

Science League Biology I – January 14, 2010

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.

Choose the best answer to the following:

- Which is not required to validate the results of an experiment
A) large sample size
B) multiple trials using the same procedure
C) use of metric units when collecting data
D) peer review of research in a scientific journal
- To be of value to science, hypothesis must be
A) established facts B) testable C) proven correct D) popular E) new

Use this information to answer questions 3 and 4.

An experiment was done to see the effect of fertilizer on grass. Four pots were used. On day one, one hundred seeds of grass were planted in each pot, placed in the same window for sunlight and watered with 100 ml of water a day. Pots A and B received 5 grams of fertilizer on day one. Pots C and D did not have fertilizer added to them.

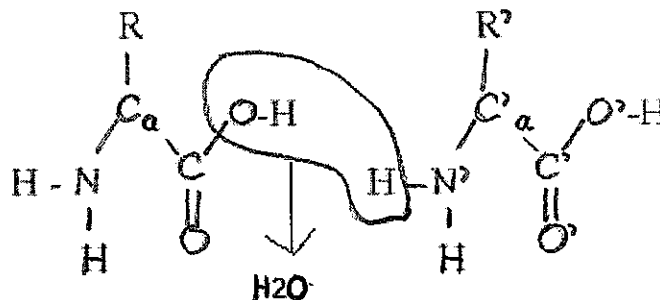
- Which of the following would be considered the control of the experiment?
A) The amount of fertilizer applied to pots A and B
B) Pots A and B
C) Pots C and D
D) The number of pots tested
E) The amount of grass planted
- Which of the following is considered the independent variable?
A) The amount of fertilizer applied to pots A and B
B) Pots A and B
C) Pots C and D
D) The number of pots tested
E) The amount of grass planted
- Theories help scientists to
A) make a conclusion
B) propose new ideas for how the world works
C) determine fact from falsehoods
D) prove hypothesis
E) explain large bodies of data

Use the following information to answer questions 6-7. A scientist tested how the use of a pesticide on a strawberry patch affected the yield of strawberries. He observed two strawberry patches with equal number of plants and sprayed only the first patch with the pesticide. During the summer, the number of strawberries harvested from each patch was counted. The first patch treated with pesticide yielded 360 strawberries while the second patch yielded 220 strawberries.

- Based on the data, the scientist would
A) report his data B) test the pesticide on the other plants
C) determine that the pesticide increased the fruit yield
D) determine the results were inconclusive E) A and B
- In order for this experiment to be scientifically valid, both patches must
A) receive the same amount of sunlight
B) receive the same amount of water
C) have the same species of strawberry
D) be planted in the same type of soil
E) all of the above
- Ultimately, all scientific knowledge comes from
A) experimentation B) observation C) textbooks D) both experimentation and observation

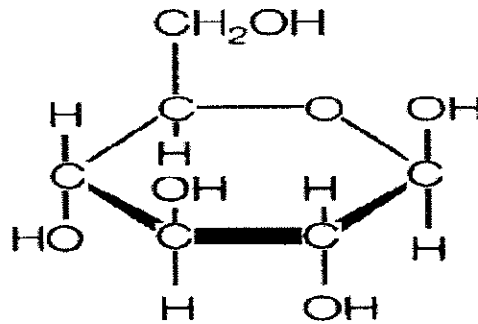
17. Which of the following elements is used to distinguish organic compounds from inorganic?
 A) Hydrogen B) Oxygen C) Nitrogen D) Carbon E) Phosphorus
18. Which type of bond is found in most organic molecules such as sugar?
 A) Hydrogen B) Ionic C) Covalent D) Sucronic
19. Hydrochloric acid is an acid because it gives off
 A) OH B) H₂O C) H⁺ D) Ions
20. If a solution has a pH of 3.5 and a chemical is added to buffer the solution, what will happen to the pH of the solution?
 A) It will move toward pH 1.0 B) It will remain near pH 3.5
 C) It will move to pH 7.0 D) It will move toward pH 14.0
21. Capillary action depends on water's
 A) high heat of evaporation B) cohesiveness C) ability to act as a solvent
 D) ability to absorb lots of energy
22. Sweating (perspiring) aids in the removal of heat primarily due to
 A) the high surface tension of water B) water's high heat of vaporization
 C) the high specific heat of water D) the buffering capacity of water
 E) the dissociation of water molecules

Use the following diagram to answer questions 23- 26.



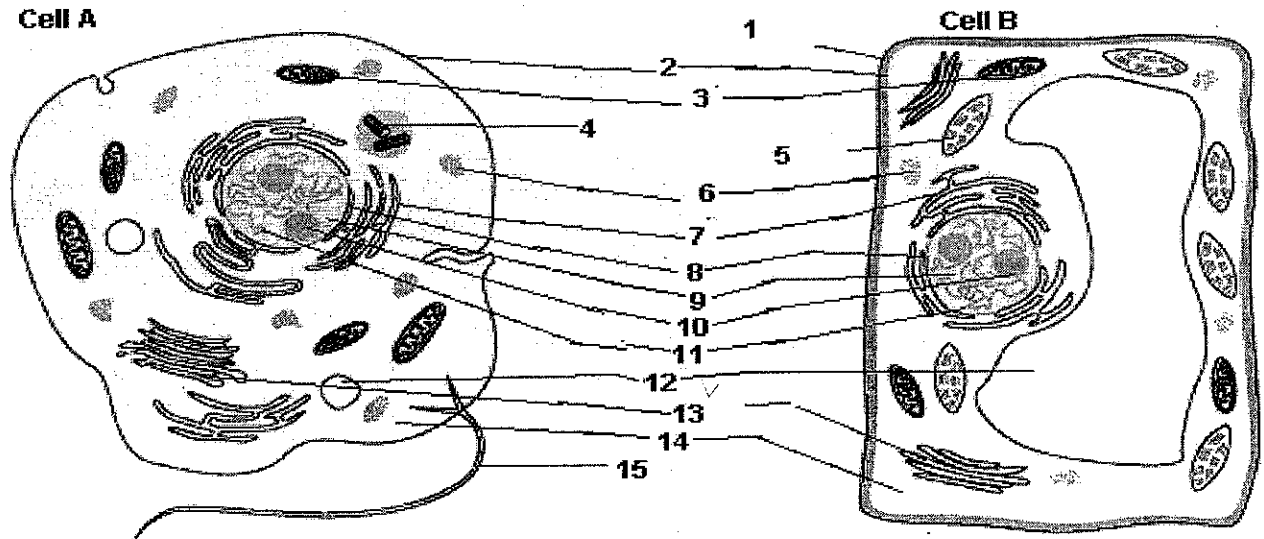
23. The chemical reactions illustrated above result in the formation of
 A) peptide bonds B) ionic bonds C) glycosidic bonds D) hydrogen bonds
24. The above chemical reaction is called
 A) dehydration synthesis B) hydrolysis C) peptidolysis D) denaturization
25. The diagram above shows a step in the formation of a
 A) carbohydrate B) lipid C) protein D) simple sugar E) A and D
26. Molecules formed from those shown in the diagram above may be involved in
 A) catalysis of reactions B) Structural and mechanical C) immune responses D) Cell Signaling E) all of the above

Use the following diagram to answer questions 27-29.



27. The molecule pictured above is a
 A) monosaccharide B) disaccharide C) protein D) lipid E) nucleic acid
28. If 100 molecules of the general type of molecule shown above were covalently joined together in sequence, the single molecule that would result would be a
 A) polyunsaturated lipid C) polysaccharide
 B) polypeptide D) fatty acid
29. Which of the following represents a polymer of the above molecule?
 A) glycogen B) cellulose C) glycerol D) A and B E) A, B and C
30. A five-Carbon sugar, phosphate group and nitrogenous base are components of which of the following?
 A) carbohydrates C) lipids
 B) proteins D) nucleic acids

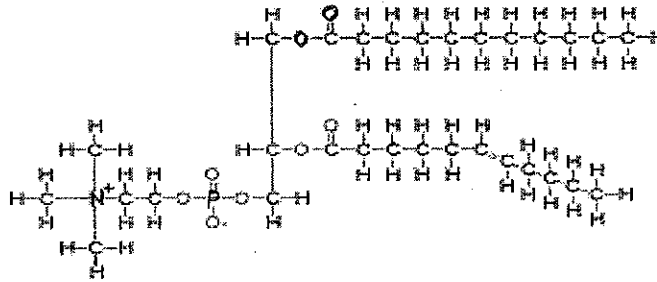
Use the following diagram to answer questions 31- 38.



31. Which of the following produces ATP?
 A) 3 B) 6 C) 7 D) 12 E) 13
32. Which of the following creates turgor pressure?
 A) 3 B) 6 C) 7 D) 12 E) 13
33. Where are proteins made?
 A) 3 B) 6 C) 7 D) 12 E) 13
34. Which of the following is primarily involved in the synthesis oils, phospholipids, and steroids?
 A) 3 B) 6 C) 7 D) 12 E) 13
35. Which of the following is capable of turning light energy into chemical energy?
 A) 3 B) 5 C) 6 D) 7 E) 13

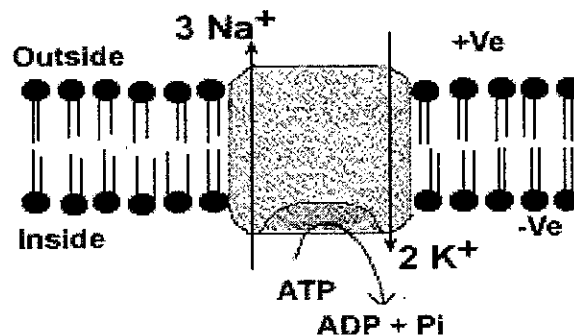
36. Which of the following tools must a biologist use to study the organelles pictured above?
 A) a light microscope B) a scanning electron microscope
 C) a transmission electron microscope
 D) both A and C E) A, B and C
37. Grana, thylakoids, and stroma are all components found in
 A) 3 B) 5 C) 6 D) 8 E) 15
38. Of the following what do # 3 and #5 have in common?
 A) ATP is produced B) DNA is present C) Ribosomes are present
 D) only A and B are correct E) A, B and C are correct

Use the following image to answer questions 39-41.



39. The molecule above is a type of
 A) carbohydrate B) protein C) lipid D) nucleic acid E) starch
40. The molecule pictured above along with _____ are the major structural components of the _____?
 A) carbohydrates, mitochondria B) proteins, cell membrane C) lipids, cell membrane
 D) nucleic acids, DNA E) starches, mitochondria
41. Because the molecule above is _____, it is a major structural component in specific cell organelle structure.
 A) hydrophobic B) hydrophilic C) polar D) nonpolar E) amphipathic
42. What will happen to an animal cell placed in a salt water solution?
 A) the cell will shrink B) the cell will expand C) the cell will burst
 D) the cell will shrink and then expand and then shrink again

Use the following image to answer questions 43- 44.

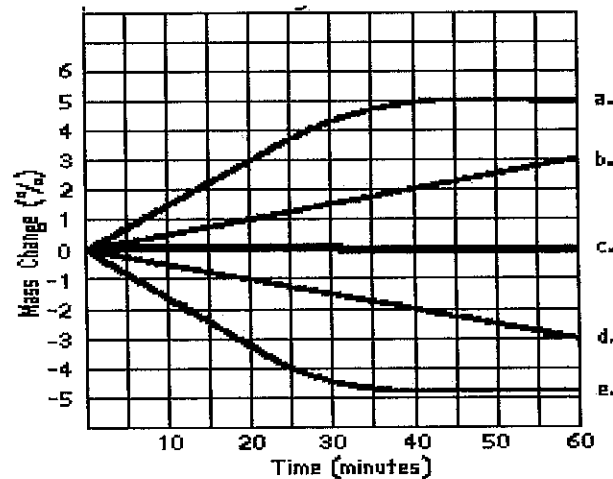


43. The image above illustrates which of the following processes?
 A) diffusion B) facilitated diffusion
 C) osmosis D) active transport

44. What is the importance of the process shown above?
- it helps maintain a balance of water both inside and outside the cell
 - it helps regulate gas exchange
 - it helps maintain the electrochemical gradient in cell
 - A and B
 - A, B and C
45. Which of the following would most likely move through the plasma membrane of a cell most rapidly?
- K^+
 - CO_2
 - an amino acid
 - starch
 - fructose

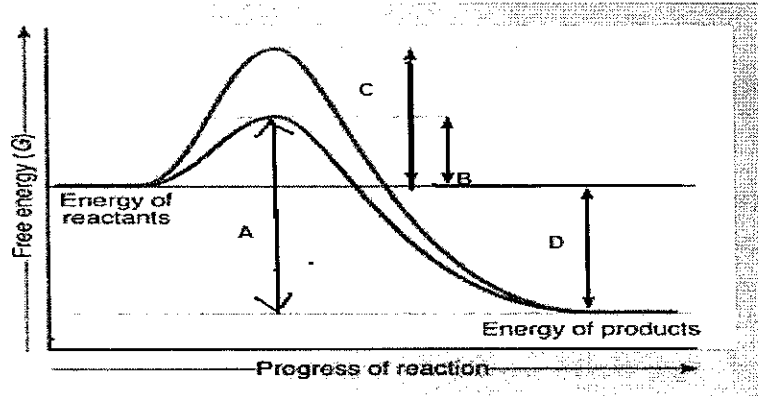
Use the following information to answer questions 46-47.

Five dialysis bags, impermeable to sucrose, were filled with different concentrations of sucrose and placed in separate beakers containing 0.6 M sucrose solution. The data taken from the experiment were plotted on the following graph.



46. Which line represents the bag that started with the highest concentration of sucrose?
- a.
 - b.
 - c.
 - d.
 - e.
47. Which of the following best explains the shape of line e after 50 minutes?
- water is no longer entering the bag
 - water is no longer leaving the bag
 - water is leaving and entering the bag at the same rate
 - water is entering the bag at the same rate that sucrose is leaving the bag
48. An experiment is set up with two chambers that are connected by a tube through which molecules can freely pass. Chamber A contains 40% Helium and chamber B contains 20% Helium. Which of the following should have occurred?
- The net movement of helium will be from chamber A to chamber B
 - The net movement of helium will be from chamber B to chamber A
 - The helium will remain concentrated in chamber A
 - All of the helium will move to chamber B
49. Which of the following terms best describes the basic process of breaking down large molecules into smaller ones?
- catalysis
 - metabolism
 - anabolism
 - dehydration
 - catabolism

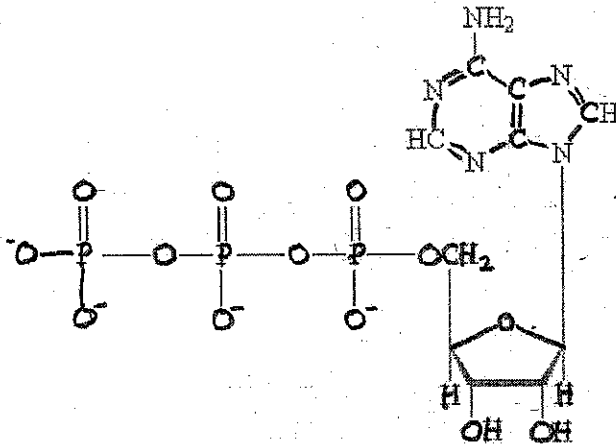
Using the following graph, based on a general reaction to answer questions 50- 51.



50. What type of reaction is pictured in the graph above?
- A) endergonic
B) exergonic
C) anabolic
D) allosteric
E) nonspontaneous
51. Which of the following refers to the activation energy required for the enzyme-catalyzed reaction?
- A) A B) B C) C D) D
52. What best characterizes the role of ATP in cellular metabolism?
- A) the free energy released by ATP hydrolysis may be coupled to an endergonic process via the formation of a phosphorylated intermediate
B) the release of free energy during the hydrolysis of ATP heats the surrounding environment
C) it is catabolized to carbon dioxide and water
D) the change in free energy associated with its hydrolysis is positive
E) the charge of the phosphate group of ATP tends to make the molecule very water soluble
53. The mechanism of enzyme action is
- A) providing energy to speed up the rate of a reaction
B) changing the direction of thermodynamic equilibrium
C) changing endergonic into exergonic reactions
D) lowering the energy of activation for a reaction
E) lowering the free energy change of a reaction
54. Which of the following statements regarding enzymes is correct?
- A) an enzyme lowers the activation energy of a chemical reaction
B) most enzymes are proteins
C) an enzyme is very specific in terms of which substrate it binds to
D) an enzyme is not consumed by the catalytic process
E) all of the above are correct statements about enzymes
55. Which of the following statements about an active site of an enzyme is correct?
- A) the active site has a fixed structure
B) coenzymes are never found in the active site of an enzyme
C) the active site may resemble a groove or pocket in the surface of a protein into which the substrate fits
D) the structure of the active site is not affected by changes in temperature
E) the active site allows the reaction to occur under the same environmental conditions as the reaction without the enzyme
56. Which of the following environments or actions does NOT affect the rate of an enzyme reaction?
- A) heating the enzyme B) cooling the enzyme C) substrate concentration
D) pH E) all of the above

57. The process of stabilizing the structure of an enzyme at a site other than the active site is an example of
- A) feedback inhibition
 B) competitive inhibition
 C) allosteric regulation
 D) noncompetitive inhibition
 E) cooperativity

LOOK UP



58. The molecule shown directly above is most likely
 A) an enzyme B) a disaccharide C) NADH D) ATP E) an amino acid
59. Metabolism is best described as
 A) synthesis of macromolecules B) breakdown of macromolecules C) control of enzymatic activity
 D) A and B E) A, B, and C
60. In order for the mitochondrion to produce ATP, it requires all of the following *except*
 A) membrane bound electron transport chain
 B) proton pumps embedded in inner membrane
 C) mitochondrion ATP synthase
 D) enzymes for glycolysis
 E) enzymes for the Krebs cycle
61. More ATP can be formed from the energy in food molecules by aerobic organisms; those which utilize
 A) carbon B) hydrogen C) oxygen D) nitrogen E) all of the above
62. In which type of cell can we expect to find the greatest concentration of mitochondria?
 A) muscle cell B) fat cell C) cell from the leaf of a plant D) bone cell
63. Chemical energy is a form of
 A) potential energy B) kinetic energy C) heat
 D) motion E) entropic
64. In your body, what process converts the chemical energy found in glucose into the chemical energy found in ATP?
 A) digestion B) cellular respiration C) anabolism D) redox E) potentiation
65. What type of reaction breaks the bonds that join the phosphate groups in an ATP molecule?
 A) anabolism B) dehydration decomposition C) hydrolysis
 D) dehydration synthesis E) entropic
66. What type of bond joins the phosphates of the ATP?
 A) hydrophobic B) hydrogen C) covalent D) hydrophilic E) ionic

67. Who is known as “the father of microscopy,” and coined the term “cell?”
- A) Anton van Leeuwenhoek
 - B) Robert Hooke
 - C) John Wilkins
 - D) Robert Boyle
 - E) Isaac Newton
68. One of the principal problems in using the electron microscope to study cells is that
- A) some cells are too small to be seen even with the electron microscope
 - B) the electron microscope has limited resolution
 - C) we can't slice the cells thinly enough
 - D) the cells need to be alive so the electrons can bounce off of them
 - E) the cells can't be alive
69. Who suggested the structure of DNA involved two chains of nucleotides, one going up and the other going down, so that matching base pairs interlock in the middle of a double helix and later won the Nobel Prize in Medicine and Physiology in 1953?
- A) Maurice Wilkins
 - B) Watson and Crick
 - C) Gorter and Grendel
 - D) A and B
 - E) None of the above
70. Who is credited with first proposing that DNA was helical from x-ray diffractions?
- A) Anton van Leeuwenhoek
 - B) Robert Hooke
 - C) Rosalind Franklin
 - D) Watson and Crick
 - E) Gorter and Grendel
71. Who used catastrophism to explain the fossil record?
- A) Charles Lyell
 - B) Charles Darwin
 - C) Georges Cuvier
 - D) Jean Baptiste Lamarck
 - E) Alfred Wallace
72. The notion that tanned skin, caused by UV irradiation, can be passed on to offspring is consistent with whose ideas?
- A) Charles Lyell
 - B) Charles Darwin
 - C) Georges Cuvier
 - D) Jean Baptiste Lamarck
 - E) Alfred Wallace
73. Who theorized a concept of natural selection independent of Darwin?
- A) Charles Lyell
 - B) Charles Darwin
 - C) Georges Cuvier
 - D) Jean Baptiste Lamarck
 - E) Alfred Wallace
74. Which of the following facts was unavailable to Darwin while he was formulating his theory of evolution in the mid-nineteenth century?
- A) most populations are stable in size
 - B) individual organisms in a population are not alike
 - C) all populations have the potential to increase
 - D) natural resources are limited
 - E) characteristics are inherited as genes on chromosomes

75. Charles Darwin concluded that the 13 species of finches on the Galapagos islands
- A) were identical to 13 finch species in northwestern South America 600 miles to the east
 - B) probably evolved from one ancestral species from South America
 - C) had all adapted to the same food sources
 - D) A and B are correct
 - E) A, B and C are correct
76. Through careful observation, Charles Darwin came to understand
- A) populations of plants and animals in nature most often consist of individuals that are clones of each other
 - B) those individuals whose variation gives them an advantage in staying alive long enough to reproduce are more likely to pass their traits on to the next generation
 - C) populations of a species that become isolated from others by adapting to different environmental niches quickly become extinct
 - D) all of the above
77. A change in genetic material that produces a variation in a species may be the result of
- A) a mutation
 - B) competition
 - C) overproduction of a species
 - D) a struggle for survival
78. Natural selection
- A) causes mutations
 - B) directly acts to change genotype
 - C) acts on phenotype
 - D) causes sexual reproduction
 - E) all of the above
79. Mutations are considered the basis for evolution because they
- A) result in variations among organisms
 - B) occur in body cells instead of egg or sperm
 - C) are unimportant unless the environment changes
 - D) survive only if beneficial
 - E) all of the above
80. What type of molecule had to be formed on Earth in order for life to exist?
- A) a molecule now found in modern life forms
 - B) a molecule containing carbon
 - C) a self-replicating molecule
 - D) An enzyme or other large protein

**New Jersey Science League
Biology I Answer Key
Date: JANUARY 14, 2010**

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

BIOLOGY I: No AP or second year students in this category. NOTE: Consistent with a modern approach to biology, principles of evolution will be included in every test as these apply to topics listed.

JANUARY TEST - the process of science, principles of evolution natural selection, structure of matter (basic chemistry including the chemistry of water and pH), "biomolecules" (carbohydrates, proteins, lipids), microscopy, measurement, cell structure and function, diffusion, osmosis, active transport, cell metabolism, enzymes, ATP, philosophy/history and experiments pertaining to the preceding topics.

FEBRUARY TEST - evolution, mitosis/meiosis, patterns of genetic inheritance, DNA/RNA (structure, transcription, translation), viruses, bacteria, cell structure and function, photosynthesis, cell respiration, enzymes, philosophy/history and experiments pertaining to the preceding topics.

MARCH TEST - evolution, principles of taxonomy, phylogeny and classification, non-human animal structure/function/systems, plant structure/function/systems, life cycles, embryology, organismic reproduction, fungi, algae, ecology (ecological relationships and succession), disease, mitosis/meiosis, philosophy/history and experiments pertaining to the preceding topics.

APRIL TEST - evolution, biotechnology (genetic engineering, PCR, DNA fingerprinting, DNA manipulation, bioinformatics, stem cells), human anatomy & physiology, human nutrition, embryology, populations, animal/plant behavior, ecology (matter and energy in the living world), inherited and acquired disease, philosophy/history and experiments pertaining to the preceding topics.

TESTING DATES FOR THE NEW JERSEY SCIENCE LEAGUE

Thursday January 14, 2010, Thursday Feb 11, 2010;

Thursday March 11, 2010; Thursday April 8, 2010

* The testing date for the April will be decided by each local area during the January exam. The date of the April exam should be a date that all schools in the area can attend. The April exam must be completed by April 30th. No area may take the April exam during the first week of April.

