

**New Jersey Science League
Biology 1 BLUE EXAM
January 14, 2016 (Corrections)**

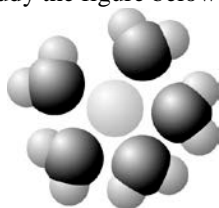
Choose the answer that best completes the statements or questions below and fill in the appropriate response on the form. If you change an answer, be sure to completely erase your first choice. Please PRINT your name, school, area, and which test you are taking onto the scan-tron. Please use the same name for all exams.

1. To test the effectiveness of light wavelength on the rate of photosynthesis the following experiment was performed. A 10 cm piece of *Elodea*, an aquatic plant, was placed in each of four test tubes. The tubes were covered with yellow, red, green and blue plastic wrap to control the wavelength of light. After 24 hours the percent change in the solution was determined. What can be done to improve the design of the experiment?
- Place a plant in the dark
 - Use distilled water for the plants
 - Place one plant on ice
 - The design is already adequate

2. How many protons are in the molecule $C_6H_{12}O_6$? C is correct because atomic number and mass numbers were not given. All full credit.

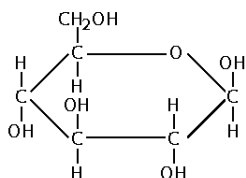
- a. 24 b. 48 c. 96 d. 192

3. Study the figure below of a solute molecule and surrounding water molecules, the solute molecule is most likely

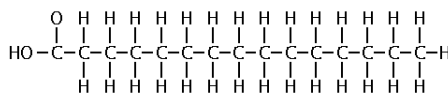


- a. Positively charged b. Negatively Charged c. Without Charge d. Non polar

4. Molecules such as number 2 below are usually found in



Molecule 1



Molecule 2

- a. Nucleic Acids b. Lipids c. Carbohydrates d. Proteins

5. You are given four test tubes containing purified biological macromolecules. The test tubes are unlabeled except for a number between 1 and 4. You are told that one test tube contains a protein, one contains a lipid, one contains a carbohydrate, and one contains a nucleic acid. You then perform some tests on the macromolecules and collect the following information:

- Test tubes #1 and #4 contain nitrogen, but the other tubes do not.
- The contents of test tube #3 are not soluble in water, but the contents of the other test tubes are soluble in water.
- The contents of test tube #2 can be broken down into subunits that are all exactly identical to each other.
- The macromolecule in test tube #1 is found to have a globular shape.

What type of molecule is found in test tube #2

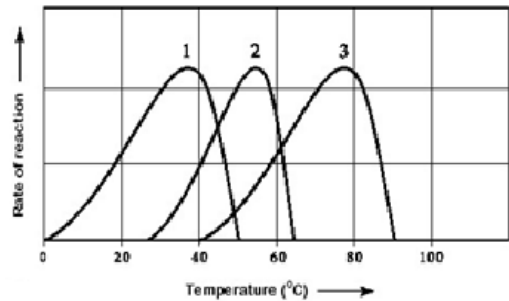
- a. Nucleic Acids b. Lipids c. Carbohydrates d. Proteins

6. Based on the pH values listed below, which of following substances has the most hydroxide ions(OH⁻¹)?

pH Values of Some Common Substances	
Substance	pH
Sulfuric acid	1.2
Tomatoes	4.2
Rainwater	6.2
Sea water	8.5
Sodium hydroxide	13.0

- a. Sulfuric Acid b. Tomatoes c. Sea Water d. Sodium Hydroxide

7. The graph shows reaction rates of three different enzymes at various temperatures. What best explains the similarities between the three curves? C is correct not A.

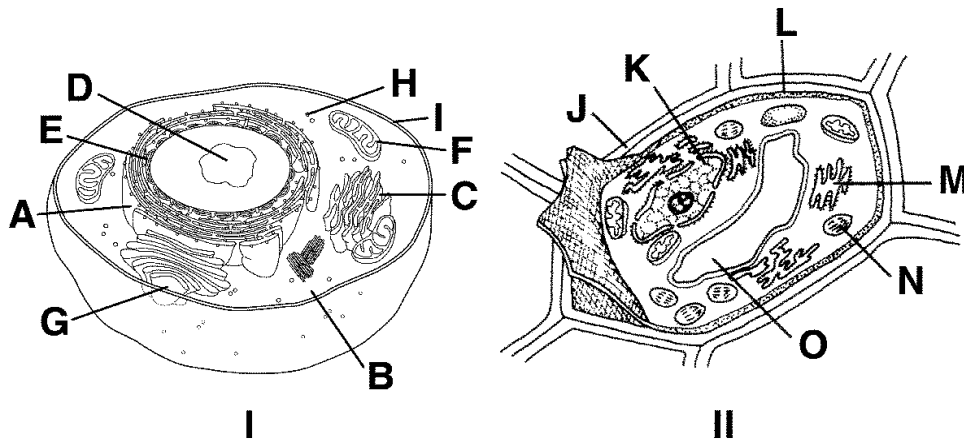


- a. Heat causes the peptide bonds in the enzyme to break
 b. Heat speeds up the reaction rate so that there is no substrate left to react.
 c. Heat destabilizes the hydrogen bonds between the functional groups.
 d. An inhibitor is interfering with the reaction

8. A new species was found in the depths a newly explored cave. Cells from this species show the presence of cell walls and very small ribosomes but no other cytoplasmic organelles. How should the new species be classified?

- a. Eukaryotic plant cell b. Eukaryotic animal cell c. Eukaryotic Fungal Cell d. Prokaryotic cell.

Use the diagram below to answer questions 9 and 10.

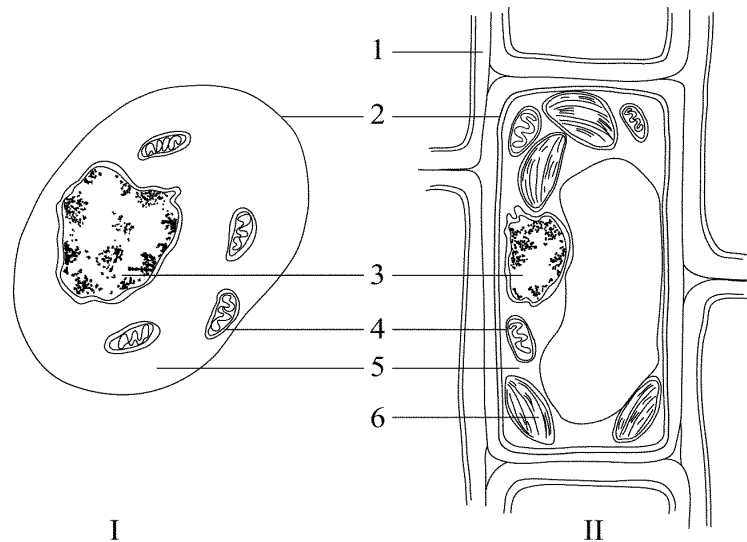


9. In cells that do a lot of work what structure would you expect to see in the largest quantity?
 a. structure A b. structure F c. structure C d. structure H

10. Which structure defines cell II as a plant cell?
 a. structure J b. structure K c. structure L d. structure M

18. Imagine looking through a microscope at a squashed onion root tip. The chromosomes of many of the cells are plainly visible inside the nuclear membrane. These particular cells are in which stage of mitosis?
a. Interphase b. Prophase c. Metaphase d. Anaphase e. Telophase
19. The formation of a cell plate is beginning across the middle of a cell and nuclei are re-forming at opposite ends of the cell. What kind of cell is this?
a. a plant cell in metaphase b. an animal cell in telophase c. an animal cell undergoing cytokinesis
d. a plant cell undergoing cytokinesis
20. If mammalian cells receive a go-ahead signal at the G₁ checkpoint, they will
a. move directly into telophase. b. complete cytokinesis and form new cell walls.
c. exit the cycle and switch to a non-dividing state. d. complete the cycle and divide.
21. Mr. Limpitt takes a sample of his aquarium water to be tested. The water's pH was 5.8. In order to make the environment safe for the fish, the pH must be neutral. Mr. Limpitt must add
a. HCl. c. additional fish to the ecosystem.
b. NaOH. d. a strong acid.
22. Which of the following best describes the effect of temperature on enzyme activity?
a. For enzyme activity to be high, the cell must become as warm as possible.
b. For enzyme activity to be high, the cell must become as cool as possible.
c. For enzyme activity to be high, the cell must remain within a narrow range of temperatures.
d. Temperature is not important, since the role of enzymes is to overcome the need for activation energy.
23. For several centuries, people believed that a plant grew because its roots consumed soil. To test this hypothesis, which of the following tests would give you the most convincing data?
a. Cover the plant for 2 weeks with a black cloth.
b. Transplant the plant into a tub of water.
c. Weigh both the plant and the soil at the beginning and end of a growing season.
d. Cut away the soil to expose a root, and observe the process.
24. Which pathway involves the rearrangement of carbon compounds?
a. Krebs cycle c. electron transport system
b. Calvin cycle d. both A and B
25. Several kinds of aquatic plants, algae, bacteria, one-celled eukaryotes, snails, and fish were placed in an aquarium. The aquarium was sealed to make it airtight and not opened. Each week it was observed and carefully weighed. The weight of the aquarium plus its contents would probably
a. increase and then decrease. c. continually increase.
b. decrease and then increase. d. remain the same.
26. Yeast cells consume more sugar when their supply of oxygen is reduced because
a. glycolysis slows down without oxygen.
b. anaerobically, they release less energy from each glucose molecule.
c. they begin to store more fat and starch.
d. they begin to require more alcohol.

27. Refer to the side figure. With structure 3 removed, a cell could not
- reproduce.
 - secrete.
 - exchange materials with the environment.
 - provide its own energy.



28. When a cell with 24 chromosomes during G1 phase divides by mitotic cell division, the resulting offspring cells will each have a maximum chromosome number of
- 6.
 - 12.
 - 24.
 - 48.
29. Distribution of one of each replicated chromosome to each of two cells following mitosis ensures
- reduction of chromosome number to one-half of the original.
 - completion of the mitotic process.
 - formation of new cells with DNA identical to the parent cell.
 - stimulation of the mechanism for cytoplasmic division.
30. How is the energy from food eventually used at the cell level?
- All food is converted to glucose.
 - All food converted to matter and stored.
 - Energy is released in the production of ATP.
 - Energy is released in the production of ADP.
31. You have two test tubes both filled with water and an *Elodea* plant. You want to test the effect of wavelength on photosynthesis, so you wrap one test tube using a red colored plastic wrap and place it under a light. What would you do to the other tube to have a proper control?
- Wrap the other tube in red colored plastic wrap and place it out of the light.
 - Do not wrap the other tube and place it under the light.
 - Wrap the other tube in clear plastic wrap and place it in the light.
 - Wrap the other tube in aluminum foil and place it in the light.
32. You have been growing some animal cells in culture. The cells grow well for several weeks, and then their growth slows down. You conduct some tests and determine that there is much lactic acid in the culture fluid. Which of the following is the most likely explanation for the poor growth of the cells?
- There is too much glucose in the culture fluid.
 - There is not enough glucose in the culture fluid.
 - There is too much oxygen in the culture fluid.
 - There is not enough oxygen in the culture fluid.
33. How do prokaryotic and eukaryotic chromosomes differ?
- Eukaryotic chromosomes are linear, whereas those of prokaryotes are circular.
 - Eukaryotic chromosomes are embedded in the cytoplasm, whereas those of prokaryotes are attached to the cell membrane.
 - Eukaryote cells are diploid, whereas prokaryotes are monoploid.
 - Eukaryotic chromosomes contain DNA, while prokaryotic chromosomes contain a different form of genetic material.

34. C_3 , C_4 , and CAM plants differ from each other in that
- C_3 plants use the Calvin cycle for carbon fixation and C_4 and CAM plants use different pathways for carbon fixation.
 - C_3 plants have their stomata open during the day and C_4 and CAM plants have their stomata open only at night.
 - C_3 and C_4 plants have their stomata open during the day and CAM plants have their stomata open only at night.
 - C_3 plants use CO_2 to form organic compounds and C_4 and CAM plants use other sources of carbon.
35. Suppose that a scientific idea is well-tested and can be used to make predictions in numerous new situations, but cannot explain one particular event. This idea is a
- hypothesis that is incorrect.
 - hypothesis that must be retested.
 - theory that should be discarded.
 - theory that may need revision.
36. Carbon-12 is the most common isotope of carbon. It has 6 protons, 6 neutrons, and 6 electrons. Of its 6 electrons, 4 are valence electrons. How many covalent bonds can a carbon atom form?
- 1
 - 4
 - 6
 - 12
37. When microorganisms in milk produce acid under certain conditions, yogurt results. Which of these processes would you expect to be key in the production of yogurt?
- the Krebs cycle
 - photosynthesis
 - alcoholic fermentation
 - lactic acid fermentation
38. One difference between cell division in plant cells and in animal cells is that plant cells have
- centrioles.
 - centromeres.
 - a cell plate.
 - chromatin.
39. A group of molecular biologists is trying to synthesize a new artificial compound to mimic the effects of a known hormone that influences sexual behavior. They have turned to you for advice. Which of the following compounds is most likely to mimic the effects of the hormone?
- a compound with the same number of carbon atoms as the hormone
 - a compound with the same molecular mass (amu) as the hormone
 - a compound with the same three-dimensional shape as part of the hormone
 - a compound with the same number of orbital electrons as the hormone
40. Compared with ^{31}P , the radioactive isotope ^{32}P has
- a different atomic number.
 - one more neutron.
 - one more proton.
 - one more electron.
41. The atomic number of sulfur is 16. Sulfur combines with hydrogen by covalent bonding to form a compound, hydrogen sulfide. Based on the number of valence electrons in a sulfur atom, predict the molecular formula of hydrogen sulfide:
- HS
 - HS_2
 - H_2S
 - H_2S_3
42. An example of a hydrogen bond is the bond between
- C and H in methane (CH_4).
 - the H of one water molecule and the O of another water molecule.
 - Na^+ and Cl^- in salt.
 - the two hydrogen atoms in a molecule of hydrogen gas (H_2).

43. Many mammals control their body temperature by sweating. Which property of water is most directly responsible for the ability of sweat to lower body temperature?
- water's change in density when it condenses
 - water's ability to dissolve molecules in the air
 - the release of heat by the formation of hydrogen bonds
 - the absorption of heat by the breaking of hydrogen bonds
44. Which of the following is a hydrophobic material?
- paper
 - table salt
 - wax
 - sugar
45. The molecular formula for glucose is $C_6H_{12}O_6$. What would be the molecular formula for a molecule made by linking three glucose molecules together by dehydration reactions?
- $C_{18}H_{36}O_{18}$
 - $C_{18}H_{32}O_{16}$
 - $C_6H_{10}O_5$
 - $C_{18}H_{10}O_{15}$
46. Under which of the following conditions would you expect to find a cell with a predominance of free ribosomes?
- a cell that is secreting proteins
 - a cell that is producing cytoplasmic enzymes
 - a cell that is constructing its cell wall or extracellular matrix
 - a cell that is digesting food particles
47. Which of the following would likely move through the lipid bilayer of a plasma membrane most rapidly?
- CO_2
 - an amino acid
 - glucose
 - K^+
48. Celery stalks that are immersed in fresh water for several hours become stiff and hard. Similar stalks left in a salt solution become limp and soft. From this we can deduce that the cells of the celery stalks are
- hypotonic to both fresh water and the salt solution.
 - hypertonic to both fresh water and the salt solution.
 - hypertonic to fresh water but hypotonic to the salt solution.
 - hypotonic to fresh water but hypertonic to the salt solution.
49. When you have a severe fever, what may be a grave consequence if this is not controlled?
- destruction of your enzymes' primary structure
 - removal of amine groups from your proteins
 - change in the folding of enzymes
 - removal of the amino acids in active sites
50. You have a friend who lost 7 kg (about 15 pounds) of fat on a "low carb" diet. How did the fat leave her body?
- It was released as CO_2 and H_2O .
 - Chemical energy was converted to heat and then released.
 - It was converted to ATP, which weighs much less than fat.
 - It was broken down to amino acids and eliminated from the body.
51. The lowest level of biological organization that can perform all the activities required for life is the
- organelle—for example, a chloroplast.
 - cell—for example, a skin cell.
 - tissue—for example, nervous tissue.
 - organ system—for example, the reproductive system.

52. What trait best differentiates prokaryotes and eukaryotes?
- The presence of chlorophyll
 - The presence of a membrane-bound nucleus.
 - The absence of ribosomes.
 - The presence of a cell wall.
53. A controlled experiment is one in which
- the experiment is repeated many times to ensure that the results are accurate.
 - the experiment proceeds at a slow pace to guarantee that the scientist can carefully observe all reactions and process all experimental data.
 - there are at least two groups, one of which does not receive the experimental treatment.
 - there are at least two groups, one differing from the other by two or more variables.
54. Which of the following is most similar in structure to ATP?
- an anabolic steroid
 - a DNA helix
 - an RNA nucleotide
 - an amino acid with three phosphate groups attached
55. Sucrose is a disaccharide, composed of the monosaccharides glucose and fructose. The hydrolysis of sucrose by the enzyme sucrase results in
- bringing glucose and fructose together to form sucrose.
 - the release of water from sucrose as the bond between glucose and fructose is broken.
 - breaking the bond between glucose and fructose and forming new bonds from the atoms of water.
 - production of water from the sugar as bonds are broken between the glucose monomers.
56. Which of the following statements regarding enzymes is *true*?
- Enzymes decrease the free energy change of a reaction.
 - Enzymes increase the rate of a reaction.
 - Enzymes change the direction of chemical reactions.
 - Enzymes are permanently altered by the reactions they catalyze.
57. The oxygen consumed during cellular respiration is involved directly in which process or event?
- glycolysis
 - accepting electrons at the end of the electron transport chain
 - the citric acid cycle
 - the oxidation of pyruvate to acetyl CoA
58. The direct energy source that drives ATP synthesis during respiratory oxidative phosphorylation is
- oxidation of glucose to CO_2 and water.
 - the thermodynamically favorable flow of electrons from NADH to the mitochondrial electron transport carriers.
 - the final transfer of electrons to oxygen.
 - the difference in H^+ concentrations on opposite sides of the inner mitochondrial membrane.
59. How many oxygen molecules (O_2) are required each time a molecule of glucose $\text{C}_6\text{H}_{12}\text{O}_6$ is completely oxidized via aerobic respiration?
- a. 1 b. 6 c. 12 d. 24
60. What is the primary function of the Calvin cycle?
- use ATP to release carbon dioxide
 - use NADPH to release carbon dioxide
 - split water and release oxygen
 - synthesize simple sugars from carbon dioxide

**New Jersey Science League
Biology I Answer Key Blue Test**

Date: January 14, 2016

Record onto the area record the # correct (Corrections)

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

BIOLOGY I : No AP or second year students in this category. 60 multiple choice questions per exam.

JANUARY EXAM : JANUARY EXAM - Carbon Compounds and basic chemistry including the chemistry of water and pH, Chemical Reactions, Enzymes, Cell structure and function, Levels of Cellular Organization, organelles, Prokaryotic and Eukaryotic, Cellular and Intracellular transport, Homeostasis, Cellular Energy Flow, Photosynthesis and Respiration, Cellular Division- mitosis, Cell Regulation.

FEBRUARY EXAM - Structure and function of nucleic acids; roles of DNA, protein synthesis, Meiosis, chromosomal analysis (pedigree, karyotyping, and DNA sequencing), Mendelian genetics, one and two factor crosses, mutations, Genetic engineering, Gene regulation and expression, Mutation and causes, Exponential growth, DNA inheritance of traits, Variation of Traits, cause and effect, Bioinformatics.

MARCH EXAM - Evidence for evolution: Molecular evidence (nucleotide sequence analysis, amino acid sequence analysis), Comparative anatomy and comparative embryology, Fossil record; Hardy Weinberg; Taxonomy: Cladograms and Phylogenetic Trees, Natural Selection, Genetic change in a population, Geologic Time scale, Patterns and causes of Evolution, Carrying capacity of a population, Evidence of diversity, Adaptation of organism to the environment.

APRIL EXAM PART - Interactions of autotrophs and heterotrophs; Flow of energy through an ecosystem; Limiting factors in Biomes; Cycles of Matter; Symbiosis; Ecosystem models of energy flow; Social Interaction and group behavior of organism; Succession; Ecological experimentation and analysis; Factors affecting biodiversity in a population; Human Influence on ecosystems.

Dates for 2016 Season

Thursday January 14, 2016 Thursday February 11, 2016

Thursday March 10, 2016 Thursday April 14, 2016

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

New Jersey Science League

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What is to be mailed back to our office?

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

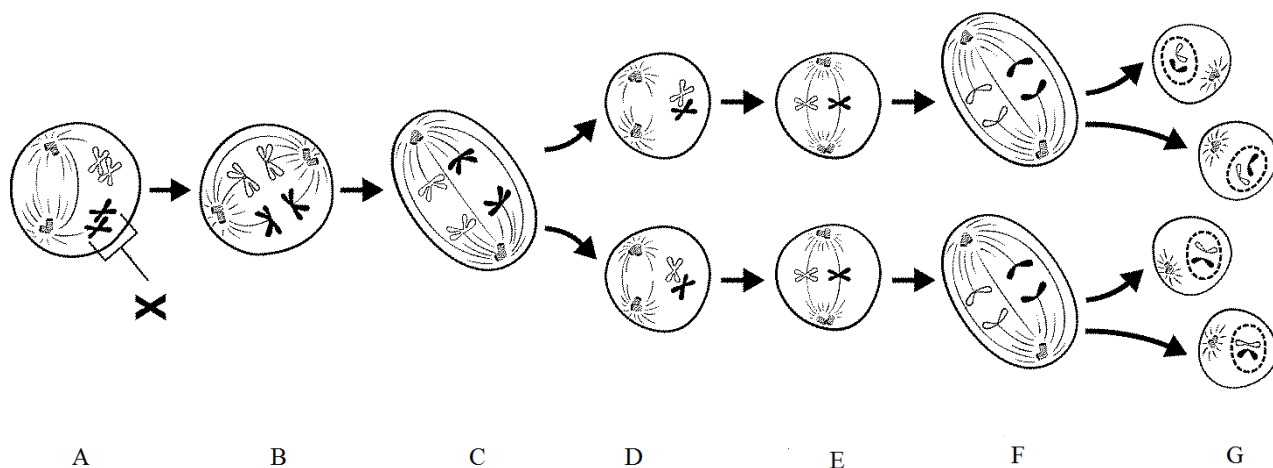
New Jersey Science League
Biology 1 BLUE EXAM
February 11, 2016 (Corrections)

Choose the answer that best completes the statements or questions below and fill in the appropriate response on the form. If you change an answer, be sure to completely erase your first choice. Please PRINT your name, school, area, and which test you are taking onto the scan-tron. Please use the same name for all exams.

1. In *E. coli*, there is a mutation in a gene called *dnaB* that alters the helicase that normally acts at the origin. Which of the following would you expect as a result of this mutation?
 - a. No proofreading will occur.
 - b. No replication fork will be formed.
 - c. The DNA will supercoil.
 - d. Replication will occur via RNA polymerase alone.

2. The leading and the lagging strands differ in that
 - a. the leading strand is synthesized in the same direction as the movement of the replication fork, and the lagging strand is synthesized in the opposite direction.
 - b. the leading strand is synthesized by adding nucleotides to the 3' end of the growing strand, and the lagging strand is synthesized by adding nucleotides to the 5' end.
 - c. the lagging strand is synthesized continuously, whereas the leading strand is synthesized in short fragments that are ultimately stitched together.

3. Which letter below indicates the phase in which the chromosomes split into chromatids?
 - a. A
 - b. E
 - c. C
 - d. F



4. What is the role of DNA ligase in the elongation of the lagging strand during DNA replication?
 - a. synthesize RNA nucleotides to make a primer
 - b. catalyze the lengthening of telomeres
 - c. join Okazaki fragments together
 - d. unwind the parental double helix

5. A biochemist isolates and purifies various molecules needed for DNA replication. When she adds some DNA, replication occurs, but each DNA molecule consists of a normal strand paired with numerous segments of DNA a few hundred nucleotides long. What has she probably left out of the mixture?
 - a. DNA polymerase
 - b. DNA ligase
 - c. nucleotides
 - d. Okazaki fragments

6. Using RNA as a template for protein synthesis instead of translating proteins directly from the DNA is advantageous for the cell because
 - a. RNA is much more stable than DNA.
 - b. RNA acts as an expendable copy of the genetic material.
 - c. only one mRNA molecule can be transcribed from a single gene, lowering the potential rate of gene expression.
 - d. tRNA, rRNA and others are not transcribed.

7. A particular triplet of bases in the template strand of DNA is 5' AGT 3'. The corresponding codon for the mRNA transcribed is
 - a. 3' UCA 5'. b. 3' UGA 5'.
 - c. 5' TCA 3'. d. 3'ACU 5'.

Use the genetic code chart to answer #8 and #9.

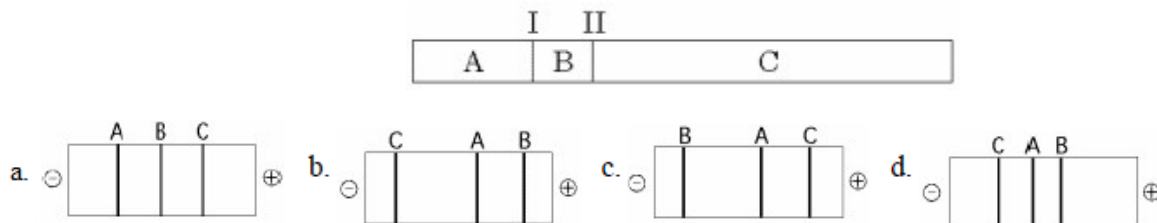
8. A possible sequence of nucleotides in the template strand of DNA that would code for the polypeptide sequence phe-leu-ile-val would be
 - a. 3' AAC-GAC-GUC-AUA 5'.
 - b. 3' AAA-GAA-TAA-CAA 5'.
 - c. 5' AUG-CTG-CAG-TAT 3'.
 - d. 3' AAA-AAT-ATA-ACA 5'.

		Second Base				
		U	C	A	G	
First Base	U	UUU } Phe UUC } UUA } Leu UUG }	UCU } UCC } Ser UCA } UCG }	UAU } Tyr UAC } UAA } Stop UAG } Stop	UGU } Cys UGC } UGA } Stop UGG } Trp	U C A G
	C	CUU } CUC } Leu CUA } CUG }	CCU } CCC } Pro CCA } CCG }	CAU } His CAC } CAA } Gln CAG }	CGU } CGC } Arg CGA } CGG }	U C A G
	A	AUU } AUC } Ile AUA } AUG } Met or Start	ACU } ACC } Thr ACA } ACG }	AAU } Asn AAC } AAA } Lys AAG }	AGU } Ser AGC } AGA } Arg AGG }	U C A G
	G	GUU } GUC } Val GUA } GUG }	GCU } GCC } Ala GCA } GCG }	GAU } Asp GAC } GAA } Glu GAG }	GGU } GGC } Gly GGA } GGG }	U C A G

9. What amino acid sequence will be generated, based on the following mRNA codon sequence?
5' AUG-UCU-UCG-UUA-UCC-UUG 3' . Use the genetic code chart from #8.
- a. met-arg-glu-arg-glu-arg b. met-glu-arg-arg-gln-leu
c. met-ser-leu-ser-leu-ser d. met-ser-ser-leu-ser-leu
10. The genetic code is essentially the same for all organisms. From this, one can logically assume all of the following *except*
- a. a gene from an organism could theoretically be expressed by any other organism.
b. all organisms have a common ancestor.
c. DNA was the first genetic material.
d. the same codons in different organisms usually translate into the same amino acids.
11. Which of the following types of mutation, resulting in an error in the mRNA just after the AUG start of translation, is likely to have the most serious effect on the polypeptide product?
- a. a deletion of a codon
b. a deletion of 2 nucleotides
c. a substitution of the third nucleotide in an ACC codon
d. a substitution of the first nucleotide of a GGG codon
12. The karyotype of one species of primate has 48 chromosomes. In a particular female, cell division goes awry and she produces one of her eggs with an extra chromosome (25). The most probable source of this error would be a mistake in which of the following?
- a. Either anaphase I or II
b. Telophase II of one meiotic event
c. Mitosis in her ovary
d. Metaphase I of one meiotic event
13. You have in your possession a microscope slide with meiotic cells on it and a light microscope. What would you look for if you wanted to identify metaphase I cells on the slide?
- a. A visible nuclear envelope
b. Separated sister chromatids at each pole of the cell
c. Tetrads lined up at the center of the cell
d. A synaptonemal complex
14. Which contributes the most to genetic diversity within a sexually reproducing species?
- a. independent assortment of chromosomes
b. self-fertilization
c. gene stability
d. somatic mutations
15. When crossing an organism that is homozygous recessive for a single trait with one that is heterozygous for the same trait, what is the chance of producing an offspring with the homozygous recessive phenotype?
- a. 0% b. 25% c. 50% d. 75% e. 100%

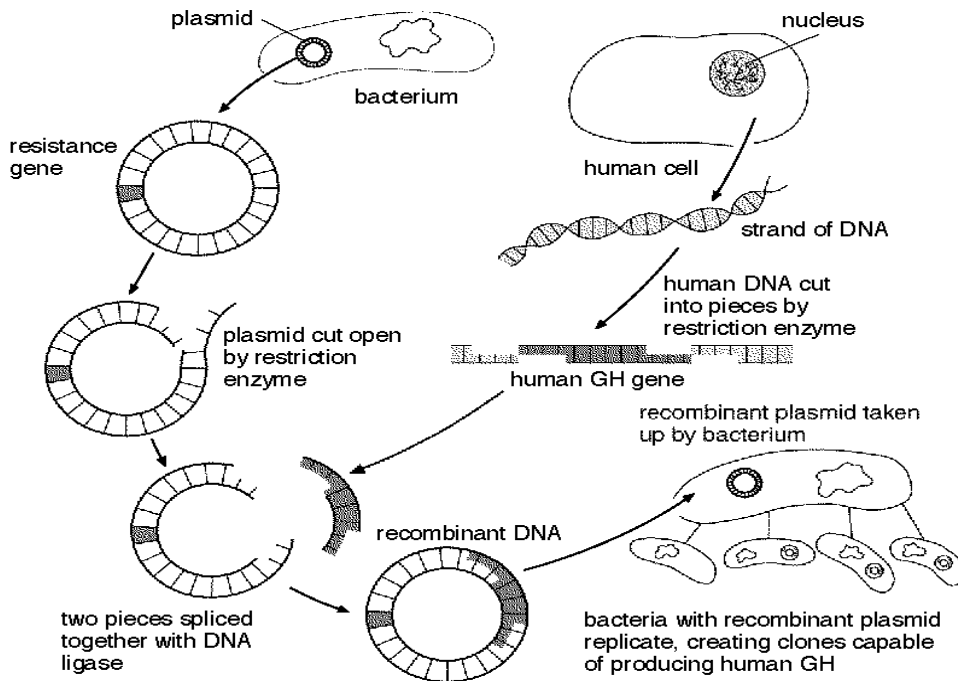
16. Black fur in mice (B) is dominant to brown fur (b). Short tails (T) are dominant to long tails (t). What fraction of the progeny of the cross $BbTt \times BBtt$ will have black fur and long tails?
 a. 1/16 b. 3/16 c. 3/8 d. 1/2 e. 9/16
17. Two true-breeding stocks of pea plants are crossed. One parent has red(R), axial(A) flowers and the other has white(r), terminal flowers(a); all F_1 individuals have red, axial flowers. The genes for flower color and location assort independently. If 1,000 F_2 offspring resulted from the cross, approximately how many of them would you expect to have red, terminal flowers?
 a. 65 b. 190 c. 250 d. 565 e. 750
18. Labrador retrievers are black, brown, or yellow. In a cross of a black female with a brown male, results can be either all black puppies, 1/2 black to 1/2 brown puppies, or 3/4 black to 1/4 yellow puppies. These results indicate which of the following?
 a. There is incomplete dominance.
 b. Yellow is dominant to black.
 c. Brown is dominant to black.
 d. Epistasis is involved.
19. In snapdragons, heterozygotes have pink flowers, whereas homozygotes have red or white flowers. When plants with red flowers are crossed with plants with white flowers, what proportion of the offspring will have pink flowers?
 a. 0% b. 25% c. 50% d. 75% e. 100%
20. A woman who has blood type A positive has a daughter who is type O and a son who is type B. Which of the following is a possible genotype for the son?
 a. $I^B I^B$ b. $I^B I^A$ c. ii d. $I^B i$ e. $I^A I^A$
21. In humans, Huntington's disease is a dominant condition with late age of onset. If one parent has the disease, what is the probability that his or her child will have the disease?
 a. 1 b. 3/4 c. 1/2 d. 1/4 e. 0
22. Red-green color blindness is a sex-linked recessive trait in humans. Two people with normal color vision have a color-blind son. What are the genotypes of the parents?
 a. $X^C X^C$ & $X^C Y$ b. $X^C X^C$ & $X^c Y$
 c. $X^C X^c$ & $X^c Y$ d. $X^C X^c$ & $X^C Y$
23. Cytosine makes up 12% of the nucleotides in a sample of DNA from an organism. Approximately what percentage of the nucleotides in this sample will be thymine?
 a. 12 b. 24 c. 31 d. 38
24. Alternative RNA splicing
 a. is a mechanism for increasing the rate of transcription.
 b. can allow the production of proteins of different sizes from a single mRNA.
 c. can allow the production of similar proteins from different RNAs.
 d. increases the rate of transcription.

25. What is the effect of a nonsense mutation in a gene?
- It changes an amino acid in the encoded protein.
 - It has no effect on the amino acid sequence of the encoded protein.
 - It introduces a premature stop codon into the mRNA.
 - It alters the reading frame of the mRNA.
26. Eukaryotic cells can control gene expression by which of the following mechanisms?
- histone acetylation of nucleosomes
 - DNA acetylation
 - RNA induced modification of chromatin structure
 - repression of operons
27. Gene expression might be altered at the level of post-transcriptional processing in eukaryotes rather than prokaryotes because of which of the following?
- Eukaryotic mRNAs get 5' caps and 3' tails.
 - Prokaryotic genes are expressed as mRNA, which is more stable in the cell.
 - Eukaryotic exons may be spliced in alternative patterns.
 - Prokaryotes use ribosomes of different structure and size.
28. One hereditary disease in humans, called xeroderma pigmentosum (XP), makes homozygous individuals exceptionally susceptible to UV-induced mutation damage in the cells of exposed tissue, especially skin. Without extraordinary avoidance of sunlight exposure, patients soon succumb to numerous skin cancers. Which of the following best describes this phenomenon?
- inherited cancer taking a few years to be expressed
 - embryonic or fetal cancer
 - inherited predisposition to mutation
 - inherited inability to repair UV-induced mutation
29. Which of the following modifications is least likely to alter the rate at which a DNA fragment moves through a gel during electrophoresis?
- altering the nucleotide sequence of the DNA fragment
 - methylating the cytosine bases within the DNA fragment
 - increasing the length of the DNA fragment
 - decreasing the length of the DNA fragment
30. The segment of DNA shown below has restriction sites I and II, which create restriction fragments A, B, and C. Which of the gels produced by electrophoresis shown below best represents the separation and identity of these fragments?



31. DNA microarrays have made a huge impact on genomic studies because they
- can be used to eliminate the function of any gene in the genome.
 - can be used to introduce entire genomes into bacterial cells.
 - allow the expression of many or even all of the genes in the genome to be compared at once.
 - allow physical maps of the genome to be assembled in a very short time.
32. Which of the following is most like the formation of identical twins? All full credit
- therapeutic cloning
 - cell cloning
 - organismal cloning
 - use of adult stem cells
33. Reproductive cloning of human embryos is generally considered unethical. However, on the subject of therapeutic cloning there is a wider divergence of opinion. Which of the following is a likely explanation?
- Use of adult stem cells is likely to produce more cell types than use of embryonic stem cells.
 - Cloning to produce embryonic stem cells may lead to great medical benefits for many.
 - Cloning to produce stem cells relies on a different initial procedure than reproductive cloning.
 - A clone that lives until the blastocyst stage does not yet have human DNA.
34. A researcher is using adult stem cells and comparing them to other adult cells from the same tissue. Which of the following is a likely finding?
- The cells from the two sources exhibit different patterns of DNA methylation.
 - Adult stem cells have more DNA nucleotides than their counterparts.
 - The two kinds of cells have virtually identical gene expression patterns in microarrays.
 - The non-stem cells have fewer repressed genes.
35. A paleontologist has recovered a bit of tissue from the 400-year-old preserved skin of an extinct dodo (a bird). The researcher would like to compare a specific region of the DNA from the sample with DNA from living birds. Which of the following would be most useful for increasing the amount of dodo DNA available for testing?
- RFLP analysis
 - polymerase chain reaction (PCR)
 - electroporation
 - gel electrophoresis
36. You clone what you think is a novel gene from your favorite experimental organism and then proceed to sequence it. You would like to know if this particular gene has been studied before. What would be your next step?
- RFLP analysis
 - electrophoresis
 - BLAST search
 - gene therapies
37. During translation, the type of amino acid that is added to the growing polypeptide depends on the
- codon on the mRNA and the anticodon on the rRNA.
 - anticodon on the mRNA and the anticodon on the tRNA.
 - anticodon on the rRNA and the codon on the mRNA.
 - codon on the mRNA and the anticodon on the tRNA.
38. Which is involved with the regulation of eukaryotic genes?
- operon
 - DNA polymerase
 - TATA box
 - operator

39. Gene therapy is successful if the
- viruses carrying the replacement gene infect the person's cells.
 - replacement gene is replicated in the person's cells.
 - replacement gene is expressed in the person's cells.
 - replacement gene is successfully spliced to viral DNA.
40. DNA replication results in two DNA molecules,
- each with two new strands.
 - one with two new strands and the other with two original strands.
 - each with one new strand and one original strand.
 - each with two original strands.
41. A *lac* repressor turns OFF the expression of the *lac* genes by
- binding to the promoter.
 - DNA polymerase.
 - binding to the operator.
 - binding to the *lac* genes.
42. To produce transgenic bacteria that make insulin, which of the steps listed below would a scientist do FIRST?
- Insert the human insulin gene into a plasmid.
 - Extract the insulin from the bacterial culture.
 - Cut out the insulin gene from human DNA.
 - Transform bacteria with the recombinant plasmid.
43. Scientists have used genes from spiders to genetically engineer goats that produce silk strands along with their milk. Which of the following is true of the silk made by the goats?
- It is slightly different than the silk made by the spiders because the genes are read differently by the goat's cells.
 - It is heavier than the silk made the spiders because goats are larger animals than spiders.
 - It is very different from the silk made by the spiders because goat cells are very different from spider cells.
 - It is identical to silk produced by the spiders because the genetic code is universal.
44. Imagine that you are scientist studying skin cancer cells. Which biotechnology technique could you use if you wanted to compare the activity levels of hundreds of genes in skin cancer cells to their activity levels in normal skin cells?
- DNA microarray
 - gene therapy
 - DNA fingerprinting
 - genetic testing
45. The farther apart two genes are located on a chromosome, the
- less likely they are to be inherited together.
 - more likely they are to be linked.
 - less likely they are to assort independently.
 - less likely they are to be separated by crossing over.
46. There are 64 codons and 20 amino acids. Which of the following is true?
- Several different codons can specify the same amino acid.
 - Each codon specifies a different amino acid.
 - Some amino acids have no link to a codon.
 - Each amino acid is specified by only one codon.

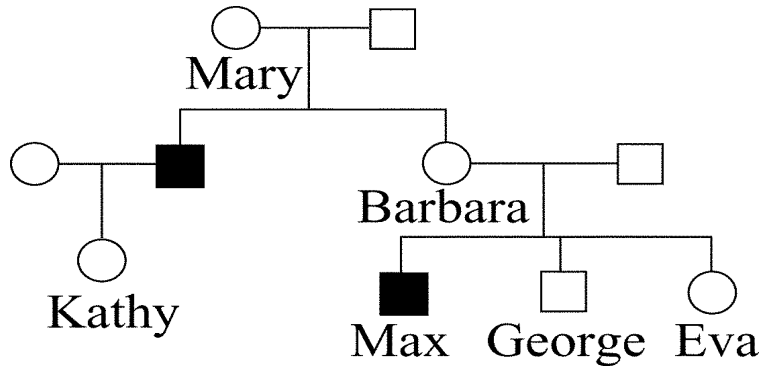


Use the figure above for questions # 47 and 48.

47. Refer to Figure above. What is the relationship between the plasmid (prior to recombination) and the piece of DNA from the human cell?
- a. They both have the resistance gene. b. They were cut with the same enzyme.
 c. They were cut with different enzymes. d. They can both produce human GH.
48. What is the reason the human GH gene is spliced together with the plasmid?
- a. Plasmids are readily taken up by bacteria.
 b. Only the plasmid would accept the piece of DNA.
 c. The enzyme used for the human cell cuts the bacterial chromosome in different places.
 d. The plasmid has the resistance gene.
49. A coin with head and tails is tossed 6 times and lands tails up 6 times. What is the probability that it will land heads up on the seventh toss?
- a. 100% b. 60% c. 50% d. 40%
50. If three-quarters of the offspring from many experimental crosses showed only the dominant traits, the parents were most likely
- a. both homozygous dominant. b. both heterozygous.
 c. one homozygous dominant, one recessive. d. one heterozygous, one homozygous dominant.
51. Genetic traits of seeds are noted as follows: G = long, W = wrinkled, Y = yellow, R = ribbed, g = short, w = smooth, y = white, r = grooved. Which of the following is a possible genotype for a short, wrinkled, yellow, grooved seed?
- a. $ggWwyyrr$ b. $GGWWyyRr$ c. $GgWwYYRr$ d. $ggWwYYrr$

Use the following information for questions # 52 and 53. Tay-Sachs disease is caused by an allele for a recessive trait. A DNA test on blood can determine if a healthy individual is homozygous or heterozygous. One member of a particular couple is homozygous dominant, and the other member is heterozygous.

52. What is the probability that this couple will have a child with Tay-Sachs disease?
 a. 0% b. 25% c. 50% d. 100%
53. What is the probability that this couple's children will be carriers (heterozygous)?
 a. 0% b. 25% c. 50% d. 100%
54. In 1988, a Florida couple charged a hospital with baby swapping, claiming that the baby they brought home was not their biological daughter. The father and the baby had type B blood, the mother type O. In terms of blood type, could the baby have belonged to this couple?
 a. Yes, this couple could have a child with either $I^B I^B$, or $I^B i$, both type B phenotype.
 b. No, a type O mother could not have a type B child.
 c. Yes, the baby could have $I^B i$ genotype.
 d. Yes, I^B is dominant to i , so a B father and an O mother would always have children with type B blood.
55. Tall (T) is dominant to dwarf (t), while red flower color is due to (R) and white to allele (r). The heterozygous condition results in pink (Rr) flower color. If two plants of the genotypes $ttRr$ and $TtRR$, respectively, were crossed, what would be the probability that they would produce a dwarf white plant?
 a. 0% b. 25% c. 50% d. 100%



Use the figure above for question #56.

56. A type of color weakness is an X-linked recessive trait. The shaded figures in the pedigree represent individuals who possess this trait. B represents the allele for normal color vision, and b represents the allele for this type of color weakness. What is Mary's genotype?
 a. $X^B X^B$ b. $X^b X^b$ c. $X^b Y$ d. $X^B X^b$

57. If a horticulturist breeding gardenias succeeds in having a single plant with a particularly desirable set of traits, which of the following would be her most probable and efficient route to establishing a true breeding line of such plants?
- Backtrack through her previous experiments to obtain another plant with the same traits.
 - Breed this plant with another plant with much weaker traits.
 - Clone the plant asexually to produce an identical one, then cross breed the clones and select for desirable progeny to breed again.
 - Force the plant to self-pollinate to obtain an identical one.
58. If a cell were unable to produce histone proteins, which of the following would be a likely effect?
- There would be an increase in the amount of "satellite" DNA produced during centrifugation.
 - The cell's DNA couldn't be packed into its nucleus.
 - Spindle fibers would not form during prophase.
 - Amplification of other genes would compensate for the lack of histones.
59. A mutation in which of the following parts of a gene is likely to be most damaging to a cell?
- intron
 - exon
 - 5' UTR
 - 3' UTR
 - All would be equally damaging.
60. A mutation that inactivates the regulatory gene of a repressible operon in an *E. coli* cell would result in
- continuous transcription of the structural gene controlled by that regulator.
 - complete inhibition of transcription of the structural gene controlled by that regulator.
 - irreversible binding of the repressor to the operator.
 - inactivation of RNA polymerase by alteration of its active site

**New Jersey Science League
Biology I Answer Key Blue Test**

Date: February 11, 2016

Record onto the area record the # correct (Corrections)

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

BIOLOGY I : No AP or second year students in this category. 60 multiple choice questions per exam.

JANUARY EXAM : **JANUARY EXAM** - Carbon Compounds and basic chemistry including the chemistry of water and pH, Chemical Reactions, Enzymes, Cell structure and function, Levels of Cellular Organization, organelles, Prokaryotic and Eukaryotic, Cellular and Intracellular transport, Homeostasis, Cellular Energy Flow, Photosynthesis and Respiration, Cellular Division- mitosis, Cell Regulation.

FEBRUARY EXAM - Structure and function of nucleic acids; roles of DNA, protein synthesis, Meiosis, chromosomal analysis (pedigree, karyotyping, and DNA sequencing), Mendelian genetics, one and two factor crosses, mutations, Genetic engineering, Gene regulation and expression, Mutation and causes, Exponential growth, DNA inheritance of traits, Variation of Traits, cause and effect, Bioinformatics.

MARCH EXAM - Evidence for evolution: Molecular evidence (nucleotide sequence analysis, amino acid sequence analysis), Comparative anatomy and comparative embryology, Fossil record; Hardy Weinberg; Taxonomy: Cladograms and Phylogenetic Trees, Natural Selection, Genetic change in a population, Geologic Time scale, Patterns and causes of Evolution, Carrying capacity of a population, Evidence of diversity, Adaptation of organism to the environment.

APRIL EXAM PART - Interactions of autotrophs and heterotrophs; Flow of energy through an ecosystem; Limiting factors in Biomes; Cycles of Matter; Symbiosis; Ecosystem models of energy flow; Social Interaction and group behavior of organism; Succession; Ecological experimentation and analysis; Factors affecting biodiversity in a population; Human Influence on ecosystems.

Dates for 2016 Season

Thursday February 11, 2016

Thursday March 10, 2016 Thursday April 14, 2016

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

New Jersey Science League

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Web address: <http://entnet.com/~personal/njscil/html/>

What is to be mailed back to our office?

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 1 BLUE EXAM
March 10, 2016 No Corrections

Choose the answer that best completes the statements or questions below and fill in the appropriate response on the form. If you change an answer, be sure to completely erase your first choice. Please PRINT your name, school, area, and which test you are taking onto the scan-tron. Please use the same name for all exams.

1. Evolution would probably occur at a very high rate in
 - a. two interacting populations that BOTH have low mutation rates.
 - b. one small population with a low mutation rate AND one larger population.
 - c. two interacting populations that BOTH have high mutation rates.
 - d. one population with a high mutation rate AND one smaller population.

2. Population genetics focuses on the gene pools of local populations because
 - a. a local population is the unit of evolution.
 - b. other population groups are too large.
 - c. total populations cannot be studied.
 - d. local populations are small enough to study.

3. Which statement best describes the evolution of pesticide resistance in a population of insects?
 - a. Individual members of the population slowly adapt to the presence of the chemical by striving to meet the new challenge.
 - b. All insects exposed to the insecticide begin to use a formerly silent gene to make a new enzyme that breaks down the insecticide molecules.
 - c. Insects observe the behavior of other insects that survive pesticide application, and adjust their own behaviors to copy those of the survivors.
 - d. Offspring of insects that are genetically resistant to the pesticide become more abundant as the susceptible insects die off.

4. Which describes an African butterfly species that exists in two strikingly different color patterns?
 - a. artificial selection
 - b. directional selection
 - c. stabilizing selection
 - d. disruptive selection

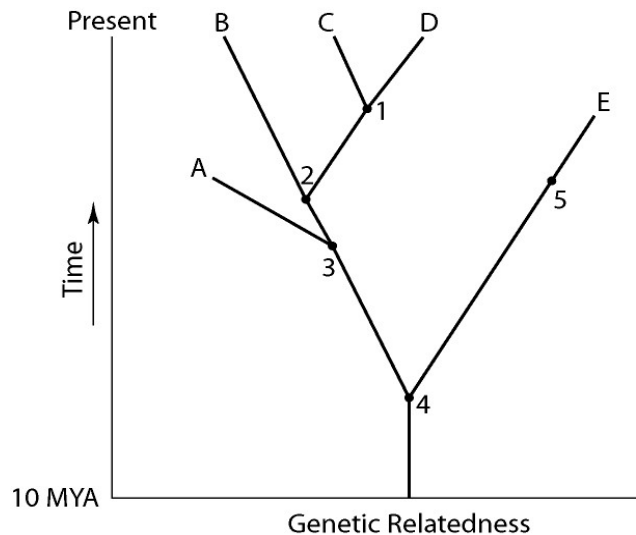
5. A population has two alleles for flower color: A = purple and a = white. If the population has an allele frequency of $F(A) = 0.45$, then what is $F(a)$?
 - a. 0.20
 - b. 0.45
 - c. 0.55
 - d. 0.50

6. Over evolutionary time, many cave-dwelling organisms have lost their eyes. Tapeworms have lost their digestive systems. Whales have lost their hind limbs. How can natural selection account for these losses?
 - a. Natural selection cannot account for losses, only for innovations.
 - b. Natural selection accounts for these losses by the principle of use and disuse.
 - c. Under particular circumstances that persisted for long periods, each of these structures presented greater costs than benefits.
 - d. The ancestors of these organisms experienced harmful mutations that forced them to find new habitats that these species had not previously used.

7. Natural selection acts directly on
 - a. alleles.
 - b. genes.
 - c. phenotypes.
 - d. mutations.
8. Of the following anatomical structures, which is homologous to the wing of a bird?
 - a. Flipper of a cetacean
 - b. Wing of a butterfly
 - c. Hindlimb of a kangaroo
 - d. Tail fin of a flying fish
9. Genetic diversity in prokaryotes is primarily due to
 - a. the mixing of DNA during binary fission.
 - b. mutations in DNA.
 - c. the mixing of DNA during fertilization.
 - d. mutations in RNA.
10. A plant evolves a high level of poison that enables it to defend itself against insects. Soon an insect that prefers to eat this plant evolves an enzyme that breaks down the poison. This is an example of
 - a. convergent evolution.
 - b. punctuated equilibrium.
 - c. coevolution.
 - d. adaptive radiation.
11. Over time, the movement of people on Earth has steadily increased. This has altered the course of human evolution by increasing
 - a. genetic drift.
 - b. non-random mating.
 - c. mutations.
 - d. gene flow.

12. According to the figure below the common ancestor for both species C and E could be at position number

- a. 1
- b. 2
- c. 3
- d. 4
- e. 5



13. According to this figure which species are extinct?
 - a. A and E
 - b. A and B
 - c. C and D
 - d. D and E

14. Which of the following pieces of evidence most strongly supports the common origin of all life on Earth?
 - a. All organisms require energy.
 - b. All organisms use essentially the same genetic code.
 - c. All organisms reproduce.
 - d. All organisms show heritable variation.
15. Two organisms in the same class but different orders
 - a. are in different kingdoms.
 - b. have the same genus name.
 - c. are in the same phylum.
 - d. are members of the same species.

23. In Darwin's thinking, the more closely related two different organisms are, the
- more similar their habitats are.
 - less similar their DNA sequences are.
 - more recently they shared a common ancestor.
 - less likely they are to have the same genes in common.
24. If a mutation introduces a new skin color in a lizard population, which factor might determine whether the frequency of the new allele will increase?
- how many other alleles are present
 - whether the mutation makes some lizards more fit for their environment than other lizards
 - how many phenotypes the population has
 - whether the mutation was caused by nature or by human intervention
25. In a hypothetical population of 1,000 people, tests of blood-type genes show that 160 have the genotype AA, 480 have the genotype AB, and 360 have the genotype BB. What is the frequency of the B allele?
- a. 0.001 b. 0.002 c. 0.100 d. 0.400 e. 0.600
26. In modern terminology, diversity is understood to be a result of genetic variation. Sources of variation for evolution include all of the following *except*
- mistakes in translation of structural genes.
 - mistakes in DNA replication.
 - translocations and mistakes in meiosis.
 - recombination at fertilization.
27. Which of the following statements is an *inference* of natural selection?
- Subsequent generations of a population should have greater proportions of individuals that possess traits better suited for success.
 - An individual organism undergoes evolution over the course of its lifetime.
 - Habitats do not generally have unlimited resources.
 - Natural populations tend to reproduce to their full biological potential.
 - Some of the variations that exists among individuals in a population is genetic.
28. Although they often live in the same habitat, the American toad breeds earlier in the spring than the Fowler's toad does. What can be inferred from this information?
- The two species do not interbreed because of geographic isolation.
 - The two species do not interbreed because of temporal isolation.
 - The two species interbreed throughout the spring season.
 - The American toad will cause the extinction of the Fowler's toad.

Use the following information to answer question number 29. A researcher compared the nucleotide sequences of a homologous gene from five different species of mammals with the homologous human gene. The sequence homology between each species' version of the gene and the human gene is presented as a percentage of similarity.

Species	Percentage
Chimpanzee	99.7
Orangutan	98.6
Baboon	97.2
Rhesus Monkey	96.9
Rabbit	93.7

29. What probably explains the inclusion of rabbits in this research?
- Their short generation time provides a ready source of DNA.
 - They possess all of the shared derived characters as do the other species listed.
 - They are the closest known relatives of rhesus monkeys.
 - They are the outgroup.
 - They are the most recent common ancestor of the primates.
30. In a Hardy-Weinberg population with two alleles, A and a , that are in equilibrium, the frequency of the allele a is 0.4. What is the percentage of the population that is homozygous for this allele?
- a. 4 b. 16 c. 32 d. 36
31. Similar patterns of embryological development in different but related organisms are responsible for the formation of
- a. homologous structures. b. analogous structures. c. Hox genes. d. intermediate fossil forms.
32. Which describes brightly colored peacocks mating more frequently than drab peacocks?
- a. disruptive selection b. artificial selection c. sexual selection d. directional selection
33. Mutation is critical to the process of evolution because changes in ____ increase variation in populations.
- a. proteins b. amino acids c. alleles d. phenotypes
34. No two people are genetically identical, except for identical twins. The chief cause of genetic variation among human individuals is
- new mutations that occurred in the preceding generation.
 - the reshuffling of alleles in sexual reproduction.
 - genetic drift due to the small size of the population.
 - geographic variation within the population.

35. The Darwinian fitness of an individual is measured **most directly** by
- the number of its offspring that survive to reproduce.
 - the number of "good genes" it possesses.
 - the number of mates it attracts.
 - its physical strength.
36. If 25% of a randomly mating population has a recessive phenotype, it is reasonable to conclude that
- 100% carry the allele for the recessive trait.
 - 50% are heterozygous.
 - 75% are heterozygous.
 - 75% are homozygous for the dominant trait.
37. Cytochrome *c* is a protein that is involved in cellular respiration in all eukaryotic organisms. Human cytochrome *c* contains 104 amino acids. The following table compares human cytochrome *c* with cytochrome *c* from a number of other organisms.

Organism	Number of d in amino cytochrome <i>c</i> amino acids that <u>differ</u> from human cytochrome <i>c</i> amino acids
Chickens	18
Chimpanzees	0
Dogs	13
Rattlesnakes	20
Rhesus monkeys	1
Yeasts	56

- Which of the following is **not** a valid inference from these data?
- Chimpanzees are more closely related to humans than yeasts are.
 - The cytochrome *c* of chimpanzees differs from that of rhesus monkeys by only one amino acid.
 - Dogs are more closely related to humans than chickens are.
 - All of the proteins produced by chimpanzees and humans are identical.
38. Female cichlid fish will mate only with males that perform the correct courtship dance and display. This is known as:
- behavioral isolation
 - seasonal isolation
 - geographic isolation
 - mechanical isolation
39. Suppose we have two organisms that are in the same order but in different families. Based on this information which statement below is true?
- These organisms are most likely in the same genus.
 - These organisms could potentially be in different classes.
 - There is a high likelihood that these two organisms would be able to interbreed, but their progeny would be sterile.
 - Based on currently acceptable taxonomic criteria, these two organisms have to be in the same class.

40. Experiments conducted by Miller and Urey, and by others after them, have demonstrated that molecules important for life could have been produced in Earth's early atmosphere. These molecules include amino acids, carbohydrates, lipids, ATP, and nucleotides of DNA and RNA. Which of the following suggests how the genetic material of cells may have evolved to give instructions for the functioning and replication of cells?
- A spark of electricity can catalyze chemical reactions that produce proteins from DNA.
 - Cells link amino acids together into proteins, using instructions carried in the DNA and enzymes to catalyze the reactions.
 - RNA, like enzymes, can catalyze chemical reactions, and some RNA molecules could be self-replicating.
 - Chains of nucleotides form when water evaporates from a solution of nucleotides.
41. Which one of these facts about mitochondria and chloroplasts constitutes support for the endosymbiotic theory?
- Their DNA resembles bacterial RNA.
 - Their ribosomes resemble the ribosomes of bacteria.
 - They are organelles that are found within plant cells.
 - They reproduce by mitosis.
42. In the United States hives of European honeybees are often treated for *Acarapis woodi*, a parasitic mite. Although in Europe these honey bees have demonstrated resistance to these mites, in North America the bees have struggled to survive mite infestations. According to the principles of natural selection, what might we expect to happen to European honeybees in North America?
- European honeybees should go extinct in North America.
 - Some European honeybees that are resistant to mites should survive and lead to mite-resistant hives.
 - No change should occur to European honeybees.
43. Tigers and lions are separate species. Animals that have been named ligers and tigons are the result of crosses between lions and tigers in captivity. Based on your knowledge about the characteristics of a species, which of the following is the best prediction about these offspring?
- They will die early.
 - They will inherit the best features of both parents.
 - They are probably sterile.
 - They will be given new scientific names.
44. In the year 2500, five male space colonists and five female space colonists (all unrelated to each other) settle on an uninhabited Earthlike planet in the Andromeda galaxy. The colonists and their offspring randomly mate for generations. All ten of the original colonists had free earlobes, and two were heterozygous for that trait. The allele for free earlobes is dominant to the allele for attached earlobes. If one assumes that Hardy-Weinberg equilibrium applies to the population of colonists on this planet, about how many people will have attached earlobes when the planet's population reaches 10,000?
- 100
 - 400
 - 800
 - 1,000

45. In an experiment, suppose that the wings of fruit flies were clipped short for fifty generations. The fifty-first generation emerged with normal-length wings. This observation would tend to disprove the idea that evolution is based on
- inheritance of natural variations.
 - inheritance of acquired characteristics.
 - natural selection.
 - survival of the fittest.
46. One application of natural selection to agriculture is to
- select seeds of plants with a desired trait, such as disease resistance, to breed a new population.
 - always take seeds from the oldest plants because they have been most fit to survive.
 - choose random plants for reproduction because each will adapt to its environment in one generation.
 - avoid selective breeding because it is not natural.
47. Reproductive isolation differs from geographic isolation in that
- reproductive isolation only occurs after fertilization, whereas geographic isolation occurs before fertilization.
 - members of the same species are not physically separated in reproductive isolation, whereas they are separated in geographic isolation.
 - geographic isolation never leads to speciation, whereas reproductive isolation sometimes does.
 - members of two species in which reproductive isolation occurs never try to interbreed, whereas geographically isolated ones do.
48. The geographic isolation of two populations of a species tends to increase differences between their gene pools because it
- prevents interbreeding between the populations.
 - prevents interbreeding within each population.
 - causes temporal isolation of the two populations.
 - increases differences in courtship behavior.
49. During drought years on the Galapagos, small, easily eaten seeds become rare, leaving mostly large, hard-cased seeds that only birds with large beaks can eat. If a drought persists for several years, what should one expect to result from natural selection?
- Small birds gaining larger beaks by exercising their mouth parts.
 - Small birds mutating their beak genes with the result that later-generation offspring have larger beaks.
 - Small birds anticipating the long drought and eating more to gain weight and, consequently, growing larger beaks.
 - More small-beaked birds dying than larger-beaked birds. The offspring produced in subsequent generations have a higher percentage of birds with large beaks.
50. According to the Linnaean system of classification, the organism *Acetabularia mediterranea* is most closely related to
- Mediterranea crassa*.
 - Acetabularia crenulata*.
 - Mediterranea crenulata*.
 - Crenulata acetabularia*.

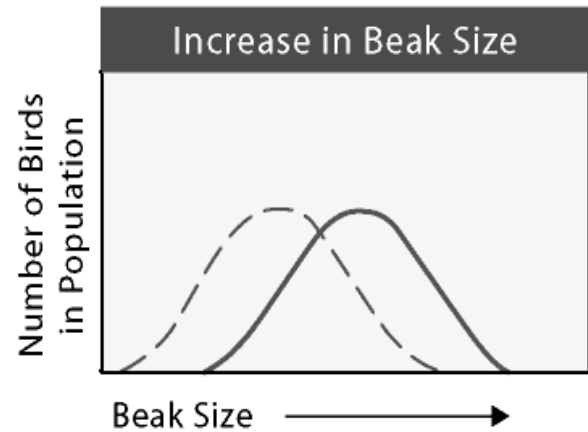
51. The common housefly belongs to all of the following taxa. Assuming you had access to textbooks or other scientific literature, knowing which of the following should provide you with the most specific information about the common housefly?
- a. order Diptera b. family Muscidae c. genus *Musca*
 d. class Hexapoda e. phylum Arthropoda
52. DNA sequences in many human genes are very similar to the sequences of corresponding genes in chimpanzees. The most likely explanation for this result is that
- a. humans and chimpanzees share a relatively recent common ancestor.
 b. humans evolved from chimpanzees.
 c. chimpanzees evolved from humans.
 d. convergent evolution led to the DNA similarities.
53. The three domain system of classification is based on similarities and differences in _____, while the six-kingdom system is based on similarities and differences in _____.

a	DNA;	DNA, fossils, embryological development, and physical features
b	DNA	embryological development, fossils, physical features, and RNA
c	ribosomal RNA	embryological development, fossils, physical features, and various molecular structures
d	physical features	embryological development, fossils, physical features, and various molecular structures

54. In the past, mass extinctions encouraged the rapid evolution of surviving species
- a. by changing developmental genes.
 b. by making new habitats available to them.
 c. because they killed all organisms that had coevolved.
 d. because they spared all organisms that had evolved convergently.
55. Natural selection changes the frequencies in the gene pool and helps a population adapt to its changed environment. This change can occur because increased reproductive success leads to _____, and poor reproductive success leads to _____.

a. increased allele frequency	decreased allele frequency
b. decreased allele frequency	decreased allele frequency
c. increased allele frequency	increased allele frequency
d. decreased allele frequency	increased allele frequency

56. One end of the figure below shows an increase in average beak size for a population of birds. When individuals at only one end of a bell curve of phenotype frequencies have high fitness, the result is
- directional selection.
 - stabilizing selection.
 - disruptive selection.
 - genetic drift.



57. Which statement about natural selection is ***most correct***?
- Adaptations beneficial in one habitat should generally be beneficial in all other habitats as well.
 - Different species that occupy the same habitat will adapt to that habitat by undergoing the same genetic changes.
 - Adaptations beneficial at one time should generally be beneficial during all other times as well.
 - Well-adapted individuals leave more offspring, and thus contribute more to the next generation's gene pool, than do poorly adapted individuals.
58. The lionfish is a venomous fish found primarily in the Red Sea and Indian Ocean. In the 1990's lionfish were accidentally released into the Atlantic Ocean, where they found abundant resources and favorable environmental conditions. Which of the following scenarios is most likely to result in the lionfish having a major impact on the communities into which they were introduced.
- With no natural predators, the lionfish population will become very large.
 - Some native species of invertebrates will develop a resistance to lionfish venom
 - Random mating will allow the lionfish population to reach Hardy-Weinberg equilibrium.
 - A virus that specifically infects lionfish will become more prevalent.
59. As a result of continental drift, the sycamore trees of Europe and of North America have been geographically isolated for at least 20 million years. The strongest evidence for placing these two groups in separate species would be
- inability to produce fertile offspring.
 - different allele frequencies.
 - growth in similar habitats.
 - overlapping pollination times.
60. Traditional classifications tended to take into account primarily
- extinct organisms.
 - RNA similarities.
 - DNA similarities.
 - visible similarities and differences

New Jersey Science League
Biology I Answer Key Blue Test
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7	C	22	A	37	D	52	A
8	A	23	C	38	A	53	C
9	B	24	B	39	D	54	B
10	C	25	E	40	C	55	A
11	D	26	A	41	B	56	A
12	D	27	A	42	B	57	D
13	A	28	B	43	C	58	A
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BIOLOGY I : No AP or second year students in this category. 60 multiple choice questions per exam.

JANUARY EXAM : JANUARY EXAM - Carbon Compounds and basic chemistry including the chemistry of water and pH, Chemical Reactions, Enzymes, Cell structure and function, Levels of Cellular Organization, organelles, Prokaryotic and Eukaryotic, Cellular and Intracellular transport, Homeostasis, Cellular Energy Flow, Photosynthesis and Respiration, Cellular Division- mitosis, Cell Regulation.

FEBRUARY EXAM - Structure and function of nucleic acids; roles of DNA, protein synthesis, Meiosis, chromosomal analysis (pedigree, karyotyping, and DNA sequencing), Mendelian genetics, one and two factor crosses, mutations, Genetic engineering, Gene regulation and expression, Mutation and causes, Exponential growth, DNA inheritance of traits, Variation of Traits, cause and effect, Bioinformatics.

MARCH EXAM - Evidence for evolution: Molecular evidence (nucleotide sequence analysis, amino acid sequence analysis), Comparative anatomy and comparative embryology, Fossil record; Hardy Weinberg; Taxonomy: Cladograms and Phylogenetic Trees, Natural Selection, Genetic change in a population, Geologic Time scale, Patterns and causes of Evolution, Carrying capacity of a population, Evidence of diversity, Adaptation of organism to the environment.

APRIL EXAM - Interactions of autotrophs and heterotrophs; Flow of energy through an ecosystem; Limiting factors in Biomes; Cycles of Matter; Symbiosis; Ecosystem models of energy flow; Social Interaction and group behavior of organism; Succession; Ecological experimentation and analysis; Factors affecting biodiversity in a population; Human Influence on ecosystems.

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**New Jersey Science League
Biology 1 BLUE EXAM
April 14, 2016 (Corrections)**

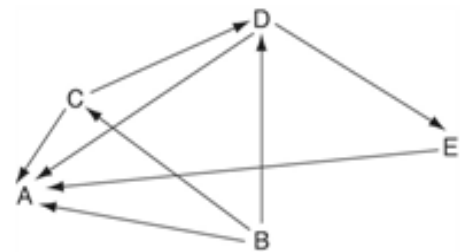
Choose the answer that best completes the statements or questions below and fill in the appropriate response on the form. If you change an answer, be sure to completely erase your first choice. Please PRINT your name, school, area, and which test you are taking onto the scan-tron. Please use the same name for all exams.

1. Succession is
 - a. the transfer of energy through a food chain.
 - b. an organism's ability to survive in its environment.
 - c. the regular progression of species replacement in an environment.
 - d. the number of species living in an ecosystem.

2. In which way are plants in a sunny mountain meadow and sulfur bacteria in a deep-sea volcanic vent alike?
 - a. They both use photosynthesis to make their own food.
 - b. They both produce carbohydrates and oxygen.
 - c. They both produce carbon and hydrogen.
 - d. They both use chemosynthesis to produce their own food.

Use the following diagram of a hypothetical food web to answer the following questions. The arrows represent the transfer of food energy between the various trophic levels.

Figure 1



3. Which letter in Figure 1 represents a species that could be a producer?
 - a. A
 - b. B
 - c. C
 - d. D
 - e. E

4. Which letter in Figure 1 represents a strictly herbivorous species?
 - a. A
 - b. B
 - c. C
 - d. D
 - e. E

5. Which letter in Figure 1 represents a strictly carnivorous species?
 - a. A
 - b. B
 - c. C
 - d. D
 - e. E

6. Cattle egrets are birds that mostly feed on insects that have been disturbed by grazing cattle. The cattle are neither helped nor harmed by the presence of the egrets. This relationship is an example of
 - a. competition.
 - b. mutualism.
 - c. parasitism.
 - d. commensalism.

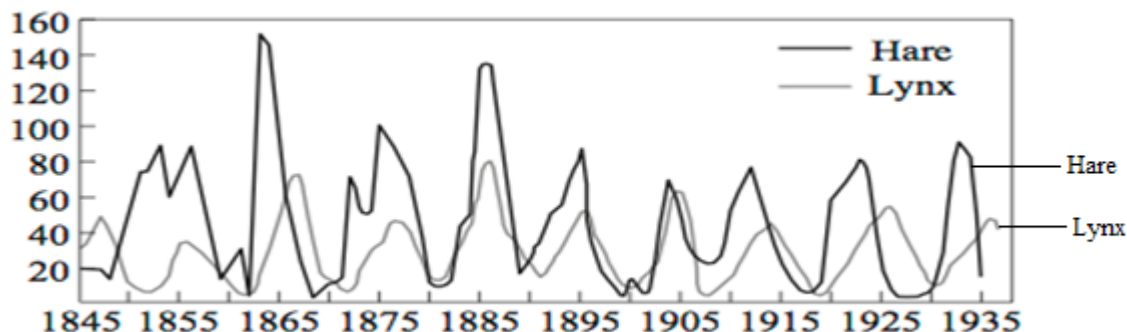
7. Which of the following characterizes relatively K-selected populations?
 - a. a high intrinsic rate of increase
 - b. small offspring
 - c. offspring with good chances of survival
 - d. many offspring per reproductive episode

8. Which of the following can contribute to density-dependent regulation of populations?
 - a. intraspecific competition for nutrients
 - b. the removal of toxic waste by decomposers
 - c. floods
 - d. earthquakes

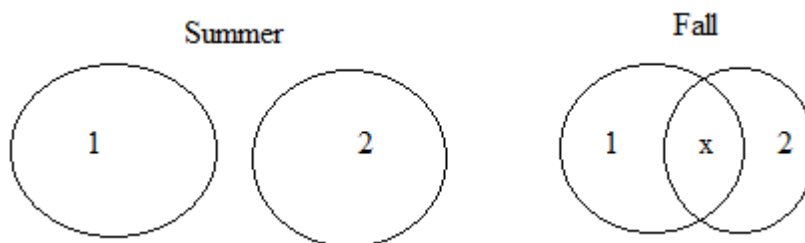
9. Which of the following is a density-independent factor limiting human population growth?
 - a. plagues
 - b. famines
 - c. earthquakes
 - d. social pressure for birth control

10. Which of the following is characteristic of the photic zone of the ocean but not the aphotic zone?
 a. bacteria b. fish c. photosynthesis d. tides

11. What does the graph below indicate between 1895 to 1935?



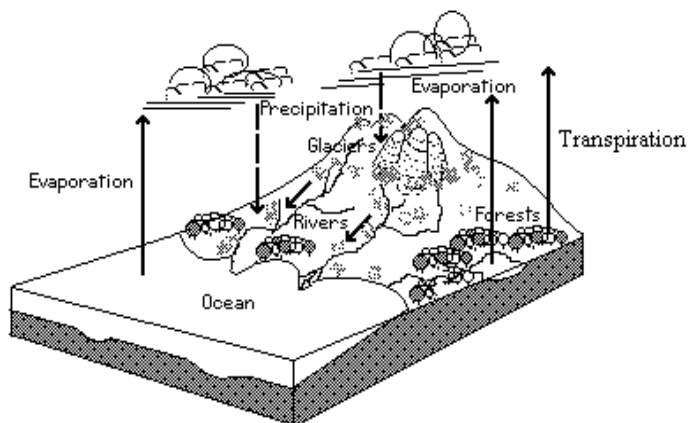
- a. The slow increase in the hare population was due primarily to interspecies competition.
 b. The lynx population decreased due to a change in abiotic environmental factors.
 c. An increase in the hare population was accompanied by an increase in the lynx population.
 d. An increase in the hare population was accompanied by a decrease in the lynx population
12. What is one difference between primary and secondary succession?
 a. Secondary succession usually begins with lichens and primary succession usually begins with trees.
 b. Secondary succession usually begins on soil and primary succession usually begins on newly exposed surfaces.
 c. Primary succession is usually rapid and secondary succession is usually slow.
 d. Primary succession usually modifies the environment and secondary succession usually does not.
13. The diagram below illustrates the **feeding** of two populations (1 and 2) in the same ecosystem during the summer and fall. Both populations feed on oak trees. What best explains the x in the fall diagram?



- a. the populations are competing for food in the fall but not the summer
 b. the species are separated by a geographic barrier
 c. the supply of oxygen is greater in the summer
 d. mating occurs between the species in the fall, but not in the summer
14. How does the data in the table below contrast with most energy pyramids?
- | Trophic level | 1 | 2 | 3 | 4 | 5 |
|---------------|---------------|-------------|---------|----------|------|
| Organism | phytoplankton | zooplankton | herring | mackerel | tuna |
| kg | 2500 | 500 | 50 | 5 | 0.5 |
- a. Transfer of energy is less efficient than usual.
 b. The table has two levels of producers.
 c. The table is missing a trophic level.
 d. This is an exception to the 10% rule.

15. A study showed that the depth at which some microscopic plants were found in a lake varied from day to day. On clear days, the plants were found as far as 6 meters below the surface of the water, but were only 1 meter below the surface on cloudy days. Which hypothesis would these observations support?
- Light intensity affects the growth of microscopic plants
 - Wind currents affect the growth of microscopic plants
 - Nitrogen concentration affects the growth of microscopic plants
 - Precipitation affects the growth of microscopic plants
16. The extinction of species
- will not be a problem in the coming century.
 - is a problem limited to the tropics.
 - has been accelerated by the activities of people.
 - is a problem only where topsoil and groundwater are limited.
17. Bees collect a positive static electricity while flying through the air. When a bee visits a flower, the charge deposits on the flower and takes a while to dissipate. Johnston organs, located in the antennae detect the presence and the pattern of electric fields in the flower. Why is this information advantageous to the visiting bee?
- The bee knows if another bee has recently visited.
 - The bee will avoid static shock.
 - It allows the bee to determine the color of the petals.
 - The bee senses the electric field and neutralizes the flower for other bees
18. If the Sun were to suddenly stop providing energy to Earth, most ecosystems would vanish. Which of the following ecosystems would likely survive the longest after this hypothetical disaster?
- grassland
 - tropical rainforest
 - tundra
 - desert
 - benthic ocean
19. The greenhouse effect occurs when gases
- trap UV light, heating the atmosphere.
 - are created by reaction with ozone.
 - trap infrared light, heating the atmosphere.
 - are destroyed by Freon.
20. Use the water cycle diagram below. By which process does most of the water vapor enter the atmosphere?

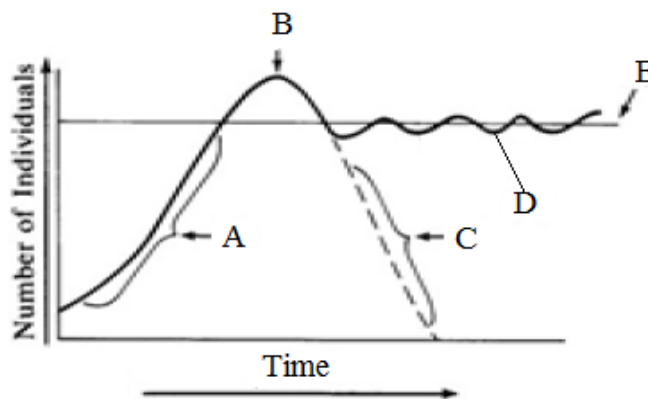
- evaporation from lakes and rivers
- evaporation from ocean surfaces
- evapotranspiration from land surfaces
- sublimation from ice and snow



21. In the water cycle in #20 where is energy released? Choice A should say condensation. All full credit.
- precipitation
 - evaporation
 - transpiration
 - all of these

22. Which statement is true concerning events occurring at point D in the graph below? **A and C are correct.**

- a. The prey population will soon rise
- b. The population is above its carrying capacity
- c. Environmental resistance is high
- d. Environmental resistance is low
- e. The population will continue to fall



23. What is the most important role of photosynthetic organisms in an ecosystem? **D is correct not C.**

- a. dissipating heat
- b. producing organic detritus for decomposers
- c. converting inorganic compounds into organic compounds
- d. absorbing solar radiation

24. Animals get the most of the nitrogen they need

- a. by consuming plants or other animals.
- b. by breathing in atmospheric nitrogen.
- c. directly from bacteria in the soil.
- d. from the process of denitrification.

25. Which of the following is a consequence of biological magnification?

- a. Only a small portion of the energy captured by producers is transferred to consumers.
- b. Toxic chemicals in the environment pose greater risk to top-level predators than to primary consumers.
- c. Populations of top-level predators are generally smaller than populations of primary consumers.
- d. The biomass of producers in an ecosystem is generally higher than the biomass of primary consumers.
- e. The amount of biomass in the producer level of an ecosystem decreases if the producer turnover time increases.

26. Evidence shows that some grasses benefit from being grazed. Which of the following terms would best describe this plant-herbivore interaction?

- a. competition
- b. parasitism
- c. commensalism
- d. predation
- e. mutualism

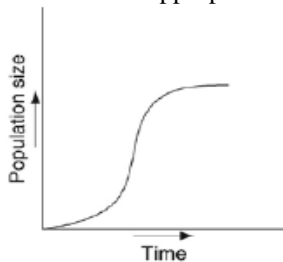
27. A secondary consumer that can eat only primary consumers receives what percent of the energy fixed by primary producers in a typical field ecosystem?

- a. 10%
- b. 20%
- c. 0.1%
- d. 90%
- e. 1%

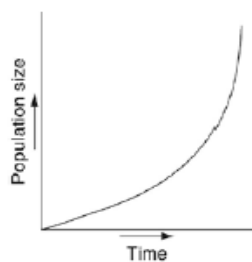
28. Nitrogen fixation is carried out primarily by

- a. plants.
- b. bacteria.
- c. consumers.
- d. humans.

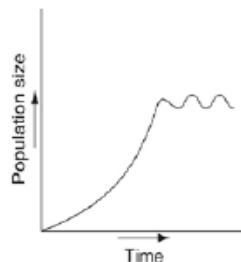
29. Which of the following graphs illustrates the growth over several seasons of a population of snowshoe hares that were introduced to an appropriate habitat which was also inhabited by predators in tundra biome?



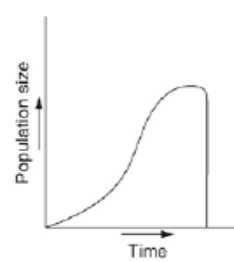
A.



B.



C.

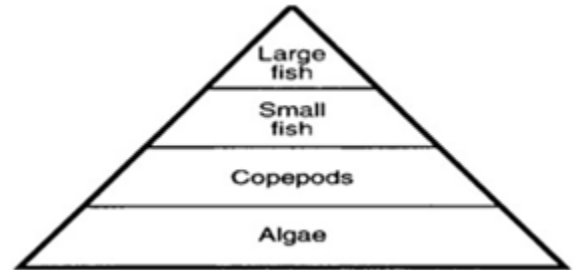


D.

30. Which graph in #29 shows a population with no predators and unlimited growth? Use the lettered choices in the graphs in #29
 a. A b. B c. C d. D

31. Which statement below best explains why biomass decreases from one level to the next in diagram below?

- a. When organisms die at higher levels, their remains sink to lower levels, thereby increasing the mass at lower levels
 b. More organisms die at higher levels than at lower levels, resulting in less mass at higher levels
 c. Organisms decay at each level, therefore less mass is supported at higher levels
 d. Energy is lost to the environment at each level, so less mass is supported at subsequent levels



32. Eutrophic and oligotrophic lakes differ primarily in the amount of ____ they contain.
 a. algae
 b. animal life
 c. organic matter
 d. salt

33. Which of the following is the most accepted hypothesis as to why invasive species take over communities into which they have been introduced?

- a. Humans always select which species will outcompete the nuisance native species.
 b. Invasive species are not held in check by the predators and agents of disease that have always been in place for the natives.
 c. Invasive species have a higher reproductive potential than native species.
 d. Invasive species are more aggressive than natives in competing for the limited resources of the environment.

34. Large herds of grazing animals are most likely to be found in a
 a. temperate deciduous forest.
 b. tropical rain forest.
 c. desert.
 d. savanna.

35. Many homeowners mow their lawns during the summer and collect the clippings, which are then hauled to the local landfill. Which of the following actions would most benefit the local ecosystem?
 a. Dig up the lawn and cover the yard with asphalt.
 b. Allow sheep to graze the lawn and then collect the sheep's feces to be delivered to the landfill.
 c. Collect the clippings and wash them into the nearest storm sewer that feeds into the local lake.
 d. Collect the lawn clippings and burn them.
 e. Either collect the clippings and add them to a compost pile, or don't collect the clippings and let them decompose into the lawn.

36. In hot and dry environments, why do mammals rely on evaporative cooling as a last resort to reduce body temperature?
 a. It is ineffective at dissipating heat.
 b. It requires movement of the limbs.
 c. It causes dehydration
 d. It requires resetting an animal's thermostat.

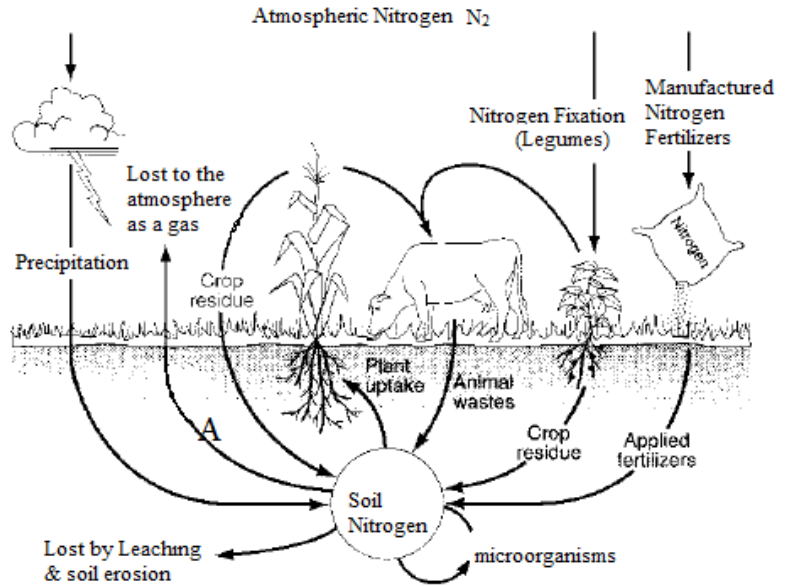
37. One winter, seven sailors were shipwrecked on a barren Arctic island with no vegetation. All they had to eat was a crate of dry cereal and a crate of 20 hens. To get the most calories from the limited food supply, they should **all full credit.** **Simply not a good question.**

- a. feed the hens the dry cereal, then eat the eggs they lay.
 b. eat the hens first, then eat the cereal.
 c. first eat the corn flakes, then the chickens.

d. feed the hens the dry cereal, then eat the hens.

38. In the illustration below the organism responsible for the process labeled as A is

- a. nitrifying bacteria
- b. Rhizobium bacteria
- c. denitrifying bacteria
- d. methanogenic protozoans
- e. nitrogen-fixing bacteria



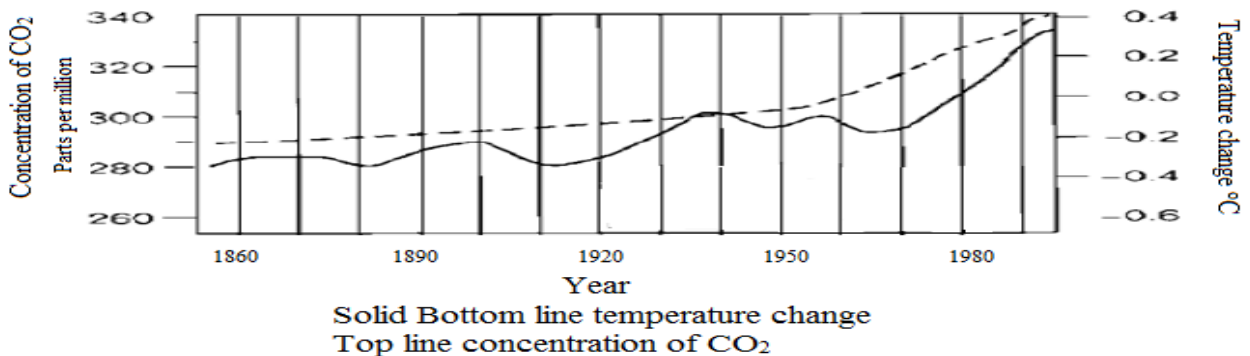
39. In the diagram above nitrogen is available to plants only in the form of

- a. N_2 in the atmosphere.
- b. nitrite ions (NO_2^{-1}) in the soil.
- c. nitrate ions (NO_3^{-1}) in the soil.
- d. uric acid from animal excretions.

40. In the diagram above how have humans interfered with the cycle in the illustration above?

- a. Dumping untreated sewage and urban runoff All full credit key has E.
- b. use of inorganic fertilizer
- c. burning fossil fuels This choice is not in the diagram even though it is true.
- d. overharvesting legumes and nitrogen rich mines
- e. all of the above

41. Based on the graph below what conclusion could be reached?



- a. the rise in temperature is causing the rise in carbon dioxide
- b. the rise in carbon dioxide is causing the rise in temperature

52. You are most likely to observe primary succession in a terrestrial community when you visit a(n)
a. recently created volcanic island. b. tropical rain forest. c. recently burned forest. d. abandoned field.
53. If a population grows larger than the carrying capacity of the environment, which of these is most likely to happen?
a. The death rate may rise. b. The death rate must fall. c. The birthrate must fall. d. The birthrate may rise.
54. Which of the following causes an increase in the intensity of UV radiation reaching the Earth?
a. greenhouse effect b. depletion of atmospheric ozone c. turnover d. biological magnification
55. The greenhouse effect is
a. a natural phenomenon that maintains Earth's temperature range.
b. an unnatural phenomenon that causes heat energy to be radiated back into the atmosphere.
c. the result of the differences in the angle of the sun's rays.
d. something that has only occurred for the last 50 years.
56. Which of the following is an example of cryptic coloration?
a. colors of an insect-pollinated flower
b. markings of a viceroy butterfly
c. brown color of tree bark
d. a "walking stick" insect that resembles a twig
57. Which of the following biomes is characterized by evergreen trees that are adapted to long winters, short summers, and nutrient-poor soil?
a. tundra b. tropical forest c. temperate forest d. taiga
58. To recycle nutrients, the minimum an ecosystem must have is
a. producers and decomposers.
b. producers.
c. producers, primary consumers, secondary consumers, top carnivores, and decomposers.
d. producers, primary consumers, secondary consumers, and decomposers.
e. producers, primary consumers, and decomposers.
59. Which of the following are important biotic factors that can affect the structure and organization of biological communities?
a. precipitation, wind
b. predation, competition
c. temperature, water
d. nutrient availability, soil pH
60. Imagine some cosmic catastrophe jolts Earth so that its axis is perpendicular to the orbital plane between Earth and the sun. The most obvious effect of this change would be
a. an increase in the length of night.
b. the elimination of tides.
c. the elimination of seasonal variation.
d. an increase in the length of a year

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