the receiver.

41. What type of behavior is exhibited when a blue jay gives an alarm call at the intrusion of a crow into a woodlot?
- altruism
 - cooperation
 - self-sacrifice
 - kin selection
42. Suppose you travel from the base to the top of Mount Kilimanjaro, and along the way you notice a gradual change in the kind of vegetation that grows at different elevations. In what other journey would you encounter a similar pattern of change in vegetation?
- from the equator towards the pole
 - from the pole towards the equator
 - from a wetland to a desert
 - from east Africa to west Africa
43. A study of the metabolic rate in a terrestrial community shows that the energy released by respiration exceeds the energy captured in photosynthesis. What is occurring?
- Community biomass is decreasing
 - Community biomass is increasing
 - A climax community is reached.
 - The 1st law of thermodynamics is ineffective.
44. What process is directly affected when girdling a tree by completely removing a ring of bark with its phloem?
- translocation
 - transpiration
 - guttation
 - photosynthesis

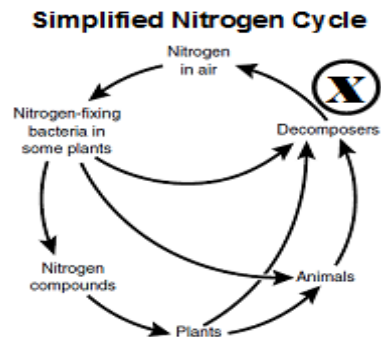
Use the diagram below to answer the following four questions 45, 46, 47, 48



45. What plant process could be measured in the experiment shown above?
- absorption
 - translocation
 - transpiration
 - respiration
46. Which experimental beaker acts as a control for evaporation?
- A
 - B
 - C
 - D
47. Why is petroleum jelly placed on the plant in beaker B?
- To allow transpiration to take place
 - To initiate the opening of the stoma
 - To prevent water loss from the plant
 - To allow growth in the opposite direction
48. After watching the behavior of earthworms in the ground, a student suggested the action of earthworms promotes root growth because CO_2 can more easily access the roots. He set up another beaker like B (see the diagram in #45, above) but substituted a plant with roots instead of the rootless plant and labeled the new beaker E. Then he placed a tube allowing CO_2 to flow into all five beakers during 10 days. What is the most likely outcome of the experiment?
- In Beaker E new roots grew from increased CO_2
 - Leaves grew in A, B, C and E due to increased CO_2
 - New roots formed in B, C and E proving the necessity for CO_2
 - New roots did not appear because CO_2 is taken in by the leaves
49. What climatic change elevates the transpiration rate in trees?
- increasing both humidity and ambient air temperature
 - increasing both humidity and wind speed
 - increasing both ambient air temperature and wind speed
 - decreasing both ambient air temperature and wind speed

50. What process is responsible for returning nitrogen to the air at X in the diagram below?

- a. Nitrogen fixation
- b. denitrification
- c. decomposition
- d. absorption



51. What is characteristic of the producers found in hydrothermal vent communities?

- a. use sunlight as their primary energy source
- b. use energy from chemical reactions involving hydrogen sulfide
- c. lack any significant carnivorous predators
- d. are similar to species found in the phytoplankton at the surface

52. Which nerves send signals that tend to slow down “housekeeping” chores and speed up parts of the body that would be involved in a flight/fright response? All full credit. Ans should be letter D, but misspelled.

- a. peripheral
- b. somatic
- c. sympathetic
- d. paparasympathetic

53. What change occurs when a lake undergoes eutrophication?

- a. increase in depth
- b. increase in nutrient concentration
- c. increase in species diversity
- d. increases in oxygen levels

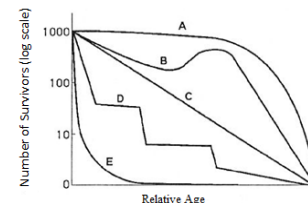
54. Some plants such as asters and chrysanthemums are considered to short-day plants. These plants flower in the fall, when there are less than 12 hours of daylight. How would a botanist be able to get them to flower in July, when there are more than 12 hours of daylight?

- a. Cover them with an opaque box every night.
- b. Cover them with a transparent box every night and expose them to infrared light all night.
- c. Place them in a darkroom at 11pm each night and return them outdoors early each morning.
- d. Place them in a darkroom after 11 hours of daylight and return them outdoors early each morning.

55. What maintains the great pattern of organization in nature?

- a. flow of energy from the sun
- b. annual climate changes
- c. activity of microorganisms
- d. recycling of all matter into usable compounds

Matching Use the following graph below on survivorship curves to answer the following questions.



56. Which curve best describes survivorship in marine mollusk, r-strategist ?

57. Which curve best describes survivorship in elephants, a K-strategist ?

58. Which curve best describes survivorship in a marine crustacean that molts?

59. Which curve best describes survivorship trees found in a light gap with only a few surviving?

60. Which curve best describes survivorship that is independent of age was left out. all full credit

NEW JERSEY SCIENCE LEAGUE

Biology II Ans Key April 14, 2016 White paper test (Corrections)

1	C	16	A	31	D(C not D)	46	D
2	B	17	D	32	D	47	C
3	C	18	A	33	D	48	D
4	A	19	A	34	A	49	C
5	D	20	A	35	B	50	B
6	B	21	A	36	D	51	B
7	C	22	C	37	C	52	C all full credit
8	D	23	D	38	A	53	B
9	C	24	B	39	C	54	D
10	D	25	E	40	D	55	A
11	A	26	C	41	A	56	E
12	D	27	B	42	A	57	A
13	C	28	A	43	A	58	D
14	A	29	C	44	A	59	E
15	C	30	D	45	C	60	B all full credit

BIOLOGY 11 For AP and second year biology students. 60 Multiple Choice

Question topics for each test will include questions which relate to the Big Ideas I–IV listed below taken from the Advanced Placement Curriculum designed by The College Board. Questions will involve science practices such as analysis of data and evidence to support biological principles. All levels of life (molecules through ecosystems) will be explored on each exam. In addition, for each exam the identified content (e.g. osmoregulation) is linked to the excretory system. For example students should be able to answer, how does osmoregulation occur in the nephron in the excretory system.

Big Idea 1: The process of evolution drives diversity and unity of life

Big Idea 2: Biological Systems utilize free energy and molecular building blocks to grow, reproduce, and to maintain dynamic homeostasis

Big Idea 3: Living Systems store, retrieve, transmit and respond to information essential to life processes.

Big Idea 4: Biological Systems interact, and these systems and their interactions possess complex properties.

EXAM 1 January: Structure and function of Biological Molecules, Protein Folding, Bonding in Polymers, Enzymes, Coenzymes, Cofactors, Lipid and their Properties, Carbohydrates. Structure and function of Cells, Organelles and subcellular structures. Cell and tissue types, Germ layers and development. Free Energy and Gibbs Reactions, Enthalpy in Biological Systems, Biological Applications to the Laws of Thermodynamics, Endothermic/Exothermic Reactions, Coupled Reactions, Photosynthesis, Cellular Respiration, Endotherm/Exotherm in Body Temperature Regulation, Cell Types, Surface Area/Volume Ratios, Fluid Mosaic Model of the Membrane, Properties of Water, Osmoregulation, Membrane Transport, Cellular Feedback Mechanisms, Metabolic Processes and Metabolism, Communication; signaling, reception, transduction and response. Systems in plants and animals include Nervous, Endocrine, Immune and Excretory

EXAM 2 February DNA and replication, RNA and Protein Production, RNA Types, Cell Cycle and Controls, Mitosis, Meiosis, Application of Mendel's Laws, Mendelian and NonMendelian Genetics, Genetic Disorders, Cancer, Genetic Engineering Techniques, Nonnuclear Inheritance, Transposons, Crossover, Gene Regulation, Apoptosis, Developmental Genes, Mutations, Biotechnology, Embryonic Development in Plants and Animals, Signaling Mechanisms, Transmission and Transduction Pathways, Polyploidy, Sex Inheritance, Mutation Effects, Viral Replication, Genetic Variation Processes, Mating Types, Behaviors and Parenting, Bacteria and Yeast Reproduction and use in Biotech. Systems in plants and animals include Reproduction and Development

EXAM 3 March Evolution, Natural Selection, Artificial Selection, Mechanisms for Evolution, Hardy Weinberg Principles, Genetic Drift, Gene flow, Evidences for Evolution, Blast Genomic Analysis, Cladogram, Evolutionary Trees, Evolution of the Domains, Adaptive Radiation, Island Biogeography Theory, Speciation, Prezygotic and Postzygotic Mechanisms, Energy in Reproductive Strategies Hypothesis on Origins of Life, Virus and Bacteria types and adaptations. Evolution of systems in plants and animals include Respiration, Excretion, Digestion, Circulation, Senses

EXAM 4 April Ecosystem Energy Pyramid Structure, Food Web Alterations, Organ and System Specialization, Interactions and Coordination in Plants and Animals, Organism Responses Adaptation to Environment, Ecosystem Transformations, Components of a community, Transpiration, Population: Variation, Growth, Dynamics and Distribution, Exponential and Logistic Population Growth Models, Population Density, Limiting Factors, Species Richness, Species Diversity, Competition, Bacteria, Fungi, Symbiotic Relationships, Food Webs, Productivity, Energy Dynamics, Keystone species, Exotic and Alien Species Biogeochemical Cycles, Energy of Reproductive Strategies, Behavioral and Physiological Response to Environmental Stress, Taxis and Kinesis, Tropisms, Biological Rhythms, Behavioral Biology.

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PLEASE RETURN THE AREA RECORD AND ALL TEAM MEMBER SCANTRONS(ALL STUDENTS PLACING 1ST, 2ND, 3RD, AND 4TH).

If you return scantrons of alternates, then label them as ALTERNATES.

Dates for 2017 Season

Thursday January 12, 2017 Thursday February 9, 2017
Thursday March 9, 2017 Thursday April 13, 2017